



*Predictors of Success in Basic Underwater
Demolition/SEAL (BUD/S) Training - Part I:
What Do We Know and Where Do We Go From
Here?*

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**Predictors of Success in Basic Underwater Demolition/SEAL Training—Part I:
What Do We Know and Where Do We Go From Here?**

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Abstract

The unconventional nature of the Global War on Terror necessitates an immediate and substantial increase in the manning of U.S. Special Operations. To this end, the Navy Sea, Air, Land (SEAL) community is faced with the challenge of graduating more Special Operations personnel without sacrificing the high intensity of training. These circumstances have led to a renaissance of interest in identifying, recruiting, selecting, and retaining individuals who are best equipped to succeed in a military environment known to test every dimension of a candidate's will. As the first of a two-part series, the purposes of this paper were to (1) review the currently available literature addressing factors and characteristics that may predict the performance and success of Basic Underwater Demolition/SEAL (BUD/S) candidates, (2) identify critical paths for future research, focusing on that which may yield the highest operational return in the shortest time. Thirteen studies were critically reviewed, and future research directions were discussed.

Introduction

Special Operations personnel play a critical role in the defense of the United States, and this service is not rendered without substantial funding and manpower. The cost of fully preparing one prospective Navy Sea, Air, Land (SEAL) operator for fleet service, for instance, requires an investment of approximately \$350,000 and 3 years of dedicated manpower. In light of the Global War on Terror, the Special Operations baseline budget has increased 81%, and the Pentagon's recent Quadrennial Defense Review¹ calls for a substantial increase in the manning of U.S. Special Operations.

For the Navy SEAL community, this confers a requirement of systematically graduating a greater number of special operators without sacrificing the high intensity of training thought necessary to ensure adequate preparation for subsequent operational demands. It is well known that the extreme physical and mental stress associated with SEAL training precipitates injury and promotes "washout," leading to a dramatic 65-80% attrition rate during Basic Underwater Demolition/SEAL (BUD/S) training. High attrition rates, coupled with an ever-increasing demand for Special Operations personnel in the operational theater, present a unique and significant human resource challenge for the SEAL community. Despite this fact, only a modest body of systematic, peer-reviewed biomedical and psychological research has been conducted to identify factors and characteristics predicting performance and success of BUD/S candidates.

These circumstances have led to a renaissance of interest in systematically identifying, recruiting, selecting, and retaining individuals who are best equipped to succeed in a military environment known to test every dimension of a candidate's will. The purposes of this paper are to (1) systematically review the currently available biomedical and psychological literature

addressing factors and characteristics that predict the performance and success of BUD/S candidates, and (2) identify critical paths for future research, focusing on that which may yield the highest operational return in the shortest time. This paper is designed, in simple terms, to address the questions, “What do we know?” about factors and characteristics predicting success during BUD/S training, and of equal or greater importance, “Where do we go from here?”

What Do We Know?

Despite a substantial interest in this area, only a modest body of systematic, peer-reviewed biomedical and psychological research has been performed to identify the factors and characteristics that may predict the performance and success of BUD/S candidates. In the present study, we review and critique several studies aimed at understanding factors influencing success during BUD/S training. Criteria for inclusion of studies in this review were (1) published military technical report or peer-reviewed scientific journal article, and (2) dependent variable(s) included performance, success, and/or attrition during Underwater Demolition Team (UDT; the predecessor units to the modern-day SEAL teams) training or BUD/S training at the Naval Special Warfare Center in San Diego, CA. Thirteen studies were reviewed, and the essential characteristics of each are displayed in Table I.

