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Analysis of the Physical and Mental Impacts of Height and Weight Standards on Marines

March 2024

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Naval Postgraduate School

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

ACQUISITION RESEARCH PROGRAM
DEPARTMENT OF DEFENSE MANAGEMENT
NAVAL POSTGRADUATE SCHOOL

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ABSTRACT

The Marine Corps currently measures body mass index using standards that date back to the middle of the 20th century, which appear to be no longer applicable to today's service members. The current policy is influencing Marines to adopt unhealthy lifestyle habits that encourage the use of rapid weight loss techniques in order to meet these standards, which contributes to physical and mental health issues. To learn more about individual Marines' perceptions of current policy, this study consisted of nine semi-structured interviews with the data collected analyzed to identify any common themes, feelings, and perceptions about the current Marine Corps policy regarding height and weight requirements. Given the number of interviewees, this research was a limited population sample which did not allow for a full representation of Marines based on race, gender, MOS, and other key demographic information. The main observations based on interview data points toward the Marine Corps' re-evaluation and updating of current methods of measuring body mass index in order to allow service members to maintain healthier weights without sacrificing their physical or mental health. These changes could significantly impact the overall health and combat readiness of the fighting force and potentially improve retention rates within the Marine Corps.

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LIST OF ACRONYMS AND ABBREVIATIONS

AC	Abdominal Circumference
BCMAP	Marine Corps Body Composition and Military Appearance Program
BCP	Body Composition Program
BIA	Bioelectrical Impedance Analysis
BMI	Body Mass Index
CDC	Centers for Disease Control
CFT	Combat Fitness Test
DOD	Department of Defense
DEXA	Dual Energy X-ray Absorptiometry
FFI	Force Fitness Instructor
IRB	Institutional Review Board
MAP	Military Appearance Program
MARADMIN	Marine Corps Administrative Message
MCO	Marine Corps Order
MOS	Military Occupational Specialty
MSK	Musculoskeletal
PFT	Physical Fitness Test
RWL	Rapid Weight Loss
SNCO	Staff Noncommissioned Officers
USAF	United States Air Force
VLCD	Very Low Calorie Diets
WHtR	Waist-to-Height Ratio

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I. INTRODUCTION AND BACKGROUND

The Marine Corps prides itself on being the most elite fighting force in the world and having the most physically fit and capable individuals of any branch of the armed services. This demand for a superior fighting force has meant that Marines must meet specific requirements for strength, stamina, and endurance. These requirements are not easy to fulfill without physical training and, in some cases, the accumulation of muscle mass would increase the overall weight of a Marine fit for combat. In turn, a Marine can be labeled as overweight based on the current metrics used to measure height and weight.

This weight requirement points to a related problem facing the Marine Corps today: outdated metrics used to measure a Marine's height and weight and make a determination on their body mass index (BMI), a measure of body fat based on height and weight that applies to adult men and women—and based on that figure, their fitness to fight. Currently, the Marine Corps uses BMI standards that date back to the middle of the 20th century, which given changes over the years seem no longer applicable to today's military and service members.

The Marine Corps height and weight standards were originally developed during World War II. At that time there were no maximum weight standards, only a minimum standard ensuring all males maintained a weight commensurate with nutrition levels required for combat operations (Fleming et al., 2022). Fleming et al. (2022) identified that "Marine Corps body-composition standards were formally established in the 1970s and have incrementally been modified over the years to address changes in force population, adjust to changes in physical fitness requirements, and meet Congressional demands" (Fleming et al., 2022, p. 24). In 2022, RAND published a report by Fleming et al. (2022) addressing these aforementioned programs, noting that "although a single Department of Defense (DOD) standard has been in place since 1981, each service has implemented slightly different body-composition policies to reflect their respective needs" (Fleming et al., 2022, p. 7).

At present, in accordance with Marine Corps Order (MCO) 6110.3A, Marine Corps Body Composition and Military Appearance Program (BCMAP), a Marine is assigned a designated allowable maximum weight based on their height. If their body weight exceeds this allowable maximum, they are subjected to the process of measuring and comparing the circumference of different portions of the body by a designated representative of the command. These measurements are then used to calculate the Marine's BMI in accordance with MCO 6110.3A. The Marine Corps does have an existing program known as the Military Appearance Program (MAP). This program is not a substitute for height and weight standards but is an additional mechanism to ensure standards are being maintained. This existing program allows commanders to subjectively deem a Marine as overweight through appearance and officially censor that Marine for correction. The program currently states, "commanders will conduct military appearance assessments based upon personal appearance indicators (personal hygiene, grooming and uniform wear) and improper distribution/excessive accumulation of body fat" (Headquarters, United States Marine Corps, 2021, p. 1–9).

The Marine Corps currently evaluates fitness in two primary ways: performance and anthropometrics. Performance is measured annually, requiring Marines to take a physical fitness test (PFT) and a combat fitness test (CFT) for a score between 0–300. The scores earned are sorted into first, second, or third-class ratings based on the overall performance of the events. A Marine's score is considered a first-class in both the PFT and CFT if the overall score is a 235 or above. When performance is evaluated across the entirety of the Marine Corps, the average score for the PFT is a 249.6 and the average CFT score is 271.6 (Debeliso & Keefer, 2020). With the rigor of the tests standing above all other U.S. Military Services' annual tests, it would appear improbable for an overweight Marine to achieve a first-class score; however, metrics can be manipulated and unhealthy habits applied to achieve temporary results. Therefore, a secondary measure of anthropomorphic measurement (height and weight) is used to validate fitness levels.

The annual height and weight verification measures Marines against explicit guidelines found in MCO 6110.3A (Table 1). Should their weight fall outside of the tabulated requirements for their given height, they are then subject to a follow-on body

composition assessment, colloquially known as the "taping" method—the process of measuring and comparing the circumference of different portions of the body. Body composition assessments measure the ratio of fat in the body for a given weight, with set tolerances dictated per each military service (Table 2 and Figure 1).

Table 1. Department of Defense Height/Weight Standards Table. Source: Headquarters, United States Marine Corps (2021).

Males			Females		
Height (Inches)	Maximum Standard (Pounds)	Minimum Standard (Pounds)	Height (Inches)	Maximum Standard (Pounds)	Minimum Standard (Pounds)
52"	106	73	52"	100	73
53"	110	76	53"	104	76
54"	114	79	54"	108	79
55"	118	82	55"	112	82
56"	122	85	56"	115	85
57"	127	88	57"	120	88
58"	131	91	58"	124	91
59"	136	94	59"	129	94
60"	141	97	60"	133	97
61"	145	100	61"	137	100
62"	150	104	62"	142	104
63"	155	107	63"	146	107
64"	160	110	64"	151	110
65"	165	114	65"	156	114
66"	170	117	66"	161	117
67"	175	121	67"	166	121
68"	180	125	68"	171	125
69"	186	128	69"	176	128
70"	191	132	70"	181	132
71"	197	136	71"	186	136
72"	202	140	72"	191	140
73"	208	144	73"	197	144
74"	214	148	74"	202	148
75"	220	152	75"	208	152
76"	225	156	76"	213	156
77"	231	160	77"	219	160
78"	237	164	78"	225	164
79"	244	168	79"	230	168
80"	250	173	80"	236	173
81"	256	177	81"	242	177
82"	263	182	82"	248	182
83"	269	186	83"	255	186
84"	276	191	84"	261	191
85"	283	195	85"	267	195
86"	289	200	86"	274	200

Table 2. Maximum Body Fat Percentage Table by Age Group. Source: Headquarters, United States Marine Corps (2021).

Marine Corps Body Composition Standards		
Age Group	**Male**	**Female**
17-20	18% BF	26% BF
21-25	18% BF	26% BF
26-30	19% BF	27% BF
31-35	19% BF	27% BF
36-40	20% BF	28% BF
41-45	20% BF	28% BF
46-50	21% BF	29% BF
51+	21% BF	29% BF

Effective 1 July 2016, use of self-tensioning circumference tapes are required to be used when conducting body fat estimations. These tapes are commercially available and a non-inclusive list of vendors includes Myotape, Health-o-Meter and Eyotool. Examples of these tape measuring devices are below.

Figure 1. Self-Tensioning BCP Circumference Measuring Devices. Source: Headquarters, United States Marine Corps (2021).

If a Marine does not satisfy the requirements listed in MCO 6110.3A, follow-on verification and explanatory procedures are taken to include a visit to a medical provider to be screened for contributory underlying health concerns. If a Marine is not deemed to have any underlying health concerns and cannot pass the height and weight or the required taping metrics to comply with body fat percentages, the Marine is formally placed on the body composition program (BCP). The Marine is to remain on BCP until they can pass all requisite exams. If a Marine is placed on BCP twice, or does not make satisfactory progress

on their first assignment to BCP, they are then processed for administrative separation from the Marine Corps.

The limitations of the taping method and questions surrounding its accuracy have been called into question for some time. A Marine Corps Administrative Message (MARADMIN) was released in 2022 and outlined forthcoming changes to the Marine Corps height and weight standard assessments for Marines who cannot make standards either by height and weight or body fat measurements (Sokol, 2022). The MARADMIN clarifies the BCP policy to state that a Marine cannot be formally assigned to the BCP program unless body fat is estimated by Dual Energy X-ray Absorptiometry (DEXA) or Bioelectrical Impedance Analysis (BIA), and validated by a unit representative. The MARADMIN provided no change to the male body composition standards, but females were granted an additional 1% increase.

In short, the Marine Corps is placing an undue amount of stress on its members through this two-fold approach. The physical fitness standards continue to become more physically intensive, requiring the accumulation of more muscle in order to achieve a desirable score and with it an increase in weight—often above the maximum allowed. In other words, Marines are required to maintain a body weight comparable to a Marine from 50+ years ago when the average American was much smaller and the Marine Corps only had minimum weight standards instead of minimum and maximum weight standards as it currently does today. One study on body mass notes that, "the average weight for men aged 20–74 years rose dramatically from 166.3 pounds in 1960 to 191 pounds in 2002, while the average weight for women the same age increased from 140.2 pounds in 1960 to 164.3 pounds" (Carroll et al., 2004, p. 2).

The existing Marine Corps height and weight standards in some cases force Marines to take extraordinary measures to make the maximum allowable weight for their height. Some of these practices include starvation where Marines will not eat for days; use of diuretics to lose water weight; and employing other methods such as the "garbage bag" approach where a Marine will sit in a sauna and wear trash bags to try and lose anywhere from 1–20 pounds as quickly as possible.

Moreover, as noted above, the Marine Corps height and weight standards are also placing extreme mental pressure upon service members fearful of losing their careers, promotion, and other advancement opportunities. The current Marine Corps order states "Marines who fail to comply with the policies and standards contained in MCO 6110.3A may result in administrative action that limits promotion, retention, and assignment" (Headquarters, United States Marine Corps, 2021, p. 2). This stress is leading to issues with retaining service members. Some are deciding that the cost to their physical and mental health is not worth staying in the Marine Corps leading to increased attrition. Fleming et al. (2022) considered whether "research about the relationship between body composition and retention has focused on accession and first-term enlistments to determine if obesity and/or overweightness is a predictor of attrition" (p. 68).

This research will provide a generalized analysis of the impacts the current Marine Corps policy is having on service members' physical and mental health as well as a desire to continue further service. This research aims to help build upon existing research already published and provide a different perspective into the topic of Marine Corps height and weight standards, focusing specifically on the individual Marine. This research aims to provide insight into policy that can offer potential benefits in improving the quality of life of service members within the Marine Corps and adding to the existing body of research.

A qualitative approach through the conduct of individual interviews with Marines would build upon the existing body of research and help to identify and address issues that have been previously overlooked or not examined. This research aims to understand the mind of the individual Marine outside of just empirical data analysis on the effects of these policies. In short, this study would offer an overlooked body of evidence upon which recommendations on future policy can be made to improve the physical and mental health of Marines as well as have a significant impact on retention issues across the Marine Corps.

Further, this research aims to understand how these additional stressors with regards to height and weight standards impact a Marine's decision to continue military service or seek employment outside of the military in the civilian sector. This research will also explore whether policy changes could positively impact the health and well-being of our Marines, as well as their retention. More broadly, this research will consider whether

alternative methods of measuring fitness, health, and height and weight requirements potentially contribute to the overall mental and physical health of our Marines and promoting retention within the force.

A. RESEARCH QUESTIONS

The research for this study will aim to answer the following questions:

1. What impacts do the current Marine Corps height and weight standards have on a Marine's physical and mental health?
2. Do current Marine Corps height and weight standards appear to be contributing to Marines' behaviors to remain within standards?
3. What is the potential impact current Marine Corps height and weight standards have on a Marine's desire to re-enlist?

B. ORGANIZATION OF THE STUDY

This study is organized as follows. Chapter I offers an overview of the problem, relevant background, need for the study, and research questions. Chapter II contains the literature review that provides amplifying information with regards to previous studies and literature that exist regarding height and weight standards and the physical and psychological effects it can have on individuals. Chapter III outlines the methodology of research conducted through qualitative interviews. Chapter IV delivers analysis of data and findings made from the interviews conducted with Marines. Chapter V provides the conclusion of this study that includes discussion, analysis, recommendations, and areas for exploration and additional research.

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II. LITERATURE REVIEW

This chapter is an overview of the history of the Marine Corps height and weight standards as well as prior literature exploring the following three topics: one, the physical and mental effects extreme forms of weight loss can have on an individual's desire to maintain compliance with current Marine Corps doctrine concerning body mass index standards; two, the effects it can have on the physical and psychological aspects on a Marine; and three, possible impacts on retention of Marines.

All of this literature is related to the Marine Corps and this research topic because the goal of this research is to expound upon findings in previous literature and draw similarities and common themes between the quantitative research examined and the qualitative research conducted in this current research. This research aims to understand how current policy affects a Marine both physically and psychologically as well as identify the impacts height and weight standards are having on retention in the Marine Corps. Observations and recommendations based on research data will be drawn through the analysis of qualitative surveys and interviews conducted to identify any common themes, feelings, and perceptions about the current Marine Corps policy regarding height and weight requirements. Examination of prior literature and studies also provides answers on the effects of height and weight standards across other services and occupations outside of the military.

