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Human Factors in Tactical Nuclear Combat

by

Robert Vineberg

Presentation for members
of The General Staff of
The Department of the Army,
27 January 1965

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Prefatory Note

This presentation summarizes information in HumRRO Technical Report 65-2, which contains the results of a study undertaken as a Technical Advisory Service project upon request of the U.S. Army Combat Developments Command. The purpose of the study was to provide bases for predicting human behavior in nuclear warfare, the probable behavior of civilians as well as the probable effectiveness of soldiers. This research includes an analysis of social, psychological, military, and training factors of particular significance for nuclear combat. In addition, a model was developed for adjusting casualty rates, based on psychological factors, for use in war gaming. The study was completed and reported to USACDC in September 1964.

HUMAN FACTORS IN TACTICAL NUCLEAR COMBAT[1]

The probable response of man to the psychological trauma of nuclear battle is largely unknown. Nevertheless, in order to make realistic plans for military action, as well as to prepare man himself to operate under such conditions, it is necessary to have an estimate--as accurate as the state of our knowledge will permit--of the psychological effects of nuclear warfare.

In December 1963, the Human Resources Research Office (HumRRO) was requested to participate in a Combat Developments Command project dealing with nuclear combat factors. HumRRO was asked to provide information on the probable effectiveness of the soldier in nuclear battle and on the likely behavior of civilians exposed to tactical nuclear warfare, and, if possible, to introduce human factor considerations into planning for war games.

The general objectives of our study were to draw together information that might provide a basis for predicting human behavior in nuclear warfare, to analyze this information for implications concerning possible preparation for such warfare, and to develop a means for estimating the psychological casualties that are likely to occur on the nuclear battlefield.

This briefing has several purposes. The general nature of the information gathered during the study will be indicated and its major findings and conclusions presented. In particular, emphasis will be given to certain specific factors which affect psychological casualty rates and appear to be of particular significance for nuclear combat. Finally, I will describe a method which was developed for adjusting casualty rates, based on psychological factors, for use in war games.

Behavior Under Stress

Since direct information about the psychological consequences of nuclear warfare is not available, an estimate of the consequences that might be expected must be based primarily on evidence drawn from the military and research literature on behavior in conventional combat, non-nuclear disasters, and other extreme stress situations. Literature covering the following types of situations has been reviewed:

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[1] Ed. Note. This presentation is a summary of a HumRRO research report which was in preparation at the time it was given. For the convenience of the reader, the reference is updated: Robert Vineberg, Human Factors in Tactical Nuclear Combat, Technical Report 65-2, April 1965.

(Slide 1)

(1) The behavior of civilians at Hiroshima and Nagasaki.

(2) The behavior of civilians subjected to conventional aerial bombing in World War II.

(3) The behavior of military personnel in ground and aerial combat.

(4) The behavior of persons in concentration and POW camps.

(5) The behavior of civilians in a wide variety of civil disasters such as tornadoes, earthquakes, floods, explosions, fires, building collapses, and train wrecks.

(6) Observations of persons with severe or terminal illness, parents of children with fatal diseases, patients who are anticipating major surgery or have had major portions of their bodies removed through surgery, persons awaiting death by execution, and persons in mourning.

Though civil disasters frequently involve stress as great as that experienced during combat, they differ in that they typically take place without warning or preparation and are not repeated. Such factors are of

(Slide 2)

considerable importance in determining a person's response to stress. In this study, primary attention was therefore given to the behavior of civilians and military personnel during war, because of the intensity and continuing nature of the threat involved. Except in passing, I will say nothing further this morning about civil disaster, behavior at Hiroshima and Nagasaki, or behavior in other special stress situations; these aspects will be described in the report which HumRRO will publish on this study.

Civilian Behavior

Responses of civilians to conventional aerial bombing during World War II may be summarized as follows: In general, emotional responses varied directly with the intensity of the threat, with fear reactions becoming more severe and depressive reactions increasing as the physical magnitude of the raids grew larger. Even so, reports consistently indicate man's remarkable recuperative powers and tolerance to stress in situations involving the most severe forms of trauma. In populations exposed to successive air attacks, sizable numbers of people underwent emotional adaptation, and fear reactions gradually

Stress Situations

Hiroshima and Nagasaki

Conventional aerial bombing

Ground and aerial combat

Concentration and POW camps

Civil disasters

Terminal illness

Children with fatal diseases

Anticipation of major surgery

Surgical removal of major portions of body

Death by execution

Mourning

Slide 1

Stress Situations

Hiroshima and Nagasaki

Conventional aerial bombing

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Terminal illness

Children with fatal diseases

Anticipation of major surgery

Surgical removal of major portions of body

Death by execution

Mourning

Slide 2

declined. This was especially noticeable in England where, as the war progressed, people tended to stop using air raid shelters

The pattern of reactions to bombing differed, however, for those persons with direct personal involvement, such as losing a loved one or having a bomb explode nearby. With the occurrence of a "near miss," adaptation was markedly reduced and emotional reactions to subsequent bombardment increased greatly.

Military Behavior

Analysis of the reactions of soldiers to the stress of military combat covers a wide range of behaviors, from mild emotional responses and transient states of shock, anxiety, and depression to the more severe and lasting conditions of combat exhaustion which make it necessary to remove a man from battle, temporarily or permanently. Upon initial entry into battle, a man tends to have low effectiveness and a greater likelihood of becoming a battle casualty. Later, he develops greater combat effectiveness; there is also a decreasing likelihood of his becoming a battle casualty. Still later, a phase of decreasing combat effectiveness ensues. If the man remains in combat long enough, this phase inevitably ends in combat exhaustion.

Factors Contributing to Neuropsychiatric Casualty Rate

The most important factor affecting the rate at which this sequence progresses is cumulative combat stress, which arises primarily from the duration of men's exposure to battle. The most important precipitating factor affecting the rate of psychological casualties at any particular time is battle intensity, or situational or current stress. Combat is usually episodic, but where information is available regarding conditions of continuous battle, the cumulative effect of combat stress on numbers of neuropsychiatric (NP) casualties is particularly dramatic.