As early as the 1950s, a few government technical reports appeared²⁻⁴ examining factors influencing successful completion of UDT training (UDTs were the predecessor to the modern day SEAL teams). Hertzka and Anderson², for example, administered a battery of questionnaires to a group of 140 students entering UDT training, and compared their pass/fail outcomes. They concluded that swimming ability and physical fitness variables (i.e., 1-mile run time, push-ups, and sit-ups) were associated with successful completion of training. Also, age demonstrated a

weak negative relationship to training success, while education showed a weak positive relationship. Interestingly, in a subsequent report³, researchers Alf and Gordon linked the same group of predictors to later success in the fleet, and identified substantially different predictors of success. Age, for instance, while marginally associated with attrition from training, was associated with success among UDT teams. Also, although swimming ability was among the most substantial predictors of training success, this characteristic demonstrated no relationship to subsequent fleet performance. Finally, while emotional stability was linked to UDT training success, this relationship lost significance relative to performance on the UDT teams. The discrepancies between the predictors of training and operational success can be interpreted at least two ways. First, it may imply simply that characteristics of UDT training evolutions poorly simulated the actual demands of the UDT profession. Alternatively, it may imply that characteristics predictive of training success are necessary, but alone insufficient, characteristics differentiating later success in the fleet. For instance, it is intuitive that all UDT performers would be good swimmers, but that a new set of skills, traits, and abilities may differentiate more- from less-successful fleet operators. In a follow-on study⁴, these same researchers found these measures to be more predictive of success for enlisted men than for officers. This may be due to less variance among the sample of officers who, on average, were better swimmers than the enlisted men. As noted by the authors, other factors such as personality may play a stronger role in differentiating success of this group. Also, Githens et al.'s work⁵ suggests that the source of UDT school input and age were two variables found to be significantly related to UDT training success. Specifically, they found that those from U.S. shore, air billets, or directly from basic training have a higher graduation rate than those from U.S. Fleet or overseas shore billets. Additionally, the enlisted men between the ages of 19 and 24 years or those 29 years or older

demonstrated a higher graduation rate than other age groups. While these early studies may be limited in scientific rigor and thoroughness of reporting, they provide preliminary insight into some physical, mental, and demographic characteristics that may predict training success as well as subsequent fleet success as UDT operators.

In 1972 Gunderson et al.⁶ produced the first peer-reviewed report of factors predictive of performance during UDT training. Subjects included 293 Navy enlisted men in five UDT classes, and an additional sample of 94 officers was examined for comparison purposes. Subjects completed Cornell Medical Index (CMI; a 195-item measure of general medical and psychiatric health), and were also assessed for height and weight, as well as performance scores on three physical fitness tests (pull-ups, indicative of dynamic strength and strength-to-weight ratio; sit-ups, representative of trunk strength; and squat jumps, thought to represent explosive strength). Performance on each of the three fitness tests, as well as a 51-item CMI subscale purported to measure psychiatric health, and to a lesser extent, age, all contributed significantly to training success, accounting for 47% and 54% of variance in two different samples. Specifically, the physical fitness tests accounted for the greatest amount of variance in performance success, followed by the CMI subscale—reported to measure a number of psychiatric symptoms—thus suggesting the role of emotional and/or behavioral health in predicting training success. Similar patterns emerged for officers and enlisted men. Relative to age, an inverted U relationship unfolded for enlisted men, where younger (17-18 years) and older candidates (over 22 years) had lower success rates than the 19- to 21-year-old candidates. For officers, who are generally older than enlisted men, UDT success was inversely proportional to age, rank, and military experience. This report did not distinguish between voluntary drops, performance drops, and medical drops, but it provided substantive insight into the roles of specific types of physical capabilities, age,

and emotional health in predicting overall UDT training success, both for officers and enlisted men.