1. Height and Weight Standards of Marines

To date, several studies have been conducted on the impacts of the height and weight standards on individual Marines, their health, and overall retention, with a focus on tangible markers of weight and fitness. In the 2022 RAND-published report by Fleming et al. (2022), the study addressed these aforementioned programs and noted that "although a single DOD standard has been in place since 1981, each service has implemented slightly different body-composition policies to reflect their respective needs" (Fleming et al., 2022, p. 7). The Marine Corps has adopted the strictest standards of all the armed forces placing a larger burden on its population to adhere to rigorous physical standards, which can lead

to unhealthy behaviors and eating practices. Fleming et al. (2022) made the following conclusions based off of their research, stating, "Changes to the BCMAP over the decades have been incremental. Relatedly, physical fitness requirements have increased for all Marines, but revisions to the BCMAP have not sufficiently accounted for these changes" (Fleming et al., 2022, p. viii). Jones et al. (2017) state that individuals with lower BMIs were at a greater risk of injury, regardless of gender or fitness level. Conversely, those with higher muscle mass and BMIs seemed to have better protection against injuries during demanding physical activities, resulting in an individual being more resistant to musculoskeletal issues and less prone to getting injured.

2. Physical and Psychological Effects of Weight Loss on Individuals

The physical and psychological effects of weight loss on individuals are examined by Bianco et al. (2020), Joshi and Mohan (2018), Beeken et al. (2014), and Bosomworth (2012). This literature explores the potentially devastating effects of rapid weight loss on the physical and mental health of an individual. On the physical aspect, these studies show that rapid weight loss can negatively impact the aerobic and anaerobic performance of athletes, including impairing the cardiovascular function, muscle blood flow, and the thermoregulatory ability of a person's body. In addition, the short-term benefits of rapid weight loss are often short term and weight gain to the original proportions are often incurred from the fluctuations in the body. Physically, rapid weight loss or an individual losing too much weight or becoming underweight actually poses more risk associated with higher morbidity rates due to increased cardiovascular issues from not sustaining healthy weights.

Beeken et al. (2014) state, "This rapid weight loss leads to even greater psychological risks such as increased anger, confusion, depressed mood, and eating disorders impairing an individual's ability to live a normal life" (p. 13). Fatigue is another common psychological side effect associated with the rapid weight loss process, which leads to further impaired performance in daily lives and athletic performance among individuals who practice such techniques. The proposed health benefits of rapid weight loss of fad diets pose no psychological benefits and actually possess greater risks to those

who practice them physiologically when compared to individuals who are within normal weight ranges and avoid the use of such techniques.

Specific to the Marine Corps, Headquarters, United States Marine Corps (2021) states that a Marine is assigned a designated allowable maximum weight based on their height and in accordance with MCO 6110.3A, Marine Corps BCMAP. If their body weight exceeds this allowable maximum, they are subjected to the process of measuring and comparing the circumference of different portions of the body by a designated representative of the command. These measurements are then used to calculate the Marine's BMI based on MCO 6110.3A. The Marine Corps does have an existing program known as the MAP. This program is not a substitute for height and weight standards but is an additional mechanism to ensure standards are being maintained. This existing program allows commanders to subjectively deem a Marine as overweight through appearance and officially censor that Marine for correction. The program currently states, "Commanders will conduct military appearance assessments based upon personal appearance indicators (personal hygiene, grooming and uniform wear) and improper distribution/excessive accumulation of body fat" (Headquarters, United States Marine Corps, 2021, p. 1–9).

3. Effects of Rapid Weight Loss on Judo Athletes

Marines are often referred to as "warrior athletes" and as such can be compared to other professionals who must maintain strict physical and weight standards such as Judo athletes. Bianco et al. (2020) conducted an examination of the effects of rapid weight loss on athletes and the effects it has on their physical and mental health, in this case, Judo athletes. In total, this study examined 1103 Judo athletes to analyze the effects of rapid weight loss on their physiological health. Bianco et al. (2020) state, "Judo athletes undergo weight measurement to identify their competitive weight category and nearly 90% of both male and female judokas evaluated (n= 822) were using rapid weight loss (RWL) techniques before official weigh-in sessions" (p. 2). This is a practice common among Marines before any official height and weight are taken by members of the command staff.

Bianco et al. (2020) further concluded that "since the majority of judo athletes are usually unable to maintain their body weight within this weight class limit, they usually

regain weight promptly after weigh-in" (p. 2). Bianco et al. (2020) addressed the various techniques athletes implement to lose weight, stating, "Some of the techniques used to drop excess weight by Judo athletes such as skipping meals and increasing exercise, restricting fluid intake, training with rubber suits or trash bags, and spending excessive time in a sauna" (p. 2). While this study doesn't include practices done by Marines specifically, the techniques are comparable to practices common among Marines. Bianco et al. (2020) even suggest some Judo athletes' resort to the use of illegal pharmaceutical drugs to assist in weight loss.

The harmful psychological effects of RWL techniques practiced by Judo athletes can also be applied to Marines conducting the same RWL practices in order to maintain standards. Bianco et al. (2020) describe the harm done to psychological well-being of athletes, in terms of them showing significant increases in tiredness and frustration. They state, "These tendencies were evident in the follow up assessments as well as in the form of tension and confusion, which also increased with even higher levels of significance compared to the baseline values before RWL techniques were employed" (Bianco et al., 2020, p. 13). According to Bianco et al. (2020), "A decrease was noticed in vigor, while depression remained unchanged among judokas" (p. 14). Increased levels of frustration were higher in the Judo athletes who practiced RWL techniques when compared to those athletes who did not as seen in Figure 2. The negative psychological effects of RWL can further lead to impaired athletic performance.

Effects of rapid weight loss on the psychological well-being in judokas.

Author	POMS Questionnaire	Results					
		T1				T2	
	Tension	↔				↑**	
	Depression	↔				↔	
Filaire et al. (2001) [17]	Anger	↔				↑*	
	Vigor	↔				↓*	
	Fatigue	↔				↑*	
	Confusion	↔				↑**	
		T1		T2		T3	
		WL	CG	WL	CG	WL	CG
	Tension	↔	↔	↑*	↔	↑#	↑#
	Depression	↔	↔	↔	↔	↔	↔
Degoutte et al. (2006) [18]	Anger	↔	↔	↑**	↔	↔	↔
	Vigor	↔	↔	↓**	↔	↓#	↓#
	Fatigue	↔	↔	↑**	↔	↑#	↑#
	Confusion	↔	↔	↔	↔	↔	↔
		CG			WL		
		pre	post		pre	post	
	Tension	↓*	↔		↓*	↑#	
	Depression	↔	↔		↓*	↑#	
Fortes et al. (2018) [25]	Anger	↔	↔		↓*	↑#	
	Vigor	↓*	↔		↑*	↓#	
	Fatigue	↔	↔		↓*	↑#	
	Confusion	↔	↔		↔	↔	

Figure 2. Effects of Rapid Weight Loss on the Psychological Well-Being in Judokas. Source: Bianco et al. (2020).

On top of the harmful psychological effects of RWL techniques, there are also equally harmful physiological effects for athletes who engage in these practices and the parallels can be extrapolated to Marines. Bianco et al. (2020) state,

> There is existing heterogenic evidence investigating the effect of RWL on performance, most studies indicate that RWL impairs both aerobic and anaerobic performance. Dehydration prompted through excessive sweat

> leads to a reduction in the blood plasma and therefore total blood volume is also reduced, hampering cardiovascular function, muscle blood flow, and thermoregulatory ability. (p. 18)

Marines are expected to perform arduous physical tasks almost on a daily basis and the effects of RWL could be the difference between life and death for those who have to practice RWL procedures to maintain standards.

The results of this study conclude that RWL techniques are psychologically and physically harmful to athletes. By extension, one might conclude that it would be equally harmful to Marines who are "warrior athletes" and practicing the same RWL techniques to maintain standards.

4. Psychological Changes following Weight Loss in Overweight and Obese Adults

Beeken et al. (2014) observed approximately 2,000 overweight and obese adults aged 50 or older and studied them over four years to assess the potential health and psychological benefits for the adults who were able to successfully lose approximately 5% body fat, those who gained less than 5% body fat and those who maintained within 5% of their starting weight. The study revealed that weight loss can actually lead to depressed mood and a feeling of lower psychological well-being. Beeken et al. (2014) report that in their findings, participants with depressed moods continued to increase as a result of the weight loss than other groups who maintained or gained weight. They also state "weight loss in initially healthy overweight/obese older adults was associated with reduction in cardio-metabolic risk but no psychological benefit, even when changes in health and life stresses were accounted for" (Beeken et al. 2014, p. 2).

The physical benefits of weight loss cannot be denied but there are risks associated with mood and depression that must be accounted for. Beeken et al. (2014) state, "However, in two population-based cohort studies there was no evidence for beneficial psychological effects of weight loss; rather, evidence for unfavorable effects of weight loss was reported" (2014, p. 2). The study concluded that the participants with depressed mood increased by 80% as they lost weight as well as a higher report rate for feelings of low

well-being than in those whose maintained or even gained weight as seen is Figure 3 (Beeken et al., 2014).

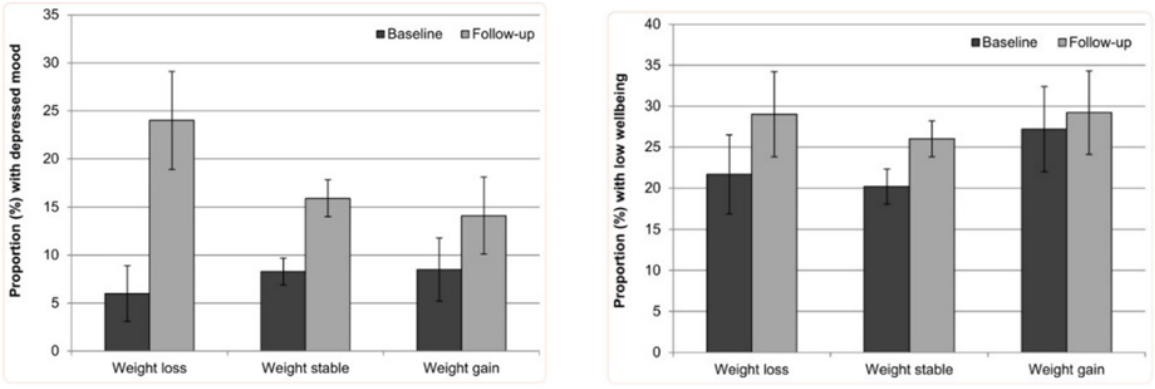

Figure 3. Prevalence of Depressed Mood and Low Well-Being at Baseline and Follow-Up by Weight Change Status. Source: Beeken et al. (2014).

This study also took into account other compounding variables, such as major life events to not conclude that weight loss is causal of depressed mood alone as other life factors can be a correlated factor. Beeken et al. (2014) state

> It was also possible that associations between weight loss and depressed mood were due to major life events which caused both depressed mood and weight loss. The overall results of this study indicated that overweight or obese adults who experience a 5% reduction in body weight over a four-year period obtain no psychological benefit and may be at risk of increased depression, despite benefiting from the expected reductions in cardio-metabolic risk. (p. 2)

This study suggests that weight loss poses many psychologically harmful effects with a prevalence leading towards depressed mood. By extension, one might conclude that it would be equally harmful to Marines who lose excessive amounts of weight to remain within or become within Marine Corps height and weight standards and lead to increased depression among Marines. It can also be concluded that the increased cardiovascular risk associated with weight loss could have detrimental effects to the health of Marines due to the high-intensity nature of most jobs and the physical fitness requirements which place an emphasis on cardiovascular activities.

5. Advantages and Disadvantages of Some Popular Extreme Weight-Loss Regimens

Joshi and Mohan (2018) analyzed the advantages and disadvantages of diets used by people in order to induce rapid weight loss. Practices included diets either very low in carbohydrate or very low in fat, very low calorie diets (VLCD), and meal replacement drinks high in fiber. These are common practices in the Marine Corps as overweight Marines are consistently attempting to lose weight in order to become within standards and quickly gain it back after a weigh in for a variety of reasons such as lifestyle.

This paper explores the different types of extreme diets that are popular among individuals to induce weight loss such as low carbohydrate and high fat diets known as the ketogenic diet. Joshi and Mohan (2018) identified that "low carbohydrate ketogenic diets have little metabolic advantages for weight reduction, and it is mostly the negative energy balance which drives weight loss" (p. 643). They further concluded that fad diets such as this can lead to bone loss, increase blood uric acid concentrations, and possibly lead to cancer in the future. They further investigated VLCD and the effects that can have on the human body, a practice many Marines use several days before having to conduct a weigh in to lose unwanted pounds. It was concluded that this can lead to very rapid weight loss but can be "associated with cholelithiasis, ketosis and increase in serum uric acid concentrations" similar to the Ketogenic diet" (Joshi & Mohan, 2018, p. 644).

In their study conducted in 2018, Joshi and Mohan examined the effectiveness and safety of extreme weight loss regimens. They found that these diets not only result in imbalanced nutrition but also pose safety concerns and are unlikely to be maintained over the long term. Additionally, their research indicated that individuals tend to regain the lost weight shortly after discontinuing these extreme dietary approaches.

According to Joshi and Mohan's findings from 2018, weight management involves two distinct phases: first, achieving weight loss, and second, maintaining that weight loss. This can come from various forms such as nutrition classes, exercise routines, and finding an individualized nutrition and exercise plan fit for each individual. The Marine Corps has invested in some forms of physical fitness training known as the force fitness instructor (FFI) in accordance with MCO 1500.62 which states its mission is to "optimize physical

fitness of individual Marines and units" (Headquarters, United States Marine Corps, 2018, p. 1). Outside of a unit FFI, there is little education about nutrition provided to Marines to help establish a healthy and nutritious diet.

6. The Downside of Weight Loss

Bosomworth (2012) analyzed previous random controlled trials observing weight and mortality. In his overall analysis, Bosomworth (2012) concluded that mortality rates among adults was actually the lowest for individuals whose weight remained in the normal-high or even obese weight ranges provided they do not have obesity related comorbidities and maintain metabolic fitness levels during their lifetimes. He further suggests that losing weight is only advisable for those obese individuals who do have obesity related comorbidities as this can help to lower the risk of death. Obesity rates continue to climb in the United States due to a variety of factors such as genetics, lifestyle, and caloric intake with genetics potentially being responsible for 25%-40% of an individual's weight gain (Bosomworth, 2012).