(Slide 3)

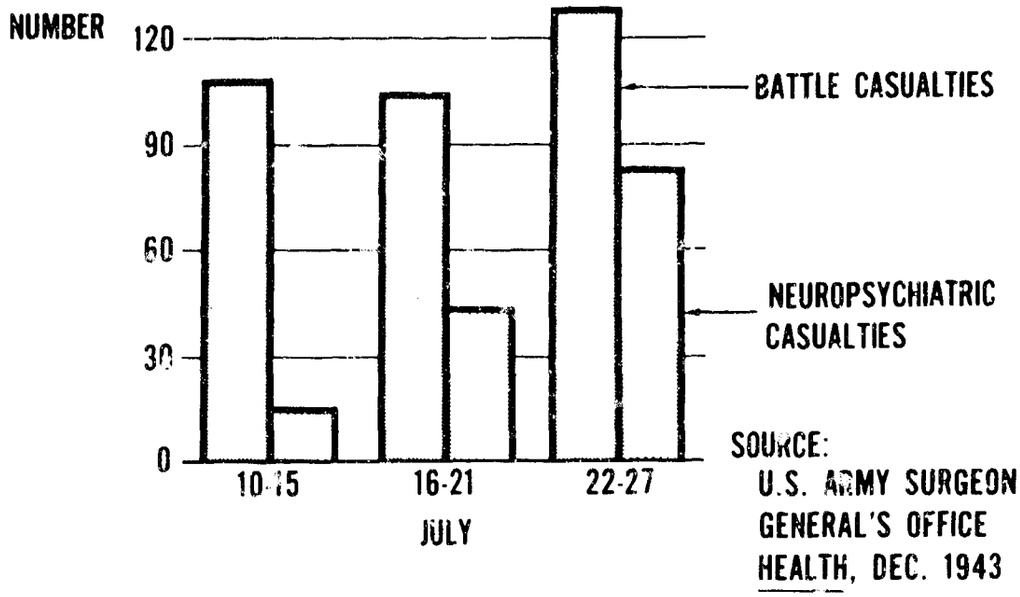
In this slide showing casualties throughout 17 days of continuous combat, note that battle casualties remain relatively constant during successive intervals, whereas there is an ever increasing rise in NP casualties.

Later in the briefing I will be getting into more quantitative material on the manner in which NP casualties occur as a consequence of combat duration and intensity.

(Slide 4)

I have already mentioned the first two factors of duration and intensity of combat. Other factors condition the progressive and inevitable psychological deterioration of the individual that occurs in combat. These factors affect levels of stress, resistance to stress, and the particular form in which psychological casualties find expression.

Neuropsychiatric & Combat Casualties
Among 3 Infantry Battalions in Sicilian Campaign



Slide 3

Factors Affecting Neuropsychiatric Rate

- Duration of Combat Exposure
- Combat Intensity
- Other
  - Environmental Characteristics
  - Expectancies About Duration of Hostilities
  - Tactical Situation
  - Potential Benefits
  - Confidence in Leaders
  - Management of Casualties
  - Cultural Background

Slide 4

For example, NP rate is affected by weather, climatic conditions, and terrain. The Southwest Pacific, with its tropical climate, monotony, isolation from civilization, danger of disease, and jungle conditions, showed an NP casualty rate completely out of proportion to the intensity of combat.

Expectancies about the duration of hostilities affect NP rate. There was a decided decrease in NP casualties in the European Theater toward the end of hostilities in 1945. Similarly, beliefs regarding rotation policies and the amount of combat that must be endured have an effect. It has been suggested that British troops tended to last longer in combat before becoming psychological casualties because they believed there was little chance of being relieved, prior to the end of the war, and they knew they would have to hold on.

The type of tactical situation is related to NP rate. A high NP casualty rate is generally associated with a static situation, slow uphill fighting against determined opposition, a first meeting with strong opposition, the halt of rapid advance or the halt of withdrawal, or situations where there is little or no possibility of taking action, for example, when "pinned down" by artillery or mortar fire.

Relatively low NP is generally associated with a fluid state of battle, a rapid advance, or a counterattack--even though casualties may be heavy. Low NP is also associated with retreats.

NP rates tend to be low where becoming such a casualty would provide little or nothing in the way of additional safety, sickness benefit, or material advantage. This situation existed, for example, during the German retreat at Stalingrad because the fleeing Germans feared capture by the Russians; it generally exists in battle at sea or in patrol actions. This absence of secondary gain also explains why NP casualties frequently occur after rather than during battle, when the fate of an NP casualty would be uncertain.

Confidence in leaders conditions the NP rate. Where two groups fighting side by side show totally different NP rates, it has frequently been possible to attribute the difference to the degree of confidence that soldiers had in their leaders.

The method of management of NP casualties has a strong effect on the number of casualties and on the likelihood of their returning to combat. The fact that the treatment of NPs as far forward as possible tends to reduce the NP rate was recognized during World War I, though the lesson had to be relearned during World War II. If for nuclear battle there is any general policy of removing all types of casualties to rear areas for diagnosis or treatment, it can be expected to result in a considerable increase in the number of psychological casualties.

The cultural background of the troops involved may affect both the type and the number of obvious NP casualties without necessarily affecting the total amount of attrition due to psychological factors. As a consequence of cultural factors, psychological attrition is sometimes reflected in ways that are not obviously neuropsychiatric. American troops in World War I and East Indian troops in World War II tended to convert their anxiety into hysterical blindness and paralysis, forms of disability sanctioned by their cultures. The influence of the Japanese culture made it difficult for Nisei troops in World War II to show fear. In general they had a low NP rate; when psychiatric disorders did appear they also tended to occur as cases of hysteria, with symptoms mimicking physical disabilities. In Korea, Republic of Korea (ROK) troops tended to have low NP as such, until integrated with American troops. Then they began to reflect the pattern accepted by their new associates.

I would like now to point out certain specific factors affecting NP casualty rates which appear to be of particular significance

(Slide 5)

for nuclear combat. They are fatigue, ambiguity of the combat situation, and isolation.

Factors of Special Relevance in Nuclear Combat

Fatigue

Ambiguity

Isolation

Integrity of Primary Combat Group

Slide 5

There is little question but that fatigue interacts with combat stress and increases the probability that a man will become an NP casualty. It seems reasonable to expect that the highly mobile, rapid, and continuously changing nature anticipated for nuclear combat will produce greater fatigue than that typical for conventional combat. This would then lead to a higher incidence of NP casualties. As I will show later, the fact that in World War II high NP rates were found among the

highly mobile Armored troops, as compared with Infantry and Airborne troops, appears to support this contention.

The way in which a man responds in any situation depends upon how he perceives it. How he perceives it depends on the information he has about it. A man who finds himself uninformed in a situation that is complex and chaotic, that is ambiguous or not understandable, where he does not know what to expect, will be under great stress. Disruption of communications during nuclear warfare, rapid and frequent changes in the combat situation, plus the unknown and ever-possible danger of radiation injury will all increase the uncertainty of the individual soldier about what may be happening to him. Thus it may be expected that in nuclear battle the ambiguity normal to combat will increase, and consequently so will stress and fear. The manner in which the understanding of a situation can operate to reduce fear and anxiety has direct implications for the design of training for nuclear combat. This topic is covered in considerable length in the HumRRO report; I will discuss it briefly at a later point.

Primary Group's Importance to Combat Behavior

The single most important factor that sustains a man in combat, that enables him to continue resistance in the face of enemy superiority as well as to resist the cumulative effects of combat stress, is the powerful psychological support that he receives from his immediate primary group--that is, his squad, platoon, or company. Isolation increases stress and at the same time reduces a man's capacity for resisting the effects of stress. In nuclear combat the individual soldier is more likely to feel isolated because he has been separated from his primary group, because his primary group is disintegrating, or because he or his group have lost contact with higher headquarters.