Biersner and colleagues⁷ further examined the relationships of physical fitness and perceived health status to performance in UDT training, along with medical visits throughout training. In this study, 329 Navy enlisted men completed the CMI subscale (discussed above), and physical fitness tests, including sit-ups, pull-ups, squat jumps, and swimming were given prior to the start of training. Scores on the individual fitness tests were also combined into a single scale. Similar to the findings of Gunderson et al.⁶, each of the individual physical fitness scores correlated significantly with training success, as did the combined physical fitness score. The CMI subscale also correlated significantly with both training success and medical visits. Further analyses indicated linear increases in success rates, with increases in physical fitness and decreases in symptomology. Finally, number of medical visits was inversely proportional to training success. In sum, this study confirmed previous findings of physical fitness and mental health predictors of UDT training success, with the added predictive role of medical visits.

In another published report, Rahe et al.⁸ examined the questionnaire responses of 194 U.S. Navy enlisted UDT trainees on the Schedule of Recent Experiences (SRE; a self-report measure of major life events and, in turn, the amount of stress experienced during the last year) and CMI questionnaires. The SRE questionnaire correlated significantly with UDT trainees' medical visits in a validation and cross-validation sample ($r = .42$ and $.19$, respectively). CMI also correlated significantly ($r = .54$ and $.26$, respectively). However, the combination of the SRE and CMI questionnaires predicted dispensary visits in both samples better than either one separately ($R = .66$ and $.33$, respectively). The SRE identified those who dropped from training for medical reasons ($r = .50$), while the CMI score was associated with those who voluntarily

dropped from training ($r = .43$). In a subsequent study, Rahe et al.⁹ followed 51 volunteers for a preliminary UDT training program through 4 weeks of training and compared candidates who passed ($n = 27$) and those who failed ($n = 24$). Serum uric acid and serum cholesterol levels were assessed for all participants at the start of training and again at the end of each of the 4 training weeks. It has been suggested that serum uric acid levels rise when one is faced with novel and challenging life situations; conversely, when one perceived a high likelihood of failure it is believed to be associated with elevated levels of cholesterol¹⁰⁻¹². Those who passed the training demonstrated higher levels of positive mood, earlier peaks in serum uric acid levels, and more stable cholesterol levels throughout the 4-week period, compared with their less-successful counterparts. By contrast, those who failed the training demonstrated more moderate mood levels, a midtraining period peak in serum uric acid, and a significant rise in serum cholesterol during the last 2 weeks of training. Biersner and colleagues¹¹ further examined physical fitness, psychological, and biochemical predictors of success in a preliminary UDT training program taking place during the last 5 weeks of basic recruit training. Similar to previous findings, key variables differentiating candidates who passed training from those who voluntarily dropped included number of pull-ups, 300-yard swim time, motivation, and serum uric acid levels, with passing candidates scoring higher on all variables.

Subsequently, Doherty et al.¹³ examined the relationship between several selection variables and attrition in a group of 289 BUD/S students. Predictor variables included four BUD/S screening tests (Armed Services Vocational Aptitude Battery [ASVAB] arithmetic and word knowledge subscales (combined), a timed 1-mile run, timed 300-yard swim test, and a mathematics inventory), as well as several demographic items and a multidimensional personality/attitude scale. In this group, 56% of the sample graduated. Of the 44% who did not,

41% were voluntary drops. All four BUD/S screening test variables demonstrated low-to-moderate relationships to training success. Also, level of education and prior scuba qualification also demonstrated weak positive correlations with graduation, while marital status and commitment to the Navy showed weak inverse relationships to graduation. Interestingly, the personality/attitude scale correlated substantially with graduation ($r = .52, p < .01$), leading the authors to conclude that individuals who were most likely to complete BUD/S are those who do not avoid stressful situations, are highly motivated to achieve, are not aggressive, are emotionally stable, are involved in their work and group efforts, and are supportive of their superiors. This study provided further confirmation for the earlier established role of physical fitness in BUD/S success, and offered additional insight into possible roles of personality dimensions, such as emotional stability, stress resilience, need for achievement, as well as demographic characteristics. Unfortunately, the specific dimensions of the personality scale are not discussed, nor were its factor structure, validity, or reliability, thus limiting the interpretation of the findings.