Bosomworth (2012) further suggests that the optimal weight range to minimize all-cause mortality is in the normal-high range or in the obese range while being underweight is actually associated with an increase in mortality. This could be due to other confounds outside of just weight but an overly excessive amount of obesity also increases mortality rates among adults. Exercise is encouraged regardless of weight range among adults to assist in managing weight and reducing mortality rates as it improves metabolic fitness and cardiovascular functions within the body. Bosomworth (2012) also finds that there is disagreement on the psychological health benefits of weight loss but rather behavior modifications play a large role in the process such as proper diet and increased exercise.

It can be concluded from this analysis that the Marine Corps is placing unduly risk to higher mortality rates among service members with the constant requirement for weight reduction to meet standards. Unless a Marine is obese or experiencing obesity related comorbidities, there is no reason for someone to lose weight other than to remain in compliance with standards set forth by MCO 6110.3A. The focus for the Marine Corps should be the education of Marines on proper diet and exercise to maintain a healthy weight

and reduce the risk of weight related medical issues vice just an arbitrary weight requirement.

7. Impacts of Body Composition Standards on Marines and Talent Management

Literature relating to body composition standards across the military and the physical effects on service members is examined by Fleming et al. (2022), Jones et al. (2017), Lopez (2022), and Matthews et al. (2021).

As identified by Fleming et. al (2022), "Marine Corps body-composition standards were formally established in the 1970s and have incrementally been modified over the years to address changes in force population, adjust to changes in physical fitness requirements, and meet Congressional demands" (Fleming et al., 2022, p. 24). In 2022, RAND published a report by Fleming et al. (2022) assessing and addressing the metrics used in the Marine Corps BCMAP program identifying the problems with current Marine Corps height and weight standards, which were originally developed during World War II. At that time there were no maximum weight standards, only a minimum standard ensuring all males maintained a weight commensurate with nutrition levels required for combat operations (Fleming et al., 2022).

In the 2022 RAND study addressing these aforementioned programs it is noted that, "although a single DOD standard has been in place since 1981, each service has implemented slightly different body-composition policies to reflect their respective needs" (Fleming et al., 2022, p. 7). The Marine Corps has adopted the strictest standards of all the armed forces placing a larger burden on its population to adhere to rigorous physical standards which can lead to unhealthy behaviors and eating practices. Fleming et al. (2022) concluded that "changes to the BCMAP over the decades have been incremental. Relatedly, physical fitness requirements have increased for all Marines, but revisions to the BCMAP have not sufficiently accounted for these changes" (p. viii).

Fleming et al. (2022) state,

> Height and weight tables are drawn from unrepresentative populations and may disproportionately affect people of color and women, particularly

women of color. This may have impacts on the health and retention of the force. Compared with the other services, the Marine Corps' body fat percentage standard is the strictest, and the service places a heavier emphasis on the need to maintain personal appearance. To meet standards, Marines are adopting unhealthy eating disorder behaviors; diagnosis rates for such disorders may be underreported. Marines are diagnosed with eating disorders at higher rates than other service members, and women Marines in particular are diagnosed more than men. (p. viii)

Figure 4 depicts the eating disorder diagnosis rates from 2013–2017.

Comparison of Service Eating Disorder Diagnosis Rates, 2013–2017

Service	Diagnosis Rate (Men)	Diagnosis Rate (Women)
Army	1.2	11.9
Navy	0.8	11.4
Air Force	0.9	10.4
Marine Corps	1.1	20.4

SOURCE: Armed Forces Health Surveillance Branch, published in Kime, 2020.
NOTE: Rates are per 10,000 members.

Figure 4. Comparison of Service Eating Disorder Rates, 2013–2017. Source: Fleming et al. (2022).

As stated by Fleming et al. (2022), "the physical requirements levied on a Marine today require increasing muscle and mass, which is at odds with Marine Corps policy encouraging a 'lean and trim' Marine who can accomplish the physical requirements while maintaining standards. BMI is a flawed tool, originating from research using an unrepresentative sample of people, and it cannot differentiate fat from muscle mass" (Fleming et al., 2022, p. 32). The implications of these findings are multifaceted, raising concerns about the long-term health and overall effectiveness of the Marine Corps. Moreover, there's a risk of diminished retention across all demographic groups, as increasing numbers of Marines opt to leave the institution to evade the burden of continually conforming to what are perceived as unattainable standards.

8. Impact of Physical Fitness and Body Composition on Injury Risk Among U.S. Army Trainees

Jones et al. (2017) studied the combined effects of body composition and physical fitness demands on Army trainees. This literature was not conducted with Marine Corps recruits but the themes can apply across all branches of services based on the overall results of the study. The authors state, "Physical fitness injuries are not uncommon in the military and due to overuse and training, musculoskeletal (MSK) injuries among active duty soldiers result in over 1.3 million medical visits and over 10 million limited duty days each year" (Jones et al., 2017, p. 2). This research studied approximately 185,000 Army trainees to observe and determine the correlation between body mass index and physical fitness related injuries. Jones et al. (2017) state that "trainees with the BMI exhibited highest injury risks for both genders and across all fitness levels while trainees with a higher muscle mass and a higher BMI could be better protected from injuries from strenuous activities making them more 'musculoskeletally resilient' and less likely to incur injuries" (p. 2). This suggests that weight and physical fitness are correlated especially with regards to injury and injury prevention. This further suggests that an accurate assessment of weight compared to height can be flawed based on current standards across the DOD and the Marine Corps.

A lower BMI does not equate to a physically fit and combat ready Marine or Solider. Inversely, a higher BMI can have substantial benefits to ensuring a combat ready force. Jones et al. (2017) state, "The benefit, or protective effect of a moderately high BMI may be related to the additional lean body mass (probably muscle)" (p. 5). This implies that just because a Marine or solider has a higher BMI than what the current military standards allow does not necessarily mean that the individual is fat or obese, in could be the fact that an individual is more muscular and carrying a heavier body weight due to this fact. Jones et al. (2017) further concluded that "substantial evidence has demonstrated that military trainees with poor aerobic fitness have an increased risk of training-related MSK overuse injuries as well as evidence that there is a higher risk of injury to male and female trainees with the lowest BMIs. The lowest risk of injury was found among the most aerobically fit trainees who exhibited 'average' or over average BMI levels" (p. 6). These

conclusions suggest that the military must find a balance between a "fit to fight" Marine or Soldiers and having service members that are considered "lean" to help prevent injury.

9. U.S. Air Force Fitness to Other Services

In this 2022 RAND publication, Matthews et al. (2021) compared results from the 2018 DOD Health Related Behaviors Survey with data collected as part of the regular United States Air Force (USAF) fitness assessment to make evaluations and determinations in this report. The study concluded that using a BMI as a measure of fitness and whether or not a service member is obese is an inaccurate way to make this conclusion. The researchers evaluated airmen fitness between 2005 and 2018 and used the data consisting of approximately four million observations, to examine the accuracy of body mass index estimates that determined an individual to be overweight. They further analyzed other physical fitness metrics used by the USAF, including body composition, cardiovascular and muscular fitness (Matthews et al., 2021).

The Marine Corps currently uses the BMI metric as the way it evaluates service members as being obese or not. Matthews et al. (2021) stated "Another limitation is that obesity estimates based on BMI can be misleading as a standalone measure of fitness" (p. 2) and that

> specifically, BMI may misclassify service members as overweight or obese when they are not; it may be less accurate than other easily obtained measures, such as abdominal circumference (AC) or waist-to height ratio (WHtR); it points to negative fitness trends, while other fitness metrics suggest that fitness has improved over the same period; and it could be combined with other body composition measures to provide a more accurate assessment of health risk across subgroups (e.g., gender, race). (Matthews et al., 2021, p. 2)

In comparison with how the Marine Corps conducts its metrics for measuring fitness, the Air Force is using a completely different method and producing significantly different results with regards to obesity rates among service members. The Centers for Disease Control (CDC) states that "BMI is a screening tool, but it does not diagnose body fat or health" (CDC, 2021). Matthews et al. (2021) state that "BMI does not differentiate between fat mass and other characteristics contributing to a person's weight, such as

muscle and bone. Consequently, individuals with large muscle mass relative to fat can be misclassified as being overweight or even obese" (p. 4).

Matthews et al. (2021) state, "Furthermore, at any given BMI level, there is wide variation in actual percentages of body fat. Therefore, individuals with widely different body fat percentages may have the exact same BMI" (p. 4). The USAF has adopted new measurements for measuring obesity among its service members, allowing females to have up to a 35 inch AC and for males to have up to a 39 inch AC before being classified as obese. Matthews et al. (2021) noted that "Since 2012, less than 1 percent of airmen have exceeded these gender-specific standards" (p. 4). They concluded that "using only BMI, we would conclude that airmen appear to be generally unfit and have been for more than a decade (Matthews et al., 2021, p. 10)." However, using the new formula of body fat measurement, the AC method, the obesity rates among Airmen have decreased from 60% to only 1% as seen in Figure 5.

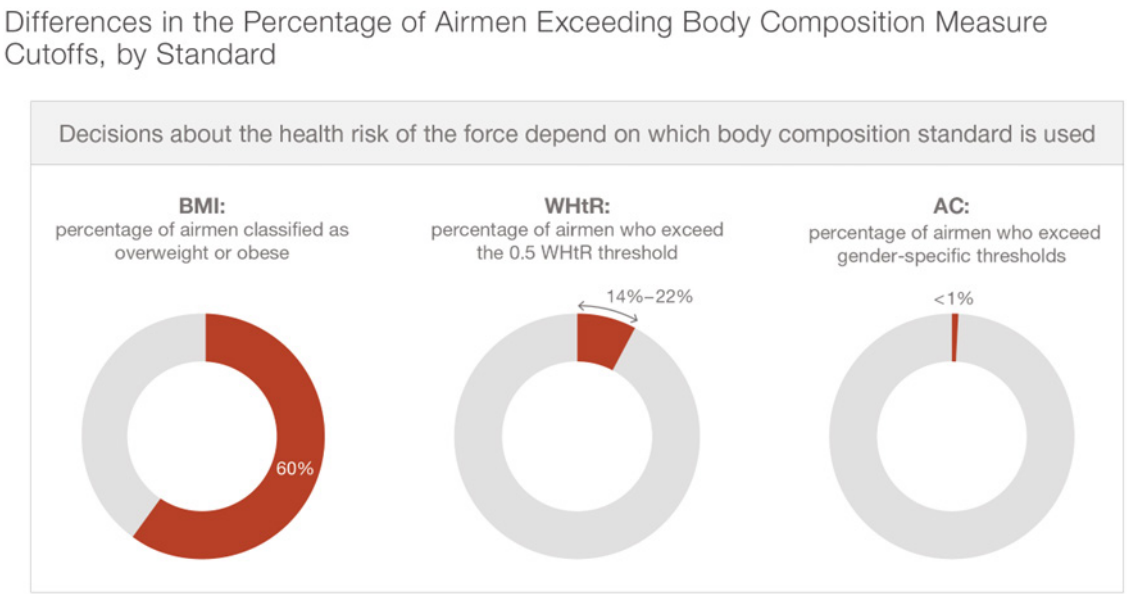

Figure 5. Body Composition Measure Cutoffs. Source: Matthews et al. (2021).

When examining muscular and cardiovascular fitness as well as new methods to evaluate body composition, it can be concluded that the average fitness of Airmen has been

improving over time. Matthews et al. (2021) recommended that "BMI should not be used alone as a diagnostic tool to indicate health risk or to report on the health of the force" (p. 10).

10. Fit vs. Fat: Reevaluating the USMC Body Composition Program

In her 2022 Naval Postgraduate thesis, Lopez (2022) studied the population of active duty Marines from the years 2010–2020. Primary data consisted of a month-to-month analysis of individual demographic data with secondary data displaying a month-by-month snapshot of each Marine's PFT data and CFT data broken down by total score, classification, and the score of each individual event. Lopez (2022) used this data to analyze the effects of policy change and how it affected a Marine's weight both before and after the policy was enacted and the impact it had on fitness through the analysis of PFT and CFT scores. Lopez (2022) placed Marines into four weight zone groups:

> (1) Well Within Standards, which identifies Marines who were 6 or more pounds below the weight maximum in 2016; (2) Danger Zone, which identifies Marines who were 0–5 pounds below the weight maximum in 2016; (3) Moderately Overweight, which identifies Marines who were 1–5 pounds over the weight maximum in 2016; and (4) Overweight High, which identifies Marines who were 6 or more pounds over the weight maximum in 2016. (p. xviii)

Lopez (2022) found that Marines PFT and CFT scores declined from 2016 to 2017 after the Marine Corps increased the standards for both the PFT and CFT but found no direct correlation between weight and the decrease in scores. Her findings concluded that on average, most Marines stay within the "danger zone" with regards to height and weight but once a policy change was enacted allowing more leniency in female Marine weight standards, there was no causal effect with regards to physical performance. Female Marines who maintained a certain weight category before the policy change and maintained a first class PFT continued to do so after standards were relaxed with regards to weight. Essentially, weight alone was not a contributing factor in overall physical performance. For men, there were no changes to the height and weight standards and even with the increase to PFT and CFT standards, once again weight was shown to not have a causal effect with regards to overall physical performance. Lopez (2022) further concluded that

"even when women were allowed to gain an additional 4–8 pounds and still be considered within standards, they gained weight but remained within standards. Men were not affected by the policy change and continued to gain weight within standards except for those who were already in the 'Moderately Overweight' category" (p. 42). This is depicted in Figures 6 and 7.

Figure 6. Female Average Weight before and after Policy Change by Weight Zone. Source: Lopez (2022).

Figure 7. Male Average Weight before and after Policy Change by Weight Zone. Source: Lopez (2022).

The overall findings of Lopez's (2022) thesis indicate that even though both male and female PFT and CFT scores decreased between 2016 and 2017, this was not connected to weight gain but rather to an increase in the difficulty of the standards of both Marine Corps physical fitness tests. She further concluded that there was no clear evidence weight gain affected physical performance as multiple polices went into effect at the same time, the leniency in height and weight standards for women as well as the increase in requirements for the physical fitness tests: "Given less restrictive weight standards, Marines will meet them without compromising performance and Marines will gain weight cautiously. Marines responded to policy by adjusting their weight to avoid the overweight category and the scrutiny of the circumference-based method" (Lopez, 2022, p. xix). Lopez's (2022) final recommendation was that "the Marine Corps should take the opportunity to reevaluate the purpose, usefulness, and effectiveness of the current body composition program" (p. 61).