That isolation affects a man's capacity to resist was demonstrated by German soldiers late in World War II. Heavy American artillery bombardment forced them to take refuge in cellars, trenches, and other underground shelters in small groups of three and four. Prolonged isolation from the nucleus of the primary group reinforced their fears of physical destruction. A soldier isolated in a cellar or in a concrete bunker for several days was much more likely to surrender than another member of his group who was in the same tactically hopeless situation but who was still bound by the continuous ties of fighting, eating, and sleeping with his fellow soldiers.

The ability of the primary group to maintain its integrity and resist disintegration will materially affect the capacity of its members to withstand the stress of nuclear combat. It should be recognized that disruption of the primary group by loss of personnel and leadership, breaks in communication, and deterioration of supply and medical care also appears more likely in nuclear combat.

The extreme importance of the primary group for coping under stress has implications for the current policy of individual replacement, as well as for the training, organization, and management of personnel. Its major implications are that groups be formed early, conceivably as soon as soldiers enter the Army, and that group members be kept together, with a group going into and being rotated out of combat in its entirety. Squads, platoons, and companies that have been removed from combat but that are still effective could be used in toto as replacements going into larger groups. Company level groups, however, should not be reconstituted through the use of replacements.

Training for Stress in Nuclear Combat

Certain recommendations are contained in the HumRRO report for preparing men for nuclear combat. They are based on the proposition that the manner in which a soldier will respond to the stress of nuclear combat is likely to depend to a large degree on three elements: (1) the extent to which he has examined the situation and developed a realistic appraisal of it; (2) the extent to which he understands possible or likely consequences of alternate ways of acting; and (3) the extent to which he feels assured that he possesses the skills that would be of most use to him in facing the situation.

A combination of two methods is proposed for training or preparing men for extreme stress. One method is to stimulate controlled amounts of anticipatory fear and self-initiated rehearsal of future events. This will serve to develop expectations and psychological defenses based on a realistic appreciation of the situation. It will also counteract a man's tendencies to discount or deny danger or to develop attitudes of personal invulnerability. The other method of preparing men is to provide for the careful and complete learning of the specific skills a man needs in order to live and fight on the nuclear battlefield. A man who has acquired skills that enable him to exert some measure of control upon his environment will simultaneously develop feelings of self-confidence.

The role that increased self-confidence, based on training and a better orientation, can play in reducing psychological casualties was demonstrated in the Korean Conflict during the winter of 1951. Here, when a battle indoctrination course was introduced among infantry replacements, there was a sharp decrease in the incidence of self-inflicted wounds.

Unless a person is given appropriate preparation and training for stressful events and engages in realistic self-preparation, it is likely that when extreme danger does occur his efforts to cope will break down. He can then be expected to show intense fear, for he has developed no realistic means of coping with the threat. The threat itself is likely to appear to him to be more intense than it may really be, if only because of the disparity between his incorrect expectations and those imposed by reality. The extreme emotional responses that can suddenly appear when

unexpected events shatter a person's defensive beliefs have been frequently reported among combat personnel and surgery patients.

Forecasting Effects of Nuclear Combat on Behavior

Next I would like to touch briefly on questions related to how civilians and soldiers will behave in nuclear combat. Many questions have been asked about the probable effects of nuclear warfare upon civilian populations, upon either the hostile or the friendly troops deployed among them, upon the indigenous forces charged with maintaining order, upon the relationships among these elements, and about how the effects might differ from one cultural or national context to another. For example, how could civilians of a given cultural group be expected to act towards allied or occupying troops when the presence of these troops exposes them to the use of nuclear weapons? How effective could members of the militia be expected to be in maintaining order among the civil population in such a situation? How would different groups of soldiers behave when engaged in fighting a nuclear war within their own country, or when cities within their country have become targets of nuclear attack?

While some basis can be found for conjecture about such questions, the answers are not known.

In attempting to forecast how nuclear warfare may affect civil populations and members of military forces, the following considerations appear to be of some relevance.

Reaction of Civilians

To the extent that nuclear warfare results in greater direct personal involvement among civilians than has been the case heretofore in conventional warfare, adaptation among civilians to the stress of warfare is likely to cease to be the general rule. Instead, states of apprehension, severe and prolonged fear reactions, and widespread emotional difficulties may be anticipated. Perhaps a general apathy would become the dominant response among surviving civilians.

In disaster situations persons do not in general reject authority or fail to follow leadership. Rather, they frequently demonstrate an unusual absence of independent action. Lack of independence sometimes appears as a tendency to become passive followers or to cling to authoritative persons. Their behavior often includes a docile waiting for orders, an active seeking of direction from others, and obedience to leaders.

Persons in this state of mind will occasionally blindly follow a directive that is inappropriate or mistaken. Thus an important consequence of this kind of dependency is that errors in leadership are not likely to be discovered or corrected rapidly.

In the past, populations in disasters have displayed more compliance and submission than aggressive hostility to authority. In nuclear warfare it is likely that, in general, social control would not break down and that civilian populations would not engage in amoral, lawless, and asocial behavior. The chief problem for nuclear warfare would seem to be less whether people would respond to authority but more whether authority structures would exist to which they could respond.

Reaction of Military Personnel

In general it seems likely that soldiers would sustain the stresses of nuclear warfare better than would civilians. Since soldiers would have been trained for survival under conditions of nuclear warfare, they would be expected to have a somewhat better understanding of it, and to be somewhat less vulnerable to its stresses. The soldier's primary group would be expected to provide strong psychological support which would help sustain him under the stress of nuclear combat. Soldiers would generally be able to take some form of direct action--however small it might be--against the threat, and action reduces stress and is of positive psychological value. The soldier would not be as helpless as the civilian, and would not be as likely to perceive himself as helpless as would a civilian in the face of nuclear warfare.

When a soldier fights within his own homeland, there would appear to be additional forces that sustain him under severe stress. A man who is fighting to save his family or home is likely to feel both rewarded and reassured by his efforts. Also, a familiar cultural and geographic context probably attenuates anxiety.

However, when an area of the soldier's home is occupied or when the soldier himself is fighting in that area, the hold of the military group may be lessened.

When military personnel are fighting within their own country or when their country is under attack, there is likely to be a strong conflict between allegiance to the military and a desire to aid civilian primary groups, especially the family. Whether or not soldiers will desert in order to go to the aid of their families will depend on a wide range of factors in the specific situation. Regardless of whether or not there is complete disintegration of the military group and actual desertion, such conditions are likely to result in a lessening in the solidarity of the military group and its capacity to provide psychological support for the soldier under stress. Thus one of the primary supports of the soldier in coping under the stress of nuclear combat may be lost or appreciably reduced when that combat is carried to his home.