In a larger study, Robertson et al.¹⁴ analyzed 20 BUD/S classes over a 4-year period. A total of 1,532 applicants reported for the Indoctrination Phase (a period of pre-training consisting primarily of physical conditioning) and only 1,173 started Phase I training (basic conditioning). A total of 599 trainees graduated from Phase III (land warfare), representing an overall attrition rate of 61% of the 1,532 who entered the Indoctrination Phase and an attrition rate of 49% of the 1,173 trainees who started Phase I training. The participants in this study performed a series of strength tests, including both dynamic (e.g., sit-ups, push-ups, and pull-ups) and static measures (e.g., handgrip, arm pull, and arm lift). The results suggested that dynamic strength tests are better predictors of BUD/S Phase I training performance than are static strength tests. This is the

first known study to compare static and dynamic modes of human performance as predictors of BUD/S success.

In a later study, McDonald et al.¹⁵ examined a total of 336 BUD/S trainees and quantified differences between graduates and those who dropped relative to history of physical activity, self-reported estimates of physical ability and attractiveness, mood, self-concept, and key aspects of personality. The authors split the total sample into two groups for replication purposes, comparing graduates and drops in each group. Across both studies, graduates scored consistently higher than drops relative to physical estimation (i.e., self-estimation of physical abilities), adjustment (i.e., self-esteem, self-confidence, and freedom from anxiety), likeability (i.e., the extent to which individuals are cordial and even-tempered), and service orientation (i.e., the extent to which an individual is helpful and courteous). A strength of this study is noted in its approach to replicating findings in two different groups. However, limitations should also be observed. First, the authors did not separate students who dropped on request (DOR) from those who dropped for performance or medical reasons. Also, multiple statistical comparisons were performed between graduates and drops despite no adjustment in significance value. On a similar note, significance tests on all comparisons were one-tailed. Although it seems intuitive that more-successful performers would score higher on each of the traits under consideration, a substantial theoretical foundation (i.e., body of empirical research) specific to the BUD/S context and suggesting a unidirectional relationship is necessary to warrant a one-tailed test. Such a body of knowledge, in our estimation, does not exist.

Sixteen years later, Trone et al.¹⁶ examined the effect of various pretraining health behaviors and physical exercise habits on attrition in a group of 1,046 BUD/S trainees. Overall, 274 (26%) trainees graduated. Of the 772 men (74%) who did not, 83% of them dropped

voluntarily. Men who were more likely to graduate from BUD/S were those who had a high body mass index (BMI) at least some college education, officer rank, excellent/very good fitness, worked up a sweat during exercise, could perform 10 pull-ups or more, exercised at least 4 times per week, and never smoked tobacco. Comparing trainees who graduated on time (within 263 days of training) with those who were delayed in graduating (after 263 days of training), high BMI, education, and rank remained important predictors of graduating on time. Additionally, stress fracture occurrence was associated with lower rates of graduating on time. Compared with trainees who did not graduate, these researchers found that successful trainees who graduated on time entered the program with the ability to do 10 or more pull-ups and did not incur a stress fracture. Trainees who were delayed in graduation, however, were not different from those who did not graduate in their stated ability to do 10 or more pull-ups, but were more likely to have incurred a stress fracture. As the study's lead author suggested (Daniel Trone, personal communication, October 21, 2006), the higher BMI scores in the successful trainees can best be explained by the fact that lean muscle mass tends to exaggerate BMI scores, which are based on height-to-weight ratio in the absence of a direct assessment of body fat percentage. This epidemiological study provided substantial additional insight into many demographic, behavioral, and physical characteristics that may influence success during BUD/S training, and reiterated the fundamental role of physical fitness as a predictor of performance in this arduous military context.