Lopez's thesis relates to the research conducted for this thesis as it emphasizes that weight is not a determining factor in a Marine's overall physical performance. Allowing

Marines a more reasonable height and weight requirement would not detract from the competency or the combat effectiveness of the Marine Corps. Lopez (2022) recommended the Marine Corps reevaluate its current body composition program which is the sole focus of the research being conducted with more of an emphasis on the physical and mental aspects of the current policy. The research previously conducted suggests height and weight are not a significant factor in physical fitness and performance while my research aims to validate that suggestion while exploring the risks associated with the current policy.

11. Summary

This literature review suggests that while much literature exists about height and weight standards for individuals and performance, there still remains little literature focusing on the implications for and impact it has on an individual Marine from their perspective. There has been data collection and analysis from a quantitative perspective but this does not capture qualitative information on the thoughts, feelings, and perceptions of the individual Marine. Therefore, this research aims to gain insight into what motivates some Marines to stay on active duty regardless of the stringent standards whether they choose to leave service for similar reasons in their own words. In short, this research aims to understand what Marines are doing to stay within height and weight standards while still meeting the physical demands of the Marine Corps and the physical and psychological impacts these standards have on the individual.

III. METHODOLOGY

The purpose of this research is to explore the physical and psychological effects of the current Marine Corps policy regarding height and weight standards on Marines. It further aims to identify and analyze any impacts these current policies are having on retention across the Marine Corps. The researcher conducted semi-structured interviews with both enlisted Marines and officers of various ranks, age, gender, and demographics across the Marine Corps. The researcher analyzed the interviews to identify any common themes, feelings, and perceptions about the current Marine Corps policy regarding height and weight requirements. The NPS Institutional Review Board (IRB) and the Marine Corps IRB reviewed and approved this research project. The researcher received approvals from all organizations by October 23, 2023.

A. INTERVIEW AND TRANSCRIPTION PROCESS

The researcher conducted nine semi-structured interviews over several weeks. Due to not being co-located with several of the participants, all interviews took place virtually using the Microsoft Teams video teleconferencing application during the period from October 24 to November 7, 2023. Interviews lasted from 40 to 120 minutes, with the average interview running approximately 61 minutes.

All interviews focused on four areas: individual background and Marine Corps career, perceptions and feelings on the physical impacts incurred from adherence to height and weight standards, perceptions and feelings on the psychological impacts incurred from adherence to height and weight standards, thoughts and feelings on current policy, and impacts on further service.

The researcher worked with his thesis advisor in the development of the semi-structured interview questions with a focus on creating questions that focused on drawing out the thoughts, feelings, and perceptions of individuals regarding current height and weight policy in the Marine Corps. The questions attempted to invoke personal stories and responses from individuals based on their experiences and how it has affected them physically and psychologically. Examples include not making height and weight in

accordance with MCO 6110.3A and being subjected to the taping process. What if any, weight loss techniques they had ever employed to maintain height and weight in order to pass a weigh-in or not be subject to the taping process, how this affected them both physically and psychologically, changes they would make to current policy, and the impacts the current policy has on continued service.

To better understand why a respondent answered the way they did, background questions had been asked regarding weight during childhood and personal experiences thus far in their military careers with height and weight standards. These questions addressed how feelings and perceptions varied among respondents who have never struggled to make height and weight compared to those who have and how each individual was affected physically and psychologically based on this fact. This approach allowed the researcher to obtain demographic information and different personal experiences from participants that informed subsequent analysis of trends. The data collected from individual participants allowed the researcher to identify how feelings and perceptions regarding current policy vary based on how the policy has affected each individual differently. This analysis allowed the researched to make an informed opinion about the effectiveness of the policy as a whole for the Marine Corps. See Appendix A for a list of interview questions.

Prior to each interview, the researcher informed all participants that the use of pseudonyms would be employed to maintain anonymity when conducting this research. Participants were asked for their approval to record the interviews which were then transcribed using the Microsoft Teams application as well as a recorder used by the researcher to capture any details missed by the Microsoft Teams application to allow for accurate transcription. Prior to conducting the interview, all respondents were provided with a consent cover letter outlining the purpose of the research, a human subjects form outlining how identities would be protected, a copy of the questions that would be asked, and an informed consent form outlining the procedures of the research and interview process. The cumulative time for all interviews conducted was approximately 545 minutes. The transcription process for recorded interviews started on 24 October 2023 with a completion date of 7 November 2023. The transcription process resulted in 460 pages worth of transcribed text with an average of 51 pages for each interview conducted.

B. PARTICIPANT RECRUITMENT

The researcher recruited participants through various methods including solicitation of personal contacts, the creation of a Facebook post on his personal social media page, and advertisement of the research being conducted to fellow Marines at the Naval Postgraduate School. The researcher accepted participants on a first-come-first-serve basis to ensure there was no bias in candidate selection and attempted to allow for a wider rank and demographic spread among participants.

This method of collecting participants enabled the researcher to interview a wide range of participants who differed in terms of gender, ethnicity, time in service, rank, experience, and military occupational specialty (MOS). The researcher's goal was to establish a population sample that spread across various enlisted and officer ranks across the Marine Corps and capture an equal spread of male and female Marines with varying time in service and personal experiences with the height and weight standards.

Once a respondent contacted the researcher either though Facebook messenger, text, phone call, or a face-to-face interaction with interest to participate, the researcher created an email that was sent to respondents describing the purpose of the research, all required consent forms, the interview questions that would be asked, estimated time required for an interview, and the expected interview process and mechanisms for conducting the interview. The focus of the email was to explain the importance of the research being conducted which explores how the Marine Corps' height and weight standards are affecting the physical and mental health of Marines as well as impacts on retention. Additionally, the researcher wanted to discuss recommendations on how the current policy regarding height and weight standards could be improved based on individual experiences. The information provided allowed respondents to make a determination on their participation in the study. Once an individual agreed to participate, the researcher sent a confirmation email containing the consent cover letter outlining the purpose of the research, a human subjects form outlining how identities would be protected, a copy of the questions that would be asked, and an informed consent form outlining the procedures of the research and interview process. Confirmations for date and times of the

interview as well as login procedures for Microsoft Teams were disseminated either through Facebook messenger, text, phone call, or a face-to-face interaction.

C. DESCRIPTION OF PARTICIPANTS/DATA

All participants were active duty enlisted Marines and Marine Corps officers. They varied in race, age, rank, time in service, MOS, and experience. All participants recruited had varying time in service allowing for a wider range of experiences within the Marine Corps. The range of experience is shown in Figure 8: Time in Service. The difference in time in service allowed the researcher to understand how policy change has affected individuals differently over time as incremental changes have occurred through the years. It also allowed the researcher to understand how policy affects a Marine's desire to continue further service differently based on proximity to being retirement eligible. The categories for years of service are broken into five separate groups. The first group, which consists of 8–10 years in service, indicates that a Marine has already re-enlisted at least one to two times or accepted career designation as an officer and is in the position to either exit service before exceeding the halfway mark to retirement or continue service in an attempt to reach the retirement eligible criteria of 20 years of service. The second and third groups, which consists of 11–12 years in service and 13–14 years in service, encompasses Marines and officers who are over halfway through their careers and are considered careerists with the expectation they will stay in service until at least the 20 year mark to be retirement eligible. The fourth and fifth group, which consists of 15 or more years in service, in comprised of your most senior enlisted Marines as well as senior officers, mainly staff noncommissioned officers (SNCO) in the ranks of Staff Sergeant and above, and field grade officers in the ranks of Major and above. These individuals have committed the majority of their lives to the Marine Corps and will most likely continue service until at least the 20 year mark when they can officially retire from service.

The researcher did not focus on a Marine's MOS in the selection process but participants came from two of the three major fields on the Marine Corps consisting of combat service support and combat arms occupations. MOS categories are provided in Figure 9.

The vast majority of the participants were white, specifically 56% of the participant data. 22% of the participants were black and 22% of the participants were Hispanic, as seen in Figure 10. Four of the respondents were female and five of the respondents were male as shown in Figure 11. There was a wide spread in rank between respondents with five respondents encompassing multiple SNCO ranks from Staff Sergeant to Sergeant Major and four officers ranging from Captain to Lieutenant Colonel as shown in Figure 12. The distribution between ranks provides a comprehensive insight based on experience and position seen through different levels of leadership.