Group Reaction

It would be naive to attempt to predict how different cultural groups are likely to act solely as a consequence of exposure to nuclear

warfare. The response of any group of people in any situation typically depends on a wide variety of factors, historical and social as well as situational. We do not know all of the factors that would need to be taken into account, as for example, the structure of specific cultural groups and the kinds of communication systems that they have. We do not know how these factors would change under conditions of severe stress.

While we know in general how individuals are likely to respond in certain classes of situations, our understanding of how groups of people act and will act in specific situations is quite poor, especially when there are cultural or national differences to be considered. For example, in the uprisings against the Communist regimes in East Germany in 1953 and in Hungary in 1956, the intensity of popular response and support for the uprisings was apparently not anticipated by the governments involved or possibly even by the leaders of the revolts themselves. The introduction of nuclear weapons as a consideration is likely, in most instances, to complicate an already uncertain picture.

Panic

I should not close this discussion without some specific mention of the problem of panic. In HumRRO's detailed report the problem of panic as a form of individual and group behavior is analyzed. The characteristics, frequency, and specific factors likely to be crucial in determining whether panic will occur in nuclear battle are discussed.

Hearsay and the more popular type of writing on disaster place such emphasis on panic that one gains the impression that it is both the most important and most common type of disaster behavior. This is not true. Panic is actually exceedingly rare. It occurs only where threat is accompanied by a joint condition: a belief that entrapment is possible and that escape is possible. Thus a soldier's understanding of the character of nuclear battle, and the particular information and training that he receives could have considerable effect on the likelihood of his giving way to panic during combat. In any event, panic is likely to remain very uncommon.

In summarizing the material that has been presented, I would like to emphasize two things. One is that the most important factors--other than combat intensity and duration of exposure to combat--that will contribute to neuropsychiatric casualty levels during nuclear combat are probably fatigue, situational ambiguity, and isolation. The second is the extreme importance of the integrity of the primary combat group--the squad, platoon, and company--in helping to sustain a man in the face of severe combat stress. I would expect soldiers to sustain themselves better in the face of such stress than civilians. I would also expect civilians to be amenable to control by authority if such authority exists. However, the broader questions of civilian reaction to nuclear warfare have no simple answers.

Model for Adjusting Casualty Rates to Include Neuropsychiatric Casualties

As I mentioned earlier, the effect of psychological factors in battle can be introduced into gaming in the form of an adjustment of the casualty rate. More specifically battle casualties can be adjusted for NP casualties. Before I present the model which was developed and used for estimating casualty rates for psychological attrition, I would like to go into some more detail on the relationships between the intensity and duration of combat and the incidence of NP casualties. These data form the basis of the model.

Relationship Between Neuropsychiatric and Battle Casualties

First I would like to demonstrate the consistency of the relationship between NP rate and battle casualties.

(Slide 6)

This slide indicates the relation between rates of NP and wounded in action (WIA), by month, in the Mediterranean Theater during 1944. You can readily see that these casualties co-vary. To facilitate comparison the graph was plotted in terms of percent of average rate. I will attempt to give you a better feel for absolute numbers in a moment.

The next two slides show NP and wounded curves for two divisions for part of two months during 1943.

(Slide 7)

Again, the same covariation appears in a smaller group over shorter periods of time.

(Slide 8)

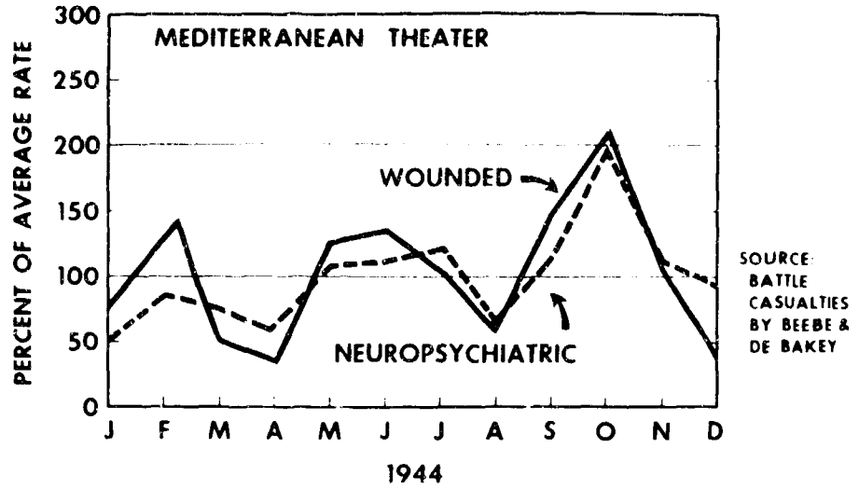
And again NP and wounded vary together.

The next two slides will provide a somewhat better notion of the actual magnitudes involved.

(Slide 9)

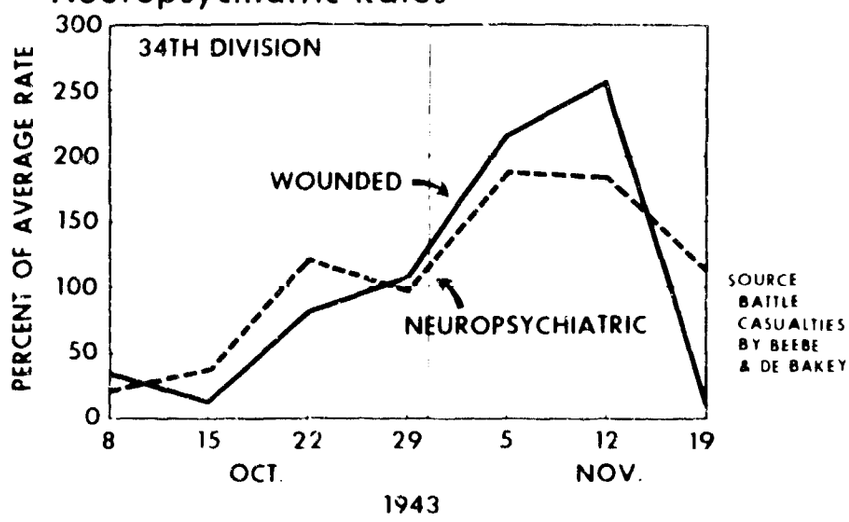
This slide shows a graph indicating the relationship between NP and wounded in rate per 1000 men for the 1st Infantry Division for individual weeks during 1944 and 1945. The scale on the right indicates NP rate and the scale on the left indicates wounded rate.