Armed with an understanding of the current status of knowledge regarding factors influencing successful training in BUD/S, it is important to identify directions for future scientific inquiry. Furthermore, in light of the pressing need to increase manning of the Navy SEAL community, it is critical that we focus first on that which may yield the highest

operational return in the shortest time, and ultimately identify “trainable” characteristics that can be targeted during preliminary phases of training (i.e., Indoctrination Phase) in an effort to “inoculate” against attrition, thus increasing the output of Navy special operators. With this in mind, in the next section we shift our attention to future research directions, with an emphasis on areas of inquiry with the greatest operational relevance.

Where Do We Go From Here?

Given the limited body of published and peer-reviewed literature examining factors discussed herein, we posit that several important areas of research are in need of development in order to more fully appreciate the multidimensional and complex matrix of characteristics underlying successful BUD/S performance. Among the most important may be (1) physical fitness, (2) personality and psychological skills, and (3) cerebral and neurophysiologic characteristics.

Physical Fitness

As noted earlier, several studies have identified fundamental components of physical fitness that predict success during BUD/S, such as aerobic endurance, swimming skill and endurance, trunk strength, and muscular endurance. Future research should build upon these preliminary findings, with a move toward achieving a more-detailed understanding by utilizing more-sophisticated tools commonly used in the fields of exercise physiology and human performance sciences (e.g., volume of oxygen uptake, lactate threshold analysis, and muscle fiber typing). Although not specific to Navy SEAL training, Van Hoof and colleagues¹⁷ identified several parameters predictive of success in a 3-month basic training program of a

Belgian Special Operations unit, including height, resting heart rate, maximal heart rate during exercise, and serum cholesterol. As an extension of this type of research, more-advanced methods should be integrated to gain a better understanding of physical fitness variables conducive to BUD/S performance. In addition, of particular operational relevance to the SEAL community, physical performance in extreme environments, including heat (i.e., desert), humidity, cold (i.e., Arctic), as well as cold, warm, and hyperbaric water environments, is in need of further study. Similarly, there is a need to better understand performance on operationally relevant cognitive and psychomotor tasks (e.g., marksmanship, enemy vs. friendly differentiation, risk–benefit calculations) during physical exertion, the presence of fatigue, and extreme environmental circumstances. Physical fitness and physical skills are among the more obvious modifiable traits that can be addressed during early phases of training for those candidates with deficiencies in this area.

Personality and Psychological Skills

In the previously reviewed literature, several personality variables have been implicated in BUD/S training success, such as emotional stability, adjustment, and likeability. These and other personality characteristics are in need of confirmation and further study. Presently, the SEAL Selection Working Group (SSWG) has been formed at the direction of the Commander, Naval Education and Training Command, with the goal of improving BUD/S retention and training success. To this end, this interdisciplinary group of scientists is systematically and prospectively examining personality and behavioral characteristics predictive of BUD/S training success. Additionally, in the second of the current two-part series (Taylor et al., manuscript submitted for publication), we describe an SSWG-sponsored study performed with 8 subject

matter experts from the Naval Special Warfare Center, exploring the key personality and behavioral characteristics of BUD/S candidates who perform successfully through the end of “Hell Week.”

Additionally, an area of study that has received substantial interest in the elite sport literature as a possible differentiating factor between more- and less-successful performers concerns psychological skills and strategies¹⁸. For example, we have documented differences between more- and less-successful Olympic athletes relative to several psychological skills, including emotional control and automaticity (performing automatically without conscious thought) (Taylor et al., manuscript submitted for publication). Other psychological skills and strategies that have been tied to successful competitive sport performance include mental imagery (imagining one’s performance in the absence of actual execution of the event), goal setting, positive self-talk and attentional control. The SSWG is currently investigating the roles of many of these skills and strategies in differentiating those who successfully complete Hell Week from those who DOR. Therefore, in addition to personality, several psychological skills and strategies may differentiate success levels for BUD/S candidates, thus warranting future study of these constructs. Furthermore, the majority of the psychological skills discussed here are subject to modification through coaching and through psychological intervention with qualified medical personnel. As with physical fitness, specific psychological skills training during early phases of training for candidates demonstrating deficiencies in this area could potentially prevent voluntary or performance drops.