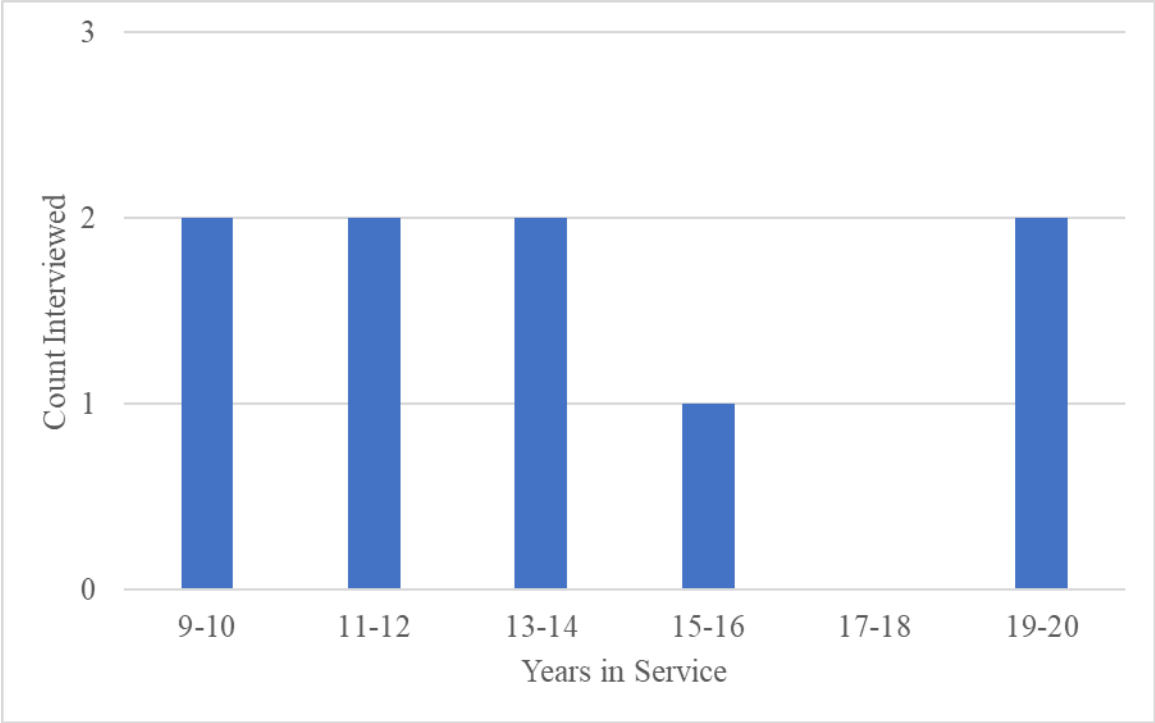

Figure 8. Time in Service

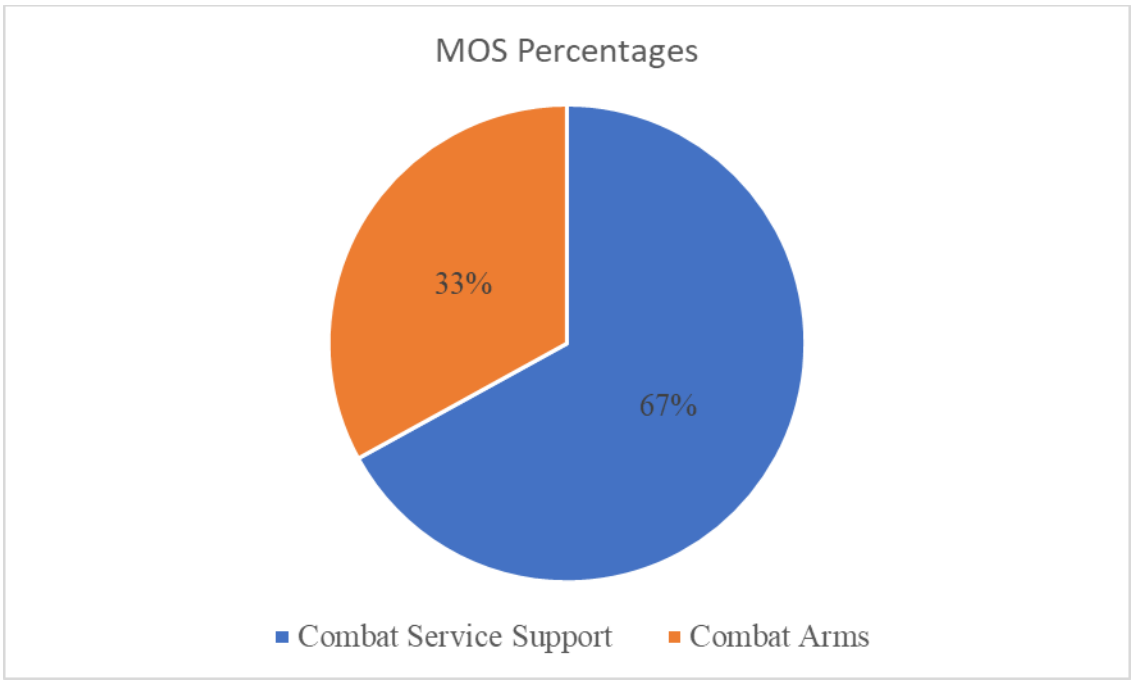

Figure 9. MOS Distribution

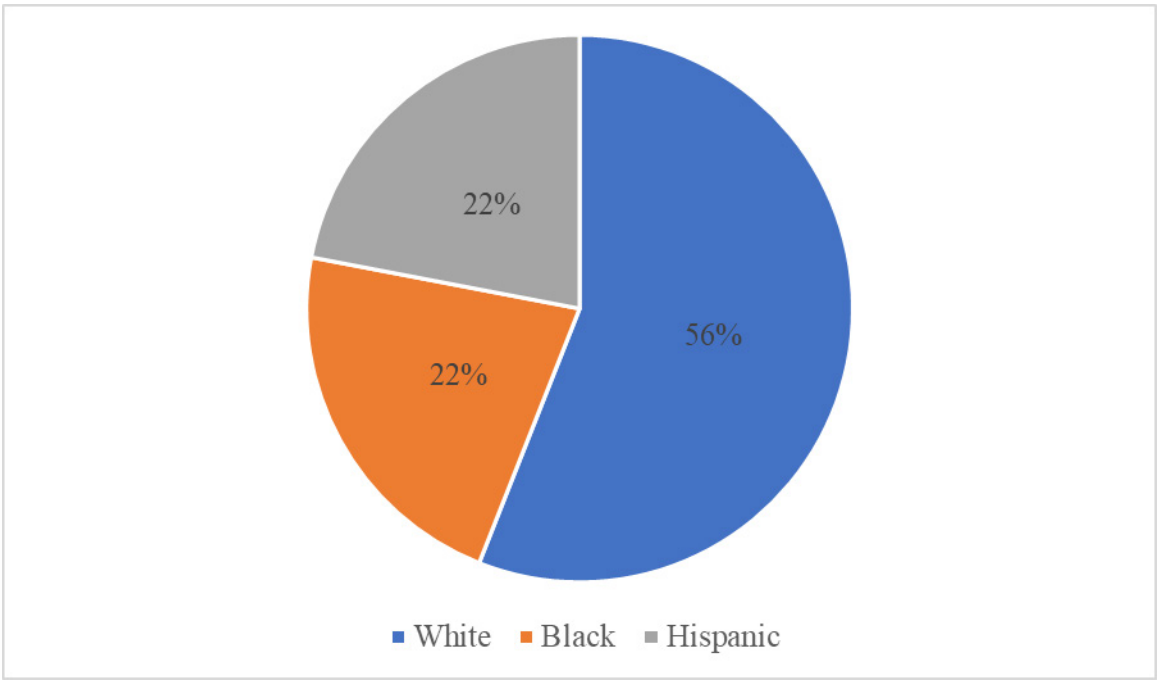

Figure 10. Race Categories

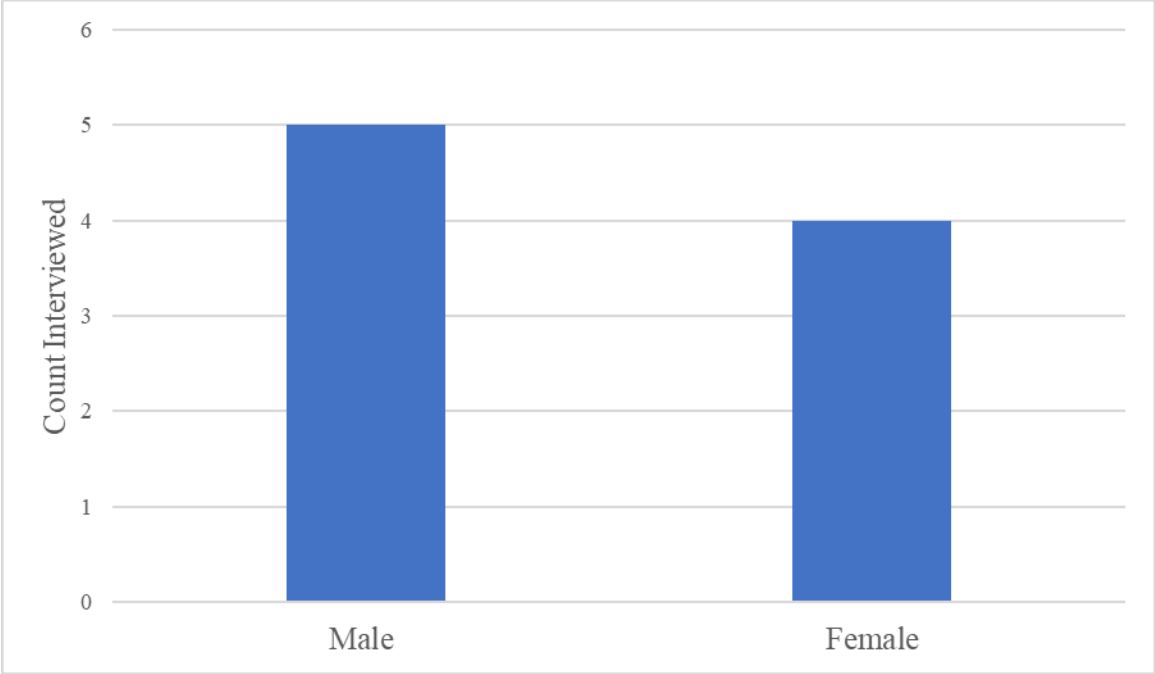

Figure 11. Gender Comparison

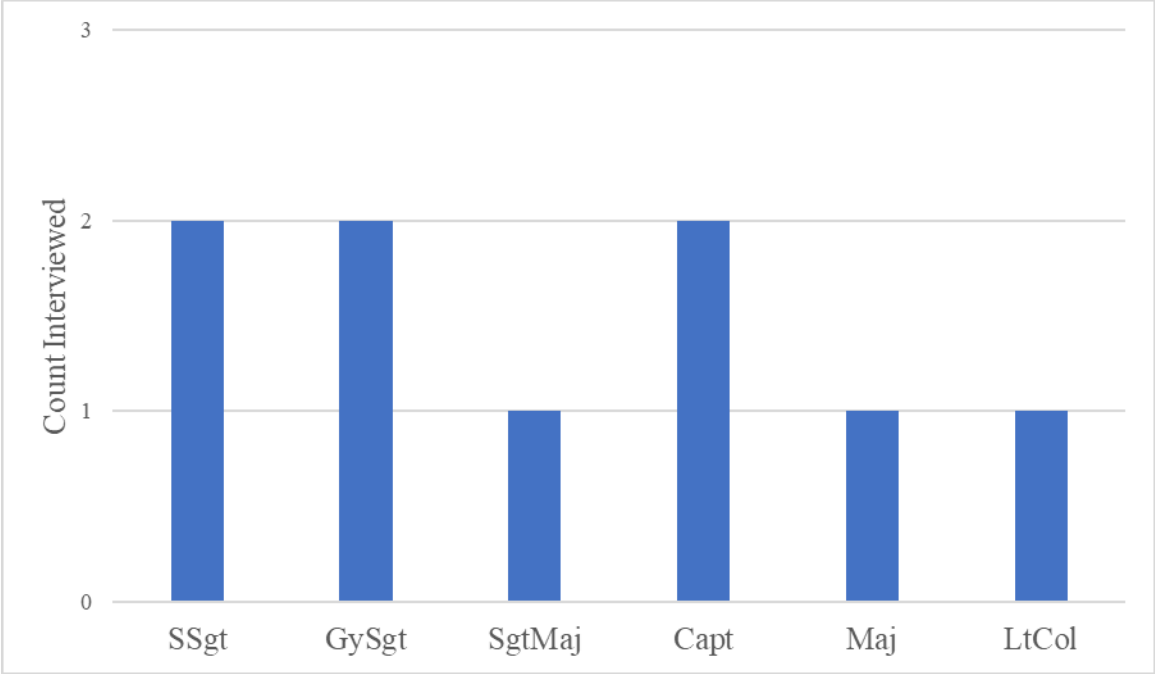

Figure 12. Rank Distribution

D. DATA ANALYSIS APPROACH

This study used thematic analysis after careful examination of data gathered from participant interviews. Data from the interviews was compiled, transcribed, and organized by qualitative coding methods into specific codes and categories based on issues and ideas stated by interview participants. The researcher then analyzed the nine interview transcripts to identify common topics which would later be turned into themes. The common themes were divided into four specific categories, physical health, psychological health, current policy, and continuation of service. The topics and themes discovered were related to the concepts and ideas presented in the literature review. The researcher reviewed the initial topics identified and found similarities between interviewees and reduced them to 121 codes. The researcher then reviewed the codes to identify common themes and grouped the codes into four initial categories. The researcher conducted further analysis and identified four key themes.

1. Generation of Themes

The researcher began the thematic analysis by carefully reading each of the nine interview transcripts and identifying excerpts associated with physical health, psychological health, views on current policy, and continuation of further service. Direct quotes obtained from interviews with respondents ranged from a single phrase to an entire paragraph or more depending on what was being discussed. These excerpts were compiled and organized into 121 codes that are found in Table 3: Codes. The 121 codes were derived from the physical and mental effects of weight loss and rapid weight loss techniques and the common thoughts, feelings, and perceptions that emerged during interviews with participants. Several of the participants' views directly aligned with the literature and many thoughts, feelings, and perceptions were shared among respondents, even those not affected by policy. Some respondents shared differing views when compared to others based on their personal experience and feeling they were unaffected personally by current policy with regard to height and weight. Frequently mentioned ideas derived from the interview data were given an individual code.

Table 3. Codes

Physical struggle	Responsible approach	Inaccurate standards	Zero impact on service
Eating disorders	Fear of not meeting standards	Doesn't equal fitness	Exit service
Starvation techniques	Personal Pride	Define fitness	Factor
Health issues	Fear of taping	Overall health	Conflicting goals
Appearance	Stigma	Military Appearance Program	Perceptions
Aging	Mental fatigue	Lack of accurate science	Failure
Dieting	Lifetsyle change	Outdated	Anger
Tired	Stress	Newer tools and science	Mental fixation
Fatigued	Inadequacy	250 PFT/CFT exemptions	Isolation
Excessive physical training	Embarrassment	Starting point	Depression
Fat vs. muscle	Uncertainty	Reflection of health	Self-conscious
Strength	Worth	Age	Jealousy
Sauna	Consequences	Fad diets	Heart health
Physical health	Body image issues	Education	Cotton mouth
Pain	Judgement	Nutrition	Excessive cardio
Dehydration	Mood changes	Fitness goals	Fear of failure
Supplements	Emotional health	Metabolism	Stress
Layering of clothing	Unworthy	Body Mass Index	Lack of confidence
Depletion	Brain fog	1st Class PFT/CFT	Expectations
Body aches	Frustration	Inaccurate methods	Metabolism
Degraded performance	Pain	Adverse material	Dizzyness
Extreme weight loss	Apprehension	One size fits all	Blood pressure
Laxitives	Anxiety disorder	Unfair	Discipline
Induced vomitting	Nervousness	Society	Taxing
Exhaustion	Exposed	Bigger humans	Personal relationships
Hunger	Mental toughness	Additonal weight	Adversity
Overtraining	Bullying	Neck size	Hornet's nest
Injuries	Shame	Metrics	Peer evaluation
Bodybuilding	Bitterness	Negative stigma	Intermediate fasting
Endurance athlete	Body dysmorphia	High level perfomer	Value
Accountability			

After several further rounds of review of the interview transcripts, the researcher grouped the 121 codes into four broader categories as seen in Table 4: Categories. The codes were grouped into the four categories based upon their relationship to physical health, psychological health, current policy, and continuation of service.

Table 4. Categories

Physical Effects		Current Policy	
Physical struggle	Extreme weight loss	Inaccurate standards	Body Mass Index
Eating disorders	Laxitives	Doesn't equal fitness	1st Class PFT/CFT
Starvation techniques	Induced vomitting	Define fitness	Inaccurate methods
Health issues	Exhaustion	Overall health	Adverse material
Appearance	Hunger	Military Appearance Program	One size fits all
Aging	Overtraining	Lack of accurate science	Unfair
Dieting	Injuries	Outdated	Society
Tired	Bodybuilding	Newer tools and science	Bigger humans
Fatigued	Endurance athlete	250 PFT/CFT exemptions	Additonal weight
Excessive physical training	Intermediate fasting	Starting point	Neck Size
Fat vs. muscle	Metabolism	Reflection of health	Metrics
Strength	Dizzyness	Age	Negative stigma
Sauna	Blood pressure	Fad diets	High level perfomer
Physical health	Heart health	Education	Accountability
Pain	Cotton mouth	Nutrition	Adversity
Dehydration	Excessive cardio	Fitness goals	Hornet's nest
Supplements	Body aches	Metabolism	Peer evaluation
Layering of clothing	Degraded performance	Expectations	
Depletion			
Psychological Effects		Continuation of Further Service	
Responsible approach	Mental toughness	Zero impact on service	Factor
Fear of not meeting standards	Bullying	Exit service	Conflicting goals
Personal pride	Shame		
Fear of taping	Bitterness		
Stigma	Body dysmorphia		
Mental fatigue	Value		
Lifetsyle change	Discipline		
Stress	Taxing		
Inadequacy	Personal relationships		
Embarrassment	Fear of failure		
Uncertainty	Stress		
Worth	Lack of confidence		
Consequences	Perceptions		
Body image issues	Failure		
Judgement	Anger		
Mood changes	Mental fixation		
Emotional health	Isolation		
Unworthy	Depression		
Brain fog	Self-conscious		
Frustration	Jealousy		
Pain	Nervousness		
Apprehension	Exposed		
Anxiety disorder			

This ultimately led to the final four themes, which provide insight into the physical and psychological effects the Marine Corps height and weight standards are having on Marines, thoughts and feelings towards current policy, and impacts to retention. The literature review and participant thoughts suggest the current Marine Corps height and weight standards are having a negative effect on Marines and the practices being employed to maintain standards are negatively affecting the physical and mental health of Marines. They further suggest the current policy is outdated and needs significant overhaul and change. These themes will be further expanded in Chapter 4, Analysis and Findings.

2. Data Limitations

This research project faced certain limitations. Due to time and institutional constraints, the researcher was limited to interviewing nine participants in the research process. No other methodologies were used to collect data. By limiting the selection of participants to only nine individuals, this research does not allow for a full representation of the approximately 177,000 Marines in the Marine Corps. This limited sample, moreover, did not allow for a full representation of Marines based on race, gender, MOS, and other key demographic information needed for a study of this nature.

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IV. ANALYSIS AND FINDINGS

The findings presented in this chapter were based on an analysis of nine semi-structured interviews conducted with active duty Marines of different ranks and demographics. The nine participants included a Hispanic female Staff Sergeant with 10 years of service, a male Caucasian Staff Sergeant with nine years of service, an African American female Gunnery Sergeant with 16 years of service, a Caucasian male Gunnery Sergeant with 13 years of service, a Caucasian male Sergeant Major with 20 years of service, an African American female Captain with 14 years of service, a Caucasian female Captain with 11 years of service, a Caucasian male Marine Corps Major with 12 years of service, and a Caucasian male Lieutenant Colonel with 20 years of service. Based on the analysis of the content of these interviews, four themes emerged: one, the negative physical effects of height and weight standards on Marines; two, the negative psychological effects of height and weight standards on Marines; three, negative perception of outdated height and weight standards and metrics for measuring BMI, and four, potential effects of current height and weight standards on retention within the Marine Corps.