Relation Between Wounded & Neuropsychiatric Rates



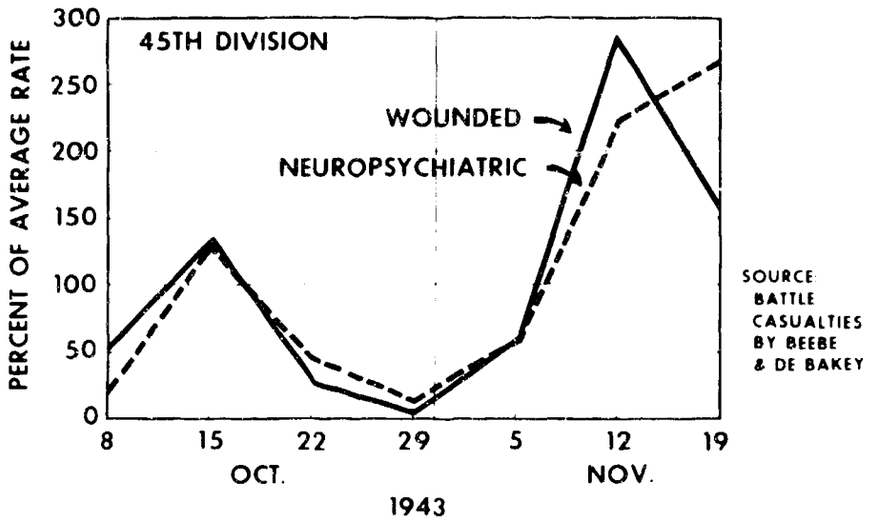
Slide 6

Relation Between Wounded & Neuropsychiatric Rates



Slide 7

Relation Between Wounded & Neuropsychiatric Rates

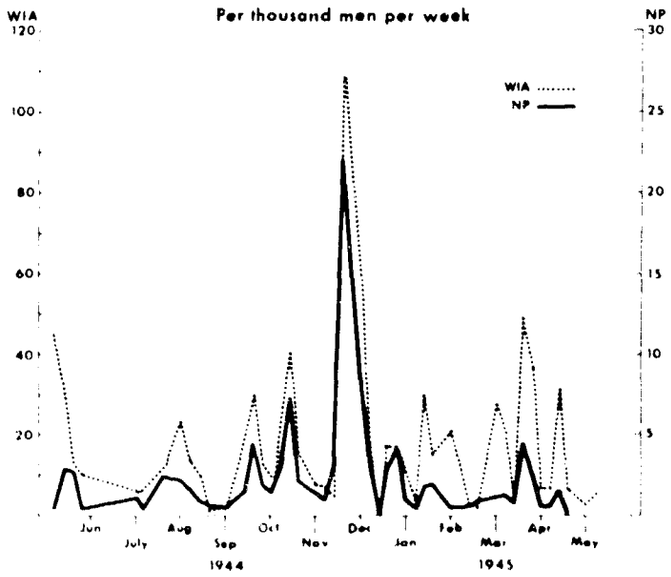


Slide 8

WIA and NP Casualties

1st Infantry Division

Per thousand men per week



Slide 9

(Slide 10)

This slide, plotted in a similar manner, shows NP and wounded rates for the 8th Infantry Division during 1944 and 1945.

The consistency of the relationship between NP and wounded is clear.

If NP is plotted against wounded, the following kinds of relationships are obtained:

(Slide 11)

Here are curves for 13 Infantry divisions in the European Theater in 1944. They are derived from data supplied by the Surgeon General's Office.1/ The scales are expressed in numbers appropriate for divisional casualties per week. The slopes of the lines represent the rate of NP casualties as a function of the number wounded, which can be considered an index of combat intensity.

A straight line has been found to be a good fit to the data. The straight line therefore gives the expected number of NP casualties for any given level of combat intensity. To illustrate the range of certainty, a little over two-thirds of the recorded cases fall within three casualties of the value shown. This is true up to levels of intensity of 500 wounded per division per week. Beyond this point the precision decreases somewhat. This increase in variability is associated to a considerable extent with the high casualty levels sustained during the beachhead operations early in the invasion of Europe. Precisely what factors cause it are not clear, though it should be noted that the line takes no account of variation associated with specific tactical situations.

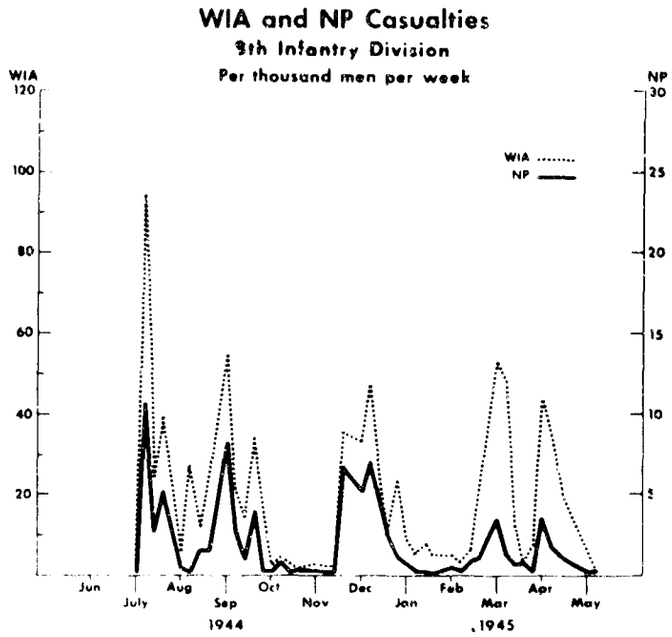
(Slide 12)

This slide shows a similar plot for six Armored divisions in the European Theater in 1944. Note that the slopes are greater than those in Slide 11 of the Infantry divisions, indicating that Armored troops in general incur a higher rate of NP casualties at any given level of battle intensity. As an example of how extreme this can be, note the 4th Armored Division. At its average battle intensity, it had about three NP casualties for every four men wounded.

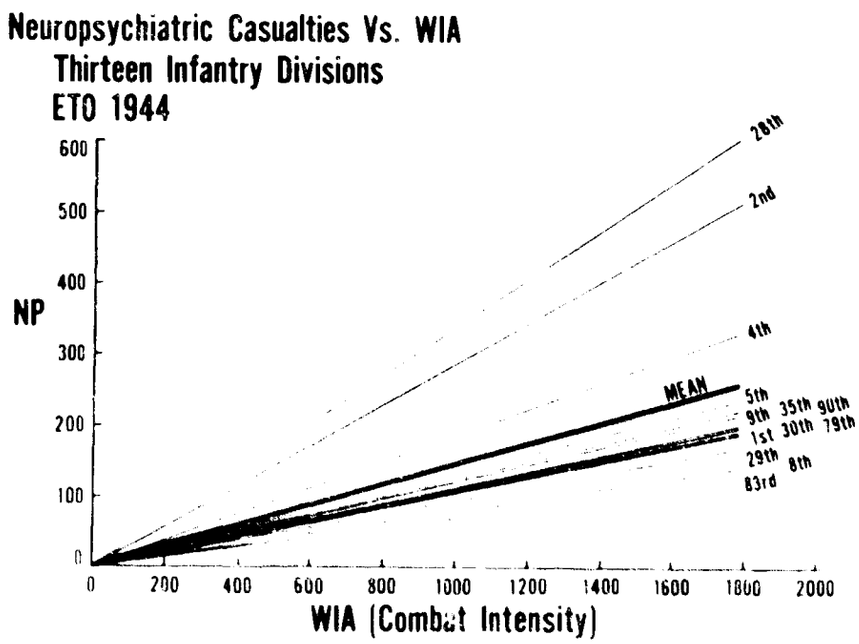
(Slide 13)

This slide shows a similar plot for two Airborne divisions in the European Theater in 1944. The slopes for these divisions are in general less than those of the Infantry divisions, indicating a somewhat lower NP rate.