Cerebral and Neurophysiologic Characteristics

To better understand human performance in extreme environments such as BUD/S, advanced technological methods that elucidate brain and central nervous system function hold great promise for differentiating more from less successful trainees. In our lab, for instance, we currently are using functional magnetic resonance imaging (fMRI), heart rate variability, acoustic startle, and neuroendocrine sampling to examine individual differences in stress resilience during Survival, Evasion, Resistance, and Escape (SERE) training, a specialized program of training for high-risk military assets, including Navy SEALs¹⁹. fMRI technology, for instance, could be extended to the Navy SEAL context, elucidating the brain regions associated with resilience to the extreme demands of BUD/S training, and could subsequently be used either as a selection instrument for potential BUD/S candidates or as a training tool to facilitate adaptive responses within the performer. Similarly, sampling of stress hormones represents yet another way to model individual differences in resilience to BUD/S training, thereby not only as a way to plot profiles of successful performers but also as a tool to facilitate the training of less well-adapted trainees during early stages of training. Morgan and associates²⁰, for instance, examined salivary cortisol reactivity during SERE training, which showed that cortisol increases significantly during captivity and is greatest after exposure to interrogation. These researchers also studied neuropeptide Y (NPY) responses to SERE training^{21,22}. Specifically, they have shown that NPY levels are significantly elevated compared with baseline following interrogation and are significantly higher in Army Special Forces soldiers compared with their non-Special Forces counterparts. Interestingly, NPY was positively related to behavioral performance under stress and inversely related to psychological symptoms of dissociation, implying a stress-buffering effect of NPY. Similar radiological and psychophysiological data collection methods

are warranted in the BUD/S context in order to better understand the mechanisms underlying stress resilience and successful performance during such extreme military training.

Future research, then, should focus on advanced measurement of physical fitness, personality, psychological skills, and key cerebral and neuroendocrine markers of successful BUD/S performance using advanced medical technologies. Clearly, multiple methods of measurement are needed to accurately and comprehensively characterize the complex phenomenon of optimal performance in this unique and arduous military context. Inquiries in this area of study should draw upon the methods and successes of other academic fields of study devoted to modeling and optimizing human performance, such as sport psychology, exercise physiology, environmental physiology, neuroscience, genetics, and biomedical engineering. A fundamental research design should be employed that prospectively compares successful versus unsuccessful BUD/S candidates, and a follow-on purpose should be to compare the factors predictive of BUD/S success with factors predictive of subsequent Navy Fleet success. Consistencies or lack thereof, in these two sources of information could have valuable implications for BUD/S curriculum planning.

Limitations of this review should be noted. First, to maintain focus on the issue of BUD/S performance, we limited our criteria for inclusion of reports to those that were SEAL-training specific (i.e., specific to the UDT or BUD/S training environment). There is a substantial body of literature addressing factors influencing effective human performance in other extreme and military contexts that could provide useful additional insight into factors worthy of study in the BUD/S context. Additionally, we included government technical reports in this review that, while offering special insight to this topic, are not subject to the peer-review process, which is the commonly accepted process for establishing quality control and promoting the scientific

integrity of research. That said, valuable information is often gleaned from information that has not been peer-reviewed, and, in turn, the peer-review process alone does not guarantee the quality or integrity of a report.

In sum, Navy Special Operations personnel play a critical role in the defense of the United States, and there is an immediate need to systematically produce more Navy SEALs without sacrificing the high intensity of training thought necessary to ensure adequate preparation for operational effectiveness. With this in mind, in the current report we reviewed and critiqued the available literature addressing factors and characteristics that may predict the performance and success of BUD/S candidates, and we identified critical paths for future research, focusing on that which may yield the highest operational return in the shortest time. In the second of this two-part series, we describe a study performed with 8 subject matter experts from the Naval Special Warfare Center, exploring the key personality and behavioral characteristics of BUD/S candidates who perform successfully through the end of Hell Week.