The analysis suggests that the current Marine Corps height and weight standards are having a negative effect on the interviewed Marines both physically and psychologically. During the interview process, some Marines stated they had been overweight most of their life or at a point in their life before joining the Marine Corps. Some participants had to engage in weight loss practices before they could even join service. This behavior suggested that some participants naturally struggle with maintaining healthy weights due to genetics or lifestyle factors and they have to work even harder to stay within Marine Corps standards. The analysis further suggests that the current perception across the interviewed Marines is the service is using outdated methods and metrics to evaluate BMI and it needs to be updated and changed. Some of the proposed recommendations will be addressed in the next chapter. The final finding is that the height and weight standards do play a role in a Marines decision to continue further service but mainly for those who have been affected or are becoming affected by the rigors of making height and weight standards.

A. NEGATIVE PHYSICAL EFFECTS

Interviewee observations about current Marine Corps height and weight standards suggest they are having a negative physical effect on some Marines, who feel compelled to engage in unhealthy practices in order to make weight.

During the conduct of the interviews, all nine participants were asked about their personal experiences with the Marine Corps height and weight standards and how they have affected them physically throughout their career. Of the nine participants, eight of the respondents stated that they have been negatively affected in a physical way from RWL and other practices they have engaged in to make height and weight standards. Only one of the participants stated that the Marine Corps height and weight standards had no negative physical effects on them due to the fact they have never struggled to make height and weight standards nor had to engage in any RWL techniques.

Regarding the negative impact of current Marine Corps height and weight standards, one can imagine based on responses to interview questions the rigorous and methodical investment of time and extraordinary lengths Marines resort to in order to ensure they meet the height and weight standards. The interviewees discussed with me in detail their devotion to the practices they use and it could be implied that some interviewees even set a date on a calendar of when the weigh in would occur and literally backward planned their weight loss protocols from there ensuring they are ready the day of the event. As one female Staff Sergeant answered this question, she began to become emotional as retelling this experience nearly brought tears to her eyes. She stated, "I developed an eating disorder and body dysmorphia. I was running 10 miles a day almost every other day, so I was averaging out about 40 to 45 miles a week. I would just get injured and reinjured" (Staff Sergeant, interview with author, October 31, 2023). She also stated that she also engaged in starvation techniques in order to lose weight rapidly, also recalling another event that appeared to anger her. "I had a surprise weigh in right after lunch specifically for me so I took some laxatives and I went to the bathroom and forced myself to vomit everything" (Staff Sergeant, interview with author, October 31, 2023). This statement by the female Staff Sergeant points to the fact that some Marines feel they have to train in excess physically in order to stay within standards as well as engage in other unhealthy

practices such as self-induced vomiting in an attempt to lose weight. Many Marines engage in physical training daily as part of their lifestyle but due to the rigorous standards, they feel that additional and excessive training must occur in order to try and lose weight. As one Major regrettably recalled his first time not making weight, he stated,

> I had a weigh in where I had 14 pounds to lose to make weight. I had to make weight to go on Christmas leave so what I did was I went home, I got sweaters, layers, long sleeve clothing and what I did was 20 minutes running, 20 minutes sauna, 20 minutes running, 20 minutes sauna. And I repeated that for a frequency of about three to four hours. Took a break. Did it again that evening for two hours, 2–3 hours and repeated it again in the morning in order to make the weight. I executed this rapid weight loss technique and lost 16 pounds and came in two pounds under my max weight.

This type of rapid weight loss technique was mentioned by a majority of the individuals interviewed. One male Staff Sergeant laughed and appeared proud as he stated,

> I have this whole RWL techniques down to a science to lose weight for a weigh in. I call it my 12–14 day process. First, I cut out all sugar and alcohol. I only drink water. I completely stop eating any food for five straight days. This shocks the body and that takes a good chunk of weight off initially from starving myself and shocking the body. Then I introduce some food such as cucumbers, salads, brown rice, and hard boiled eggs. I do this until the last three days before the weigh in and the final days leading up to the weigh in which are the worst days for me, I start the heavy sauna suit runs for six miles at a time. The last 24 hours I cut out all water and use an ice cube just to rub on my lips because they are so dry by this point. I take an Epsom salt bath the night before the weigh in and I weigh in as soon as possible the next day because at this point, I am ready to pass out from exhaustion and dehydration. Once I make weight, I start eating and hydrating again. I am only in standards for a few hours two days a year.

Another female Captain reflected for a moment before responding to interview questions, seeming almost reminiscent. She stated "As a Second Lieutenant, I definitely practiced more of the starvation technique. I don't know if you've heard of like the three day military diet, but it's pretty much like this extreme three day cut where you lose like I mean five to ten pounds in the course of three days. It's not healthy at all and it impacted my physical performance" (Captain, interview with author, October 24, 2023). A female Gunnery Sergeant commented on a similar regimen. She stated,

> I practice techniques I call preventative maintenance on weight. I would essentially know that I would have to cut back on a lot of eating, I know that I have to do like Hydroxycut or I will have to take some type of laxatives in order to like preventative maintenance on my weight to make sure that I am at least five pounds underneath my max if I do get close. I have had to suit up with sweats and layered clothing and I am on the stair stepper for 30 minutes to 45 minutes or I'm on the treadmill walking on an incline for 30–45 minutes to an hour. So, I do excessive amounts of unidealistic cardio to where I'm layering up and I have a waist trainer on and you know I'm sweating and depleting so that is one way I maintain weight.

Despite the relative diversity of Marines interviewed, the majority practiced similar techniques. A Sergeant Major vividly stated "I've tried fasting, specifically, 72 hours fasting which is a miserable event. I've also tried the sauna. You know, going to the sauna, drop water weight prior to the weigh in." The Sergeant Major also excitedly stated "I've done some excessive PT when it comes to weigh ins before and it made my body get pretty jacked up." When discussing how excessive physical exercise affected a Gunnery Sergeant attempting to make weight he stated with bitterness "I would say it 100% affected me in a negative way. I was dehydrated, you know, lethargic. You know you don't have as much energy." On the other hand, one participant, a Lieutenant Colonel did not feel he had been affected in a negative way physically explained that he had never been affected because he has never had trouble making weight. He naturally was always within height and weight standards but expressed understanding and empathy for those who were not.

In short, while select interviewees appeared to not be negatively affected by existing Marine Corps height and weight standards, most struggle to make weight under current Marine Corps policy. Laxatives, excessive physical training, weight loss supplements, or RWL techniques were used in an attempt to meet weight requirements.

B. NEGATIVE PSYCHOLOGICAL EFFECTS

Interview data also suggests that current Marine Corps height and weight standards are having a negative psychological effect on the interviewed Marines, even those who do not struggle to maintain height and weight standards. The Marine Corps has an alternate method of measuring BMI for those who cannot make weight according to the order, the

taping method as previously described in chapter one. The lingering fear of not making weight and being subject to the taping method is something 100% of respondents stated affected them in a psychological way. However, this method appears to carry a negative stigma and places an unduly amount of pressure on Marines to do whatever is necessary to make weight and not be subject to the taping method. Even the Lieutenant Colonel mentioned above who has never been taped in his career stated with concern "As an officer, I think that there's a certain stigma that would be attached to you as an officer being taped. Being an officer on BCP or having to explain to your OIC or your Commanding Officer you might potentially be on BCP because you couldn't make weight and now you have to be taped." In addition, a Sergeant Major unequivocally stated "It's always looked at negatively as an 8999 having to tape. Do I think when I look myself in the mirror, do I think I am fat or out of standards? No, but it's still stressful being taped and your Marines and your peers knowing you got taped." A female Captain who has been subject to the taping method appeared sad in response to the topic and stated "It was just stressful and just like having that negative feeling about yourself having to feel like everyone's judging you, it definitely impacted relationships with people and how I perceived people to perceive me, I guess like a little bit of perception inception, if you will." Finally, a female Staff Sergeant shared her experiences with the taping method, showing remorse, stating "So it made me feel pretty bad and I felt things I've never felt before, like, you know, being ashamed of, of being overweight in my own body. I just felt ashamed being overweight by Marine Corps standards."

The psychological effects of the height and weight standards are not only affecting Marines who are hesitant and try to avoid the taping method, but the constant demand to make weight affected most Marines in their personal lives as well outside of the Marine Corps. To that point, one female Gunnery Sergeant shared a story about her experiences and the fear, pressure, anxiety, and worry she felt and how it affected her personal life outside of the Marine Corps. She stated,

> Obviously, when you move up in rank or billets, you have a higher precedence and you have more of a facade of an illusion like you are the greatest, when you're standing in front of X amount of people, X number of other Marines, elite Marines, they're ultimately going to judge you. So,

> the moment that you step in front of them in my mind, I'm like, oh my God, these people are looking at how tight my cammies are. I can't breathe. Do they think, you know, do they think that I am bad or I'm lazy? So, you have like this mental rush through your head of like, what are people thinking of me like they probably think I'm fat and gross. You start thinking the same way about yourself and you're constantly looking in the mirror. You're constantly jumping on the scale. You're constantly like depressed. You're constantly battling with yourself like, hey, what am I going to do today? How am I going to force myself to just lose like, point eight pounds today? Not even a pound, just point eight pounds? You're like super fixated on trying to become skinny, your waist, like a size 22 inch waist. I need my waist to get smaller, I need my weight to get smaller. I need to run faster. And in a way it's kind of like you're bouncing back and forth like oh, I'm getting smaller, I'm getting fatter. Like I don't want anyone to look at me and then you feel as though other Marines are judging like oh, she was a drill instructor or her Charlie's are super tight. I don't want anyone to see me until I look better. But it does play a part in my intimacy if I have a partner. Don't touch me here. Don't grab me. I don't feel like doing anything because I feel fat.

This response is just one of many indicating a negative psychological impact posed as a result of the stresses of meeting height and weight standards. Another female Staff Sergeant shared her personal struggles with the height and weight standards like above. In addition, she specifically cited her experience with being bullied by her leadership and fellow Marines for not being able to make weight and having to resort to the taping method to pass the height and weight standards. She stated,

> In uniform I don't like to look at myself like I rarely do. Like what we do, we take a few selfies and it and never leaves the phone. Like never send it to my significant other, my mom because I just don't. I look at the photos and I still look at myself like how I looked when I was in Japan when I was being bullied. I was targeted in that command a lot for everything. Not just weight. It was work. It was a whole different scenario that till this day, I'm still bitter about it because I don't understand why it was just me. So, I take pictures at a certain angle because it makes me look thinner because I feel like I look fat. It makes me feel ashamed because I did get a lot of bullying because of my weight and felt embarrassed and it left a pretty bad taste of the Marine Corps from when I was a Lance Corporal.

The psychological effects of the standards impacted most of the Marines interviewed and in turn affected the way they view themselves. Feelings of unworthiness

or shame about their personal appearance followed. Consider the comments from a female Captain:

> You have this like other layer of guilt on top of all this because, like, you're not doing what the Marine Corps needs you to do. And that's really hard and that feeling of like failing your subordinates and feeling your peers and failing your supervisors. Like it's just a huge mental load that like, just kind of compounds on the fact that you're already struggling with your weight.

While not every Marine interviewed for this study expressed the same sentiments regarding height and weight standards, nonetheless it appears that they were impacted in some fashion. Consider the following comment from one Major, who stoically stated: "Yeah, the standards add a little extra stress. It does, but that's fine. It's ok, I guess, because that is what I got to do. I can't change the policy so the policy is the policy. And as we're taught, Marine Corps officers we enforce the policy. Whenever it comes time to make height and weight, I've had to become super conscientious about it." Some respondents repeatedly expressed similar feelings of shame, embarrassment, fear, a lack of self-worth, and even feelings of anxiety from constantly feeling stressed about maintaining standards. One Gunnery Sergeant appearing bothered, stating, "Yeah, I think anxiety and apprehension are kind of really what I feel. Because I mean, I'm trying to make weight, but there's no guarantee I'm going to make it so that whole process, whether it be 24–48-96 hours, whatever it is, that whole process is anxiety filled." A Sergeant Major noted, "I think most Marines that value performance has some kind of anxiety disorder, the Marine Corps breeds anxiety and anxiety disorders into the Marines. So, they want to be performers, you know, and there's that fear of failure. So, 100% it's always mentally taxing."

The common theme drawn from the interviews conducted with Marines of all ranks and demographics suggests that Marines need to deal with some degree of negative psychological impact given the need to remain within height and weight standards and not be subject to the taping method or not pass the requirements all together. Some Marines are directly affected more than others, but this data suggests in general the standards place undue emotional and psychological stress on Marines. As previously stated, even Marines such as the Lieutenant Colonel, who has never struggled to make height and weight, are

weary of the idea of ever having to resort to the taping method due to the perceived stigma associated. Other Marines, particularly the female Marines have had to resort to extreme measures to ensure they remain in height and weight standards and the impacts have affected their personal relationships. In some form or another, every Marine is affected on some level, the depths of the impacts vary person to person and the effects are all different.

C. OUTDATED METRICS TO MEASURE BMI

A third theme that emerged from the interviews with respondents was the perception that the current Marine Corps height and weight standards are outdated, inaccurate, and need to be changed. All of the respondents felt that the metrics used by today's Marine Corps is not an accurate reflection of health, BMI, or a person's overall physical appearance. For example, take the following observation by a Sergeant Major: "The numbers for height and weight haven't changed too much since Marine Corps 2002. You can't measure fitness and physical appearance with body composition numbers. The body types of our society have changed drastically over the years. I think the standards need to be rethought and I think needs to be rebase lined."

The interviewed Marines continued to express feelings of frustration with the current metrics being used to measure BMI with the perception that they were being compared to a population group that is no longer an accurate representation of today's society or Marine Corps. Some even expressed frustration with the current methods because of the neck to waist method to measure BMI when a Marine does not make weight. When asked about their perceptions about the accuracy of Marine Corps height and weight standards almost every respondent had a view similar to that shared by one female Staff Sergeant: "I wholeheartedly believe that Marine Corps standards are an inaccurate representation of the Marine Corps and personal appearance because you can have a Marine who looks significantly overweight but makes tape because they have a short and wide neck." A Staff Sergeant frustratingly elaborated on this point by explaining the ways Marines "cheat the system" by being overweight and managing to grow their necks. He stated,

> It is not accurate at all. I had a 30 year Master Gunnery Sergeant smacking my neck to help me make tape one weigh in. A 30 year Master Gunnery Sergeant! Smacking the **** out of my neck because I was at 221 pounds one day and he was like, no, we're doing this now and he smacked my neck so hard it swelled up and he gave me the extra freaking quarter of an inch. I needed to tape. Like that's 30 years of Marine Corps experience, and he's like, we can get you there. You might not like it, but we can get you there if you are willing to do that, he knows that the systems flawed. It means that someone probably did it to him because he was similarly built, right? It's known and it's like one of the things.