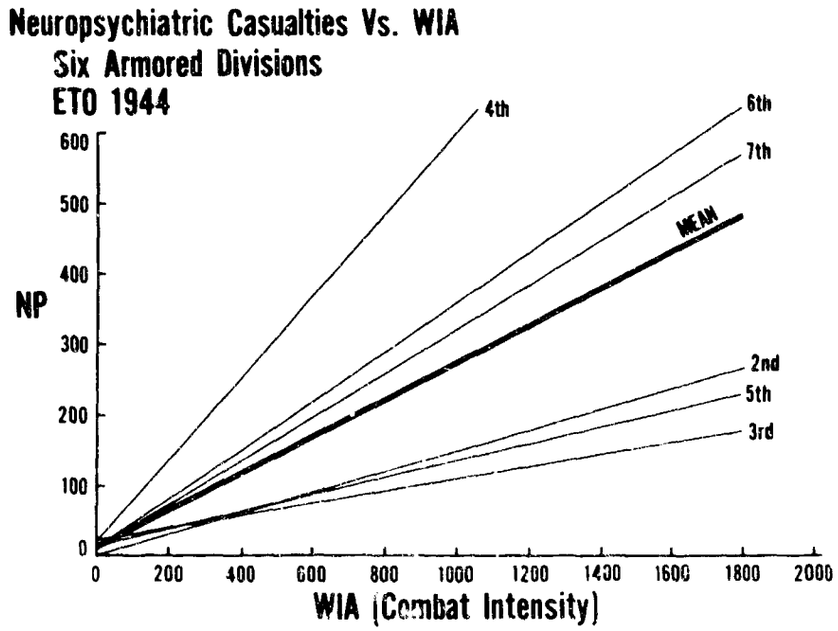
1/Medical Statistics Agency, Office of the Surgeon General.



Slide 10



Slide 11



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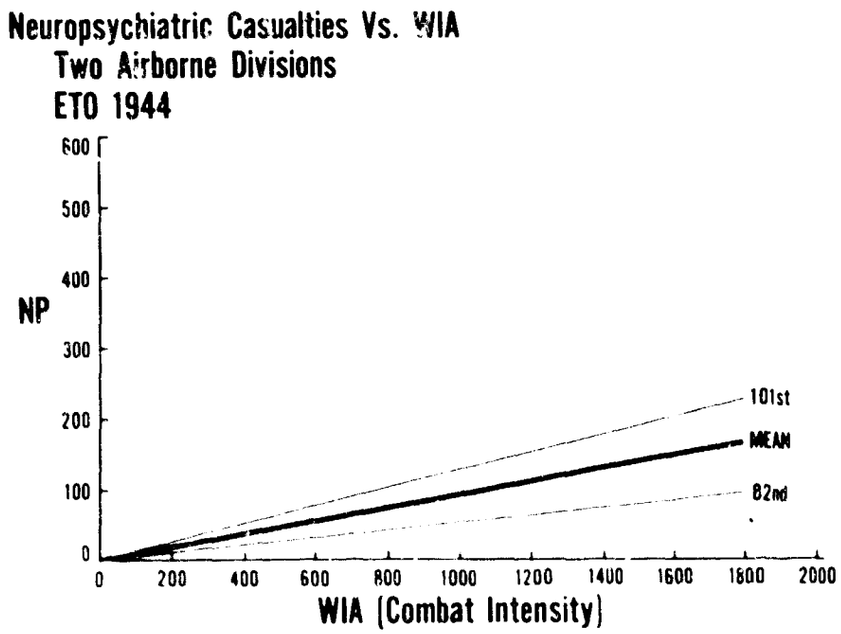


Slide 13

(Slide 14)

This slide shows the mean slopes for the Infantry, Armor, and Airborne units. At average combat intensity for Infantry divisions the proportion of NP to wounded is about 1 to 6. For comparable levels of intensity the proportion of NP to wounded is about 1 to 10 in Airborne and 1 to 3 in Armor.

Relationship Between Neuropsychiatric Casualty Rate and Time in Combat

Thus far we have dealt with NP casualties solely in relation to combat intensity without taking into consideration length of time in combat.

Data bearing on this matter are much more difficult to obtain, but there is information from one extremely well done study that is pertinent.

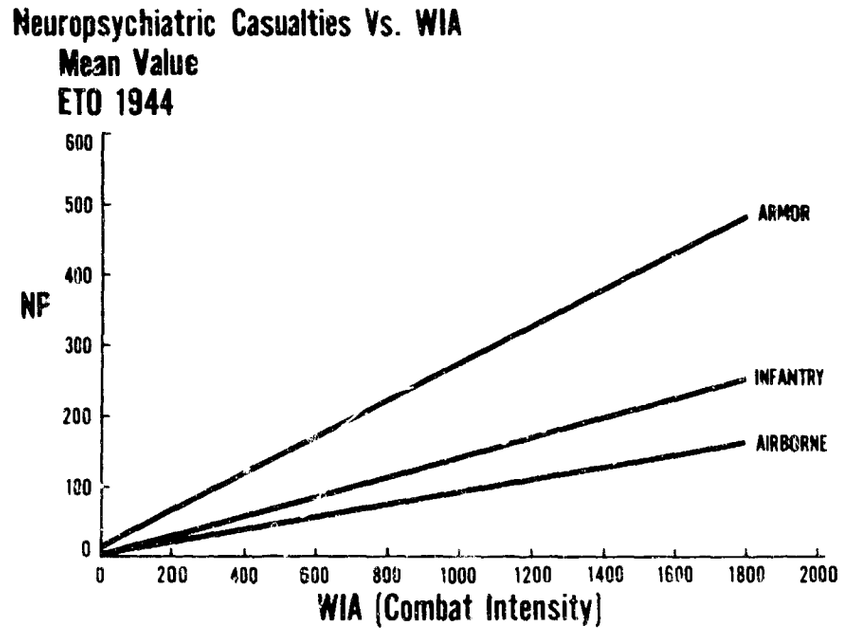
In that study, done for the Department of the Army by Beebe and Appel,1/ under the auspices of the National Academy of Sciences, the records of 1000 men were drawn at random from men in high risk MOSs in Infantry divisions in the Mediterranean Theater during 1943 to 1945. Battle casualty rates were used as an index of combat risk. The MOSs in the sample accounted for about 75% of the World War II rifle company. For example, 530 of the sample of 1000 were riflemen, 181 were squad leaders, 101 were automatic riflemen.