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TABLE I

REVIEW OF LITERATURE EXAMINING PREDICTORS OF BUD/S SUCCESS

Type	Author(s)	Year	Sample	Predictors	Endpoint	Results
TR	Hertzka et al.	1956	140 UDT students	Swimming ability, physical fitness, age, education	UDT training success	Swimming ability, physical fitness predicted training success. Age, education demonstrated weak relationships to training success.
TR	Alf et al.	1957	140 UDT students	Age, swimming ability, emotional stability	Subsequent success on UDT teams	Age predicted later fleet success. Swimming ability demonstrated no relationship to later fleet success.
TR	Alf et al.	1958	55 Officers (UDT students)	Age, swimming ability, physical fitness	UDT training success	Swimming ability was less predictive of success for Officer sample (compared to Alf et al., 1957). Range restrictions were noted in the sample Trainees from U.S. shore or air billets, or directly from basic training demonstrated a higher graduation rate than
TR	Githens et al.	1967	Students from 11 UDT classes	UDT trainee source, age	UDT training success	those from U.S. Fleet or overseas shore billets. Enlisted man ages 19-24 years or those 29 years or older demonstrated a higher graduation rate than other age groups.

PR	Gunderson et al.	1972	293 enlisted men, 94 Officers	CMI, HOS, height, weight, physical fitness	UDT training success	Physical fitness and a CMI subscale predicted UDT training success.
PR	Biersner et al.	1972	329 enlisted men	CMI, physical fitness, medical visits	UDT training success	CMI, physical fitness, and medical visits predicted UDT training success.
PR	Rahe et al.	1972	194 enlisted UDT trainees	SRE, CMI	UDT training success	SRE predicted medical drops from training. CMI predicted voluntary drops from training.
PR	Rahe et al.	1976	51 students in preliminary UDT program	Serum uric acid, serum cholesterol, mood states	Pre-UDT training success	Mood, serum uric acid profile, and serum cholesterol predicted training success.
PR	Biersner et al.	1977	148 students in preliminary UDT program	Physical fitness, psychological variables, serum uric acid	Pre-UDT training success	Physical fitness, motivation, and serum uric acid levels predicted training success.
PR	Doherty et al.	1981	289 BUD/S students	Screening tests, physical fitness, mathematics test, demographics, personality	BUD/S training success	Physical fitness, ASVAB arithmetic/word knowledge, education, prior scuba qualification, marital status, and emotional stability predicted training success.

TR	Robertson & Trent	1983	1,532 BUD/S applicants	Static and dynamic strength	BUD/S training success	Dynamic strength predicted BUD/S success better than static strength.
PR	McDonald et al.	1990	336 BUD/S students	Physical activity, estimation of physical ability, attractiveness, personality	BUD/S training success	Physical estimation, adjustment, likeability, and service orientation predicted training success.
R	Trone et al.	2006	1,046 BUD/S students	Pretraining health behaviors, exercise habits, stress fractures	BUD/S training success	Body mass index, education, rank, high fitness level, exercise behavior, tobacco use, and stress fractures predicted training success.

TR, Government technical report; PR, peer-reviewed journal article; R, published report, not peer-reviewed; UDT, Underwater Demolition Team; CMI, Cornell Medical Index; SRE, Schedule of Recent Experiences questionnaire; HOS, Health Opinions Survey; ASVAB, Armed Services Vocational Aptitude Battery.

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13. SUPPLEMENTARY NOTES

14. ABSTRACT (maximum 200 words) As the first of a two-part series, the purposes of this paper were to (1) review the currently available literature addressing factors and characteristics that may predict the performance and success of BUD/S candidates, and (2) identify critical paths for future research, focusing on that which may yield the highest operational return in the shortest time.
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