When asked if the current height and weight standards are accurate and not outdated, a female Captain also expressed frustration, stating,

> I just think the standards aren't correct, because if even if I'm exempt from the standards because of PFT/CFT scores, the fact is that the tape measurement is not correct. That shows me that that's like it's not reliable like you could do linear regression model on all of this data and show that taping is not reliable. It's not accurate. For body weight and everything. And for your BMI. Which is really, really frustrating.

A second female Captain echoed these concerns highlighting an apparent contradiction of a Marines self-assessment and restrictions imposed on them by current standards. She stated,

> You have Marines that enjoy working out Marines that you know want a bigger physique and they work really hard to get that body and their performance reflects that, right? Like they have the build and the physique that just works. They fill out their uniform very well. But they can't make weight, and they probably won't make tape either. You know? So, I don't think that the height and weight standards are serving the purpose that the Marine Corps intended them to serve when they first thought of this policy or, you know, have kept it going. They are just inaccurate and out of date.

To address these shortcomings, Marines suggested other methods to calculate fitness as well as other forms of measuring a Marines BMI. For example, a Lieutenant Colonel commented that "When determining BMI, there's so many other tools out there that are available. Height and weight can be a starting point, but there is the MAP. Give Commanders the authority to waive height and weight based on the MAP program."

The data suggests that the general perception among the interviewed Marines about height and weight sees them as outdated and no longer an accurate representation of the

population of today. The metrics being used are inaccurate and causing some Marines to feel like they have to maintain a certain level of physical fitness which has changed drastically over the years since inception of the height and weight standards but with ever increasing physical requirements, this requires the accumulation of more muscle. With the accumulation of more muscle comes added weight. This cumulative effect of trying to maintain physical fitness standards and height and weight standards are the dilemmas pointed out by participants. As one Gunnery Sergeant noted with a caustic tone:

> Do we want to represent a war fighting organization that is lethal, that that can win the battle when the wars in the battlefield? Or do we just want people who can make height and weight standards based upon the outdated standard that we have or that was in, in and I don't have the data right to say it's outdated, but I'm going to make the hypothesis that the standard they've created is not based on good data, they haven't accurately surveyed and studied the war fighter of today right to determine what is, what is the standard. You go back to 1945, it was all calisthenics. It was calisthenics, that's all they did.

In short, a common theme drawn from interviews conducted with Marines representing different ranks and demographics is that they perceive that the current standards are outdated and inaccurate and need to be reviewed and changed to meet the demands of today's Marine.

D. IMPACTS ON RETENTION

All respondents interviewed said that the height and weight standards were not a significant enough factor to deter them from continuing service but was a factor in the decision-making process. One Major noted, "It was part of the deliberation when I was deciding what to do early in my career, it may not have been the largest part, but it definitely was a factor in consideration level when deciding to stay in or get out." All but one participant had ten years of service or more so this may have been a contributing factor in the feelings expressed by the interviewees. All participants are currently on the 20 year retirement plan known as the legacy system meaning that at 20 years they can retire from active duty and receive a military pension for the rest of their lives. Since all but one participant has already reached the halfway point in their term to retirement, they do not believe that the height and weight requirements alone are enough to deter them from further

service and reaching retirement eligibility. Regardless of their individual decision, Marines interviewed witnessed other Marines who chose to exit service simply because they could no longer deal with the stringent and seemingly outdated height and weight requirements. One Gunnery Sergeant shared a personal experience with a former Marine.

> I knew a Marine who got out as a Staff Sergeant. He was a machine gunner, jacked dude. He was a Sergeant on deployment. He came in in 2016, did a few deployments, and was just an overall big guy. He got out because it's like my values and morals aren't aligned, aren't aligned with the Marine Corps. He wants to be a fit dude. He wants to have muscle. He got out and started doing professional bodybuilding shows, that's how fit he was even though he couldn't make Marine Corps standards for height and weight. You know like it was mentally and physically exhausting for him and he got out because you know he had vocalized he wants to be fit and jacked and in the Marine Corps, with the current standards, he just couldn't.

Regarding their direct individual experiences, one female Staff Sergeant stated "I would want to stay in. However, I will always cut it close with height and weight. I've endured too much over the past 10 years to throw in the towel now." One female Captain added:

> When I was younger and out of standards it made me want to exit service, now that I am older and able to maintain standards better, it is less of a factor but it is a determining factor with regards to my physical and mental health as I continue to get older. I don't want to keep destroying my body and sacrificing my health just to stay in the Marine Corps. But at this point in my career, the height and weight standards alone wouldn't be enough to make me exit the Marine Corps.

The Lieutenant Colonel and Sergeant Major both unequivocally stated the height and weight standards would not be enough to make them exit service. A Gunnery Sergeant stated, "I'm on legacy, so for me the height and weight is never going to influence my decision to continue because I'm at the end of the rope. I am almost at retirement eligible." A female Gunnery Sergeant also shared very strong views on how the standards would not be enough to make her exit service because of the life the Marine Corps has provided for her. She stated,

> I haven't had those thoughts about exiting service over the standards. I mean, I'm not the one that makes the rules and I've been doing it for so long. Maybe I am institutionalized but that's just how I see it. The Marine Corps has put a roof over my head. They've put money in my pocket. You

> know, they sent me to all these great places, so why not just figure out how to be in height and weight standards just like everything else in the Marine Corps or you go to a job and you don't know it, I figured it out. So, I put the same perspective in the Marine Corps pays me to stay in shape. The Marine Corps pays me to show up on time. So, I think that's where my rationality comes into. Why not? Make height and weight standards by any means necessary? Despite my struggles, height and weight standards are not enough to make me leave the Marine Corps.

Another female Captain explained she was at a point in her career that she would not exit service because of the standards. Nonetheless, she seemed dissatisfied by being forced to comply with the current height and weight standards. She stated,

> The height and weight standards among other things, yes, it is a factor. I think that just coupled with the PFT/CFT; it's definitely impacts it. But it's just frustrating to know that I can have achieved all these things and demonstrated my worth in so many other ways, but they put so much emphasis, you know, on this one little thing. I'm almost at 15 years and I'm already like this the first time to exit service and I'm like no too much. I'm ready. I'm old now. This is not the time to be trying to take drastic measures to change lifestyle changes like no. But I am almost at retirement so I won't exit service now. If I had these issues when I was younger and had less time in, I think it may have been a bigger factor in my decision to continue service.

E. SUMMARY

The research findings suggest that the Marine Corps height and weight standards are impacting Marines. More specifically, they are negatively affecting Marines both physically and psychologically as Marines try to maintain the current standards.

From the physical aspect, some Marines are resorting to methods and practices that have a direct and negative impact on the body itself. Some of the techniques discussed such as fad dieting, excessive physical training, layering of clothing to sweat and lose water weight, sitting in a sauna, dehydration techniques, and the use of supplements are methods to lose weight but are impacting the body in a harmful and negative way. These methods to lose weight also lead to issues with the physical performance of the body itself such as aches and pains, fatigue and tiredness, injuries, heart complications, and an overall degraded physical performance decreasing a Marine's fitness for combat. The practices used are ways Marines are attempting to manipulate their bodies to maintain a standard but

in turn are potentially causing severe negative health outcomes and potentially long lasting detrimental physical side effects.

The psychological issues associated with current standards and the stigmas within the Marine Corps about physical appearance are potentially creating psychologically unsafe environments for Marines. The research suggests that the stigma associated with having to resort to the taping method to make standards or subject oneself to harmful RWL practices is resulting in the overall feeling of a loss of personal pride in one's appearance leading to negative psychological effects on Marines as well. These negative psychological effects associated with these issues can lead to the development of many harmful emotions and feelings such as depression, anxiety, shame, anger, and even impact personal relationships. Some of the issues identified that further degrade the psychological safety among Marines is the bullying that can occur among Marines who struggle more than others to maintain these standards. The judgement from others can cause serious and long lasting psychological damage leading to body image issues, anxiety disorders, and even the development of body dysmorphia in some instances. These harmful psychological effects can create lasting trauma and emotional issues for Marines and degrade their warfighting performance in addition to the degraded physical performance.

The perception of the majority of interviewees was that Marine Corps height and weight standards are outdated and need to be changed to fit the Marine of today and an ever growing and changing society. Current standards appear no longer accurate and no longer reflect the ideal image or required weights for the requirements of the Marine of today. The literature discussed in chapter two further suggests that the current standards do not reflect an accurate assessment of health and fitness. There is no one size fits all approach for measuring health, fitness, and the population originally used to create the current metrics and evaluation techniques is no longer an accurate representation of the population that exists within the Marine Corps today. There are newer and more relevant methods to measure health and fitness and more accurately assess the health and fitness levels of today's warfighter. Recommendations and proposed changes to policy will be discussed in detail in chapter five. While the height and weight standards did not have a significant impact on the interviewed populations decision to continue further service, the

data suggests that the height and weight standards may play a significant factor in a younger population of Marines with less time in service making a decision to continue further service.

There seems to be an issue within the Marine Corps regarding height and weight standards when eight out of nine of the interviewed population feel they have been affected physically in a negative way, all nine individuals interviewed population have been affected psychologically in a negative way, and all nine interviewees shared the perception that standards are outdated. The following chapter will further build on the analysis of this data and discuss, make recommendations, and identify areas for continued research into this issue.

V. CONCLUSION

A. FINAL STATEMENT

This study attempts to answer three questions related to the impacts of Marine Corps height and weight standards on Marines, if these standards are contributing to Marines' behaviors to comply with standards, as well as the impacts of these standards on retention. More specifically, the data obtained through interviews with nine Marines has illuminated potentially harmful practices Marines are engaging in to maintain height and weight standards, how these practices and the stressors associated with height and weight appear to be impacting the physical and emotional health of Marines, and how any of these factors might be impacting retention within the Marine Corps.

Based on the analysis of interview data and corresponding responses to the research questions, three suggestions for the future of Marine Corps height and weight standards are offered. In addition, this study includes specific recommendations made by participants during interviews as well those derived from an analysis of existing literature. The ideas for future research are offered by way of suggesting ways to expand available data above and beyond what was possible to collect in this study, and in turn to serve as gateway for new ideas to continue to look for ways to contribute to the health and welfare of individual Marines by focusing on the Marine Corps height and weight program.

B. RESEARCH QUESTIONS AND CONCLUSIONS

The three research questions and a summary of findings related to each other are as follows:

(1) What impacts do the current Marine Corps height and weight standards have on a Marine's physical and mental health?

Analysis of interview data and literature suggest that the current Marine Corps height and weight standards are having a negative impact on the physical and mental health of Marines. The physical aspect stems from the practices that Marines feel they must engage in to stay within height and weight standards, an observation that will be elaborated

on in research question two. Many participants stated that the practices they have engaged in to make height and weight standards have affected them physically in a negative way by inducing feelings of fatigue, body aches, injuries, and other potential health issues. At the same time, these practices and the constant desire to remain within standards has negatively affected most study participants in some way psychologically. Participants described feelings of shame, depression, anger, and frustration; in some cases, their mental health was being affected to the point it was interfering in personal relationships due to the feelings of anxiety and self-esteem issues they developed. Marines seem to be doing whatever is necessary to maintain standards but the impacts onto their physical and psychological well-being appears to be the price most Marines are paying. In short, based on the data collected during this study, the current Marine Corps height and weight standards are negatively impacting the health and well-being of Marines included in this study leading to unhealthy behaviors and practices.

(2) Do current Marine Corps height and weight standards appear to be contributing to Marines' behaviors to remain within standards?

The findings of this study suggest that the Marine Corps height and weight standards are contributing to Marine's behaviors to remain within standards. Marines interviewed for this study are engaging in unhealthy weight loss practices that are impacting them both physically and mentally. These same Marines are practicing unhealthy behaviors such as RWL techniques, the use of diuretics, excessive PT, overuse of the sauna, layering or other methods to induce abnormal dehydration, starvation, and in some cases even self-induced vomiting to meet current height and weight standards. In short, Marines seem to be pushing their bodies to unhealthy extremes, finding ways to decrease weight before weigh ins. Out of all the participants interviewed, eight out of nine interviewees have practiced some form of a RWL technique.

(3) What is the potential impact current Marine Corps height and weight standards have on a Marine's desire to re-enlist?

The analysis suggests that among the nine active duty Marines interviewed for this study, the Marine Corps height and weight standards are a factor in a Marine's desire to

continue service but not a strong enough factor to be the sole reason a Marine would choose to exit service. The population interviewed was a more senior group of Marines with almost every participant having over ten years in service and being closer than a first-term Marine to retirement eligibility. However, it can be suggested, subject to further research, that if the interview population had been a younger group of Marines with less time in service, the current height and weight standards may have played a larger role in the determination to continue further service. Even with this more senior population, the majority of participants stated they do consider the height and weight standards when deciding to continue further service, but most will do whatever is necessary to maintain standards and continue service.

C. RECOMMENDATIONS

Based on this research and analysis, and subject to further study, the Marine Corps might rethink and change the way height and weight is measured in the Marine Corps. More specifically, leaders should consider the following:

(1) Eliminating the Use of Height and Weight to Measure BMI and Utilizing the Military Appearance Program for Determining Military Appearance Standards

One of the biggest benefits of this recommendation to the Marine Corps and to the Marines is that a Marine's weight will no longer be relevant when determining military appearance and BMI. Taking this action achieves two ends. First, using the military appearance program to determine a Marine's military appearance empowers the Commanding Officer and empowers the small unit leader within a unit to determine if a Marine looks overweight as opposed to just seeing a number on a scale. Using this method, there will no longer be a way to cheat the system by enlarging a Marine's neck to compensate for an overly large abdominal region. It also eliminates the need for Marines to practice unhealthy weight loss habits to meet an arbitrary number that does not provide an accurate assessment of fitness or health.

Second, implementing this recommendation likely eliminates the need for a Marine to subject themselves to unhealthy habits that lead to physically and psychologically

negative effects. It allows Marines to achieve the physique they desire provided they maintain a good military appearance in uniform. Marines would no longer be chasing a number on a scale or attempting to meeting a specific taping number. This would encourage Marine's to maintain a healthy weight suited to their body and allows them to focus more on maintaining health and military appearance over a height and weight metric developed over 50 years ago.