The records of these men were examined to determine the relationship between NP rate and time in combat. Defining a day of combat as any day in which a company containing a member of the sample sustained at least one battle casualty, a determination was made of the number of days of combat that a man had gone through prior to leaving combat as an NP casualty. Reliable data were obtained for time periods up to 80 days of company combat. Using actuarial procedures, the rate at which men became NP casualties as a function of time in combat was established. A curve describing this relationship is shown in the next slide.

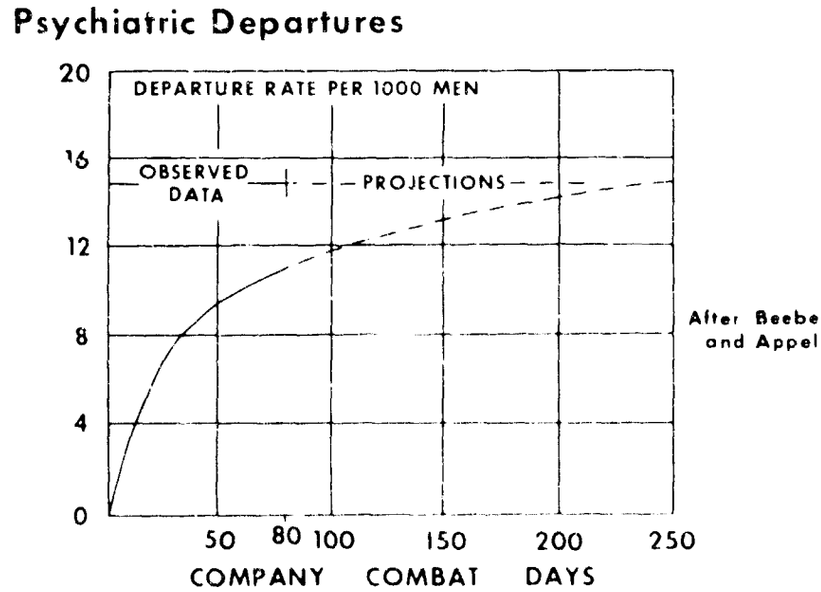
(Slide 15)

During the first 10 days of combat men became NPs at a rate of roughly 2 per thousand per day, during the second ten days at a rate of 5 per thousand per day, and during the third ten days at 7 per thousand per day.

1/Gilbert W. Beebe and John W. Appel, Variation in Psychological Tolerance to Ground Combat in World War II, Final Report, National Academy of Sciences, National Research Council, Washington, April 1958.



Slide 14



Slide 15

The model for adjusting battle casualty rates to include NP casualties involves the use of both the data on NP casualties as a function of combat intensity and information regarding NP attrition as a function of time in combat. Information on NP casualties at various levels of combat intensity was derived from data supplied by the Surgeon General's Office. For NP attrition as a function of time, the information developed by Beebe and Appel was used, after mathematical adjustment to allow for the fact that their data dealt with high risk MOSs.

Ratios of Neuropsychiatric to Battle Casualties

In presenting the model, I will mention both some of the assumptions on which it is based and certain sources of bias and uncertainty.

Illustrative families of curves or nomographs for Infantry, Armored, and Airborne divisions that permit adjustment of battle casualty figures to include NP casualties as a function of both battle intensity and time in combat are shown in the next three slides.

Here is the Infantry nomograph.

(Slide 16)

I will not go into the details of how it was generated. Let me say simply that the data from the Surgeon General's Office were used to determine the slopes of the lines, while the intercepts are based on the findings of Beebe and Appel. In using the nomograph, the point of intersection of a given number of combat casualties and the appropriate time line is located; the NP estimate is then read off the ordinate.

For example, for Infantry soldiers who have been in combat for 11 to 20 days, a group of 1000 men with 50 battle casualties would be expected to show about 10 NP casualties.

Note that the abscissa is now scaled in terms of battle casualties rather than in terms of wounded, and that the scales are expressed in terms of numbers of casualties per 1000 men per day. This was done to facilitate resolution during war gaming. To determine NP casualties for a unit of any particular size, battle casualties are adjusted to a base of 1000 and the resulting NP estimate is then adjusted to the size of the unit. Graphs for other time intervals can readily be prepared.

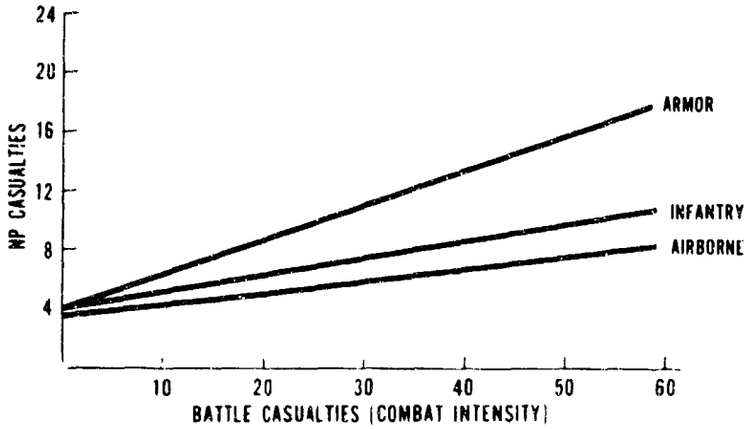
Here is the Armor nomograph.

(Slide 17)

As you saw before, the slopes for Armor are greater and NP rates higher.

Neuropsychiatric Casualties as a Function of Combat Intensity: Airborne, Infantry, & Armor

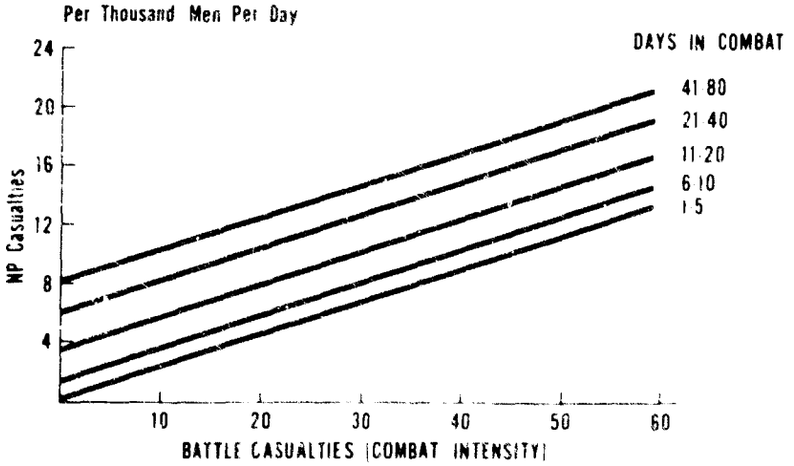
(In terms of casualties per thousand men per day, for troops with 11-20 cumulative days in combat)



Slide 16

Neuropsychiatric Casualties Among Armored Troops as a Function of Combat Intensity by Cumulative Time in Combat

Per Thousand Men Per Day



Slide 17

Here, for soldiers who have been in combat for 11 to 20 days, a group of 1000 men with 50 battle casualties would be expected to show 15 NP casualties in comparison to the 10 of Infantry.

Here is the Airborne nomograph.

(Slide 18)

Here, for soldiers who have been in combat for 11 to 20 days, a group of 1000 men with 50 battle casualties would be expected to show 8 NP casualties as compared to the 10 of Infantry and the 15 of Armor.

(Slide 19)

The final slide shows a comparison of NP casualty corrections that would be applied to Infantry, Armor, and Airborne battle casualties sustained after 11 to 20 days in combat.

Applying Model to Nuclear Battle

I would like to close with a few remarks about the appropriateness and adequacy of the model in accounting for man's behavior in nuclear battle.

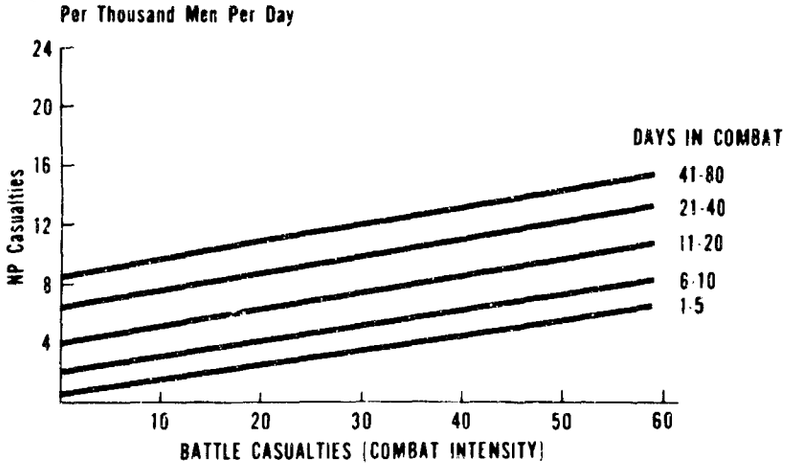
First, it should be recognized that the model is essentially empirical, describing the relationship between intensity and duration of combat and NP casualty levels experienced during World War II.

Furthermore, it is obvious that the model says nothing whatever about man's effectiveness prior to the time he becomes a psychological casualty, nor does it say anything about other forms of combat failure, such as refusal to obey orders, self-infliction of wounds, and malingering. Few would argue that performance does not deteriorate prior to the time a man is removed from combat as a psychiatric casualty. Indeed, there is a wealth of evidence indicating that it does. The problem lies in being able to reliably quantify this deterioration. There is, in fact, little if any hard data on which such an estimate can reasonably be based. Meaningful and reliable measures of individual performance are exceedingly rare even in the peacetime Army. There are none whatever under combat conditions.

General Propositions

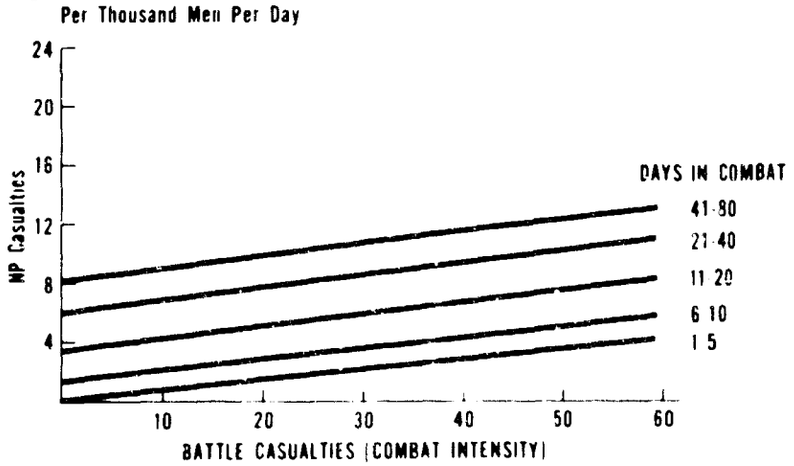
Now, with regard to the adequacy of the model for predicting NP casualties *per se* during nuclear battle: Whether a model based on the experiences of conventional land warfare may be used to predict NP casualty rates in tactical nuclear war is, as yet, an open question. However, some bases for assessing the applicability of the model do exist. Evidence from a wide variety of situations, both contemporary and throughout history, involving severe stress and trauma, indicates certain general propositions:

Neuropsychiatric Casualties Among Infantry Troops as a Function of Combat Intensity by Cumulative Time in Combat



Slide 18

Neuropsychiatric Casualties Among Airborne Troops as a Function of Combat Intensity by Cumulative Time in Combat



Slide 19

(1) That for some period of time at least, men can tolerate and will continue to perform remarkably well under conditions of extreme stress.

(2) That men fight or otherwise maintain themselves when death is likely or even inevitable.

(3) That if men remain in combat long enough psychological breakdown is certain to occur.

These propositions suggest that in general man will act in nuclear battle much as he has always acted in battle. While stress on the nuclear battlefield may be greater than that of the past, and psychological casualties may therefore increase in number, there is no evidence to suggest that there will be sharp qualitative changes in man's responses to such increases in stress. Thus a model which predicts NP as a function of current and cumulative stress is not unreasonable.

Index of Stress

The main question arises regarding the index of stressfulness employed in the model. One can argue that battle casualties sustained will provide an adequate index of the stress of nuclear battle, or one can argue that nuclear battle will be stressful in a degree far beyond that indicated by casualty levels.

The model is based on the experiences of conventional land warfare in World War II, when the ratio of killed to wounded among battle casualties was 1 to 4. In tactical nuclear combat this ratio would probably differ, depending on such factors as the yields of the weapons used, burst heights employed, environmental protection, and mode of troop deployment. In addition, there would be new forms of casualties not encountered in conventional warfare, that is, radiation and thermal injuries. It is not known whether these factors would make nuclear combat more or less stressful than conventional warfare if total battle casualties were comparable.

Battle casualties sustained may provide an adequate index of the stress of nuclear battle, or nuclear battle may be stressful in a degree far beyond that indicated by casualty levels. No one would argue seriously that nuclear battle would be less stressful than indicated by its own casualty rates.

It is clear, therefore, that the estimates of stressfulness used in the model are conservative. Depending on whether these estimates are, in general, correct, the model adjusts for either all of the NP casualties or some of them. I might add that psychiatric data such as those upon which the model is based are almost invariably underestimates. Thus, on all counts, using the model results in conservative

corrections rather than overestimates of probable NP casualties. Such corrections, though conservative, still have considerable impact on overall casualty figures.

This concludes the formal part of my presentation. I would be glad to try to answer any questions that you may have.