(2) Exempting Marines from Height and Weight Standards Who Achieve a 250 PFT and a 250 CFT Score

The Marine Corps continues to increase the physical demands placed on our Marines in an ever-changing warfighting environment while simultaneously holding Marines accountable to standards that have not been significantly modified in over 50 years. By exempting Marines from height and weight standards who achieve a 250 PFT and CFT score, this recommendation encourages an attainable level of physical fitness to a larger group of Marines and provides benefits to the Marine Corps and the individual Marine.

In her 2022 Naval Postgraduate School thesis, Lopez (2022) stated that only 15% of the Marine Corps scores a 250 and above on the PFT and CFT suggesting that this exemption would only apply to the most physically fit portion of the force. It is highly unlikely a significantly overweight Marine could achieve this level of physical fitness and maintain a good military appearance. The exemption would also encourage Marines to become more physically fit in order to obtain this exemption creating a stronger and more physically fit Marine Corps overall. Only 2% of the Marine Corps qualifies for exemption from current height and weight standards which requires a 285 or above on both the PFT and CFT (Lopez, 2022). Lowering the scores for exemption could have the potential impact of creating a more physically and mentally healthier Marine Corps while simultaneously improving overall fitness. It could be expected that this would encourage Marines to work harder to achieve a more reasonable exemption score.

(3) Exploring and Implementing New Ways of Measuring BMI

The current methods of measuring height and weight in the Marine Corps seem outdated and have not been significantly modified in over 50 years. Marines are being compared against standards that are not relevant to today's population or today's Marine: "BMI is a flawed tool, originating from research using an unrepresentative sample of people, and it cannot differentiate fat from muscle mass" (Fleming et al., 2022, p. 32). Finding a new way to measure BMI would allow for more muscular Marines to continue to be physically dominant while not stressing the importance of a number on a scale for their overall evaluation. This leads to a more well-rounded warfighter capable of handling harsher conditions and physical requirements than someone with less muscle. The Marine Corps wants a fighting force that can compete and win in today's wars but are still using methods that are not accurate. The Marine Corps is advised to find new and more scientific ways of measuring BMI, not just height and weight measurements or the taping method which has proven to be flawed.

Other methods such as the abdominal circumference method the Air Force has begun using is one potential option to measure BMI in a different manner. This method for measuring obesity among its service members allows females to have up to a 35-inch AC and for males to have up to a 39-inch AC before being classified as obese: "Since 2012, less than one percent of airmen have exceeded these gender-specific standards" (Matthews et al., 2021, p. 4). In comparison with how the Marine Corps conducts its metrics for measuring fitness, the Air Force is using a completely different method known as the abdominal circumference method (discussed in chapter two of this study) which produces significantly different results with regards to obesity rates among service members. Upon switching to the abdominal circumference method to measure BMI among its members, the Air Force went from a 60% obesity rate down to a 1% obesity rate among its members (Matthews et al., 2021).

Another alternative to the current policy for Marines who do not pass height and weight nor the taping method has been implemented by the Marine Corps. The Marine Corps implemented this additional policy via a MARADMIN in 2022, which stated that a Marine cannot be formally assigned to the BCP program unless body fat is estimated by

Dual Energy X-ray Absorptiometry (DEXA) or Bioelectrical Impedance Analysis (BIA), and validated by a unit representative (Sokol, 2022). "Not only does a DEXA scan provide fast results, but it is also widely accepted as the gold standard for obtaining a comprehensive analysis of body composition" (Shaikh, n.d., p. 1). However, these DEXA machines have not been widely disseminated across the Marine Corps to date. This limited use does not allow for adequate and fair assessment across the force. Ensuring every Marine Corps base is equipped with this capability potentially opens the aperture to assessing new forms of measuring BMI outside of the normal height and weight practices currently being used. Assuming these DEXA machines are fully disseminated across the force, this technology will offer another alternative solution to address the current policy with regards to height and weight standards.

D. FUTURE RESEARCH

Observations based on this study must at best be considered preliminary given the fact that only nine interviews were conducted. That said, additional research might be undertaken in support of avenues of inquiry related to the three recommendations outlined above, as follows:

Recommendation 1: Additional research might be undertaken to explore the potential impacts of implementing these recommendations. Such research, moreover, would further support or refine the specific recommendations.

Recommendation 2: Additional research could explore the potential impacts of modifying PFT and CFT scores. The target goal of 250 for each measurement might be one such option in a subsequent study to identify the "sweet spot" (the specific score) that would work well both for Marines and the Marine Corps as a whole.

Recommendation 3: Possible new measures of BMI would provide additional avenues of inquiry, specifically the extent to which they may or may not help to address the shortcomings of the current system highlighted in interviewee comments.

More broadly, the existing study could be expanded by incorporating additional data. Such data includes an individual's medical record with prevalent health marker

information such as lipid panels, physical fitness scores, and weight fluctuations over several years to determine if there is any correlation between weight, fitness, and health.

Moreover, previous research has suggested that there is not a direct connection between BMI and actual health, yet the issue appears unresolved. The Marine Corps uses the PFT and the CFT to measure fitness combined with the height and weight standards but research as discussed in chapter two has suggested that an individual can be within their designated BMI and not necessarily be healthy. The research has also suggested that an individual can be outside the normal range of their BMI and be healthy. The Marine Corps would need additional methods of measuring an individual's true marker of health through scientific methods such as blood panels and other methods that give a descriptive depiction of an individual outside of just their weight.

In short, future research offers possibilities to gain additional insight into perceptions and practices of Marine Corps height and weight standards and ways to continue to improve them in the future. Such research might:

- Explore the relationship between weight loss and physical and mental health.
- Evaluate the relationship between the BCP program and Marines exiting service.
- Evaluate the relationship between the Marine Corps height and weight program and the various programs the Marine Corps offers on health and nutrition.
- Explore other methods of evaluating health such as the use of blood panels to evaluate key health markers.

Data can best be obtained by

- Conducting additional interviews with a larger subset of the Marine Corps active duty population, and in turn identifying issues relevant to specific segments of the Marine Corps population

- Administering surveys with a larger subset of the Marine Corps active duty population
- Collecting and evaluating a large subset of individual health markers against weight and physical fitness scores to determine if there is a relationship.

Finally, this study focuses solely on the perceptions of Marines of the current system of height and weight standards. The matter of implementing changes in the existing system lies outside the scope of this study, but nonetheless merits brief discussion here as new standards would necessarily merit additional research.

The Marine Corps has a reputation for being resistant to change. An article published by a Marine Corps Colonel through the Brookings Institution in 2021 identified some of the key reasons the Marine Corps is so resistant to change in any capacity. Reid (2021) states, "Two particular external bureaucratic constraints appear to have contributed to a Marine Corps enlisted human capital system that is highly tolerant of waste and inefficiency as well as highly resistant to change and innovation. Bureaucratic change is always disconcerting to stakeholders" (p. 42). Reid (2021) further elaborates that "a key reason the Marine Corps is resistant to change is contentment with the status quo; that is, the system does not appear to be broken, so there is no need to fix it" (p. 43).

Another point Reid (2021) identifies as underlying this resistance to change is the lack of sufficient data to model alternatives. While some research into the effectiveness of the Marine Corps height and weight standards has been conducted such as the 2022 RAND study, and small incremental changes have occurred, further research, as previously described is required with regards to the current Marine Corps height and weight standards. The Marine Corps should continue to invest resources into conducting internal and external research to continue to further evaluate the accuracy and effectiveness of current policy. In order to provide adequate data to support the need for change, the Marine Corps should invest further resources both internal and external to the institution into exploring this issue and identifying ways to review and revise current policy.

A move away from the BMI standard would require additional manpower and the engagement of potential outside entities such as the RAND corporation to conduct further study, implementation, and evaluation. The manpower costs come in the form of the time and resources in the form of the individual Marine being removed from the fighting force as body mass index evaluation, health marker evaluation, and physical fitness evaluation are conducted on participants. More importantly, the Marine Corps will need to change its perception of professional military appearance from being associated with a numerical value that has not changed or been updated in decades. Such an evolution in thinking and behavior represents nothing short of a disruption to status quo.

E. CLOSING STATEMENT

This study, based on interviews with nine Marines, suggests that Marine Corps change current policy regarding height and weight standards. Through data collection, literature review, and analysis, the Marine Corps seemingly faces a dilemma that must be addressed. The physical and psychological health of Marines is being affected and Marines are adopting unhealthy practices in order to meet standards which can lead to impacts on retention. If the Marine Corps wants to remain the most lethal fighting force in the world, significant change is advisable in order to preserve the health and well-being our Marines. This study hopes to bring awareness to an issue that is impacting Marines across the force and explore ways to meet both the demands of the Marine Corps and the needs of the Marines who comprise its ranks.

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APPENDIX: INTERVIEW QUESTIONS

Thesis Topic: Analysis of the Physical and Mental Impacts of Height and Weight Standards on Marines.

Format: Interviews conducted will follow a semi-structured format while taking place in-person (when suitable), on the phone, or through Microsoft Teams. All interview conversations will be recorded through digital means to maintain dialog accuracy and will be later transcribed for data analysis purposes.

Instructions: Participants will be asked open-ended questions while reflecting on their individual experiences with Marine Corps height and weight standards. Focus areas for questions will cover the physical and psychological aspects and the impacts on retention. Before beginning, please understand that under no circumstances should you feel obligated or coerced into completing this follow-on interview. You may choose to quit this interview at any point without consequence or retaliation for choosing to do so. This interview is being completed out of free will and from a desire to have your voice and opinions heard.

Q1. Have you ever not made weight for a weigh-in and had to be taped in accordance with MCO 6110.3A and of so, how did this make you feel?

Q2. Did you pass the taping measurement in accordance with MCO 6110.3A and how did this process make you feel?

Q3. If you didn't pass the taping method, what happened and how did this make you feel?

Q4. Have you ever had trouble making weight for a weigh-in and decided to practice any techniques to make weight? If so, what techniques have you employed and why?

Q5. If you have employed some rapid weight loss technique to make weight, do you feel this affected you physically in a negative way and if so, how?

Q6. If you have employed some rapid weight loss technique to make weight, do you feel this affected you psychologically in a negative way and if so, how?

Q7. Do you believe the current Marine Corps height and weight standards are an accurate representation of a Marine's fitness and military appearance and if not, why?

Q8. Do you believe the current Marine Corps height and weight standards are outdated and need to be changed?

Q9. If you believe they are outdated and need to be changed, what should be changed and why?

Q10. Do the current Marine Corps height and weight standards impact or influence your decision to continue further service, if so, how?

LIST OF REFERENCES

Beeken, R. J., Jackson, S. E., Kivimaki, M., Steptoe, A., & Wardle. J. (2014). *Psychological changes following weight loss in overweight and obese adults: A prospective cohort study*, 9(8), 1–20. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4123950/

Bianco, A., Drid, P., Lakicevic, N., Mani, D., Maksimovic, N., Milovancev, A., Ostjic, S. …Trivic, T. (2020). *Effects of rapid weight loss on Judo athletes: A systematic review*, 12(5), 1–25. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7281976/

Bosomworth, J. N. (2012). *The downside of weight loss,* 58(5): 517–523. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3352786/

Carroll, M. D., Flegal, K. M., Fryar, C. D., & Ogden, C. L. (2004). *Mean body weight, height, and body mass index, United States 1960–2002* (Report No. 347). https://www.cdc.gov/nchs/data/ad/ad347.pdf

Centers for Disease Control and Prevention. (2020) *Assessing your weight*. https://www.cdc.gov/healthyweight/assessing/index.html

Debeliso, M. & Keefer, M. (2020). *A comparison of United States Marine Corps physical fitness test and combat fitness test results,* 13(4): 1741–1755. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7745917/

Fleming, J., Haynie, G. J., Locker, A. R., & Shih, A. (2022). *Impacts of Marine Corps body composition and military appearance program (BCMAP) standards on individual outcomes and talent management*. RAND. https://www.rand.org/pubs/research_reports/RRA1189-1.html

Headquarters, United States Marine Corps. (2018, Dec 18). *Force fitness instructor program* (MCO 1500.62). https://www.fitness.marines.mil/Portals/211/Docs/MCO%201500.62.pdf

Headquarters, United States Marine Corps. (2021, Feb 23). *Marine Corps body composition and military appearance program* (MCO 6110.3A Change-3). https://www.marines.mil/News/Publications/MCPEL/Electronic-Library-Display/Article/2863863/mco-61103a-wch-3/

Jones, B. H., Hauret, K. G., Dye, S. K., Hauschild, V. D., Rossi, S. P., Richardson, M. D., & Friedl, K. E. (2017). *Impact of physical fitness and body composition on injury risk among active young adults: A study of Army trainees*. Journal of Science and Medicine in Sport, 20 (Suppl. 4), S17–S22. https://doi.org/10.1016/j.jsams.2017.09.015.

Joshi, S. & Mohan, V. (2018). *Pros & cons of some popular extreme weight-loss diets,* 148(5): 642–647. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6366252/

Lopez, C. (2022). *Fit V. Fat: Reevaluating the USMC body composition program to increase accuracy and optimize long-term performance*. [Master's thesis, Naval Postgraduate School]. NPS Archive: Calhoun. http://hdl.handle.net/10945/69676

Matthews, M., Robson, S., Sims, C. S., Snoke, J., & Walsh, M. (2021). *Is today's U.S. Air Force fit? It depends on how fitness is measured*. RAND. https://www.rand.org/content/dam/rand/pubs/research_reports/RRA500/RRA552-1/RAND_RRA552-1.pdf

Reid, E. (2021). *The courage to change: Modernizing U.S. Marine Corps human capital investment and retention*. https://www.brookings.edu/wp-content/uploads/2021/06/FP_202106_28_courage_to_change_reid_v3-1.pdf

Shaikh, J. (n.d.). *Which is the most accurate test to measure body fat?* Retrieved December 2, 2023, from https://www.medicinenet.com/most_accurate_test_to_measure_body_fat/article.htm

Sokol, S. N. (2022). MARADMINS: 423/22: *Forthcoming changes to the body composition program*. https://www.marines.mil/News/Messages/Messages-Display/Article/3135873/forthcoming-changes-to-the-body-composition-program/

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