Analysis of Casualty Rates & Patterns Likely to Result from Military Operations in Urban Environments

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Executive Summary

The study was conducted as part of the U.S. Marine Corps Commandant's Warfighting Laboratory's initiatives to develop an operational health care doctrine in support of the U.S. Marine Corps' emerging tactical doctrine "From the Sea". It was tasked specifically to examine the impact of casualty rates and wounding patterns in urban operations.

The study aimed to identify the key factors affecting health care support and wounded combatant outcome in urban operations. The methodology used was a comprehensive search of known and available casualty databases and a review of extant literature. The aim being to extrapolate relevant and current data on casualty rates in past operations in urban scenarios across the spectrum of conflict from Peacekeeping to mid-intensity conventional conflict. The data were then analyzed to identify dependent, independent and confounding variables that might shape future operational health-care support. The authors recommend a flexible scenario dependent, tactical zone medical support construct for combat casualties. This needs to be further developed on available data to enable estimates of the severity and time-dependent lethality of injuries sustained in an urban operational environment and thus define treatment and triage guidelines. A combat trauma index analogous to those used in civilian practice is an essential prerequisite for quantifying, aggregating, and resourcing combat injuries. This also would allow measurement of the effects of emerging technologies and Warfighting concepts on combat injured.

A PROJECT TO ANALYZE CASUALTY PATTERNS LIKELY TO RESULT FROM MILITARY OPERATIONS IN AN URBAN ENVIRONMENT

INTRODUCTION

"When thou comest nigh unto a city to fight against it, then proclaim a peace unto it….And if it will make not peace with thee, but will make war against thee, then thou shalt besiege it" [1]

"The only certain result of your plan will be casualties - mainly the enemy if it is a good plan, yours if it' s not. Either way, foremost in your supporting plans must be the medical plan" [2]

The United States' military has, for some years, recognized the increasing likelihood that military operations will be undertaken in urban environments. Fighting in and around centers of population are not peculiar to our time but given the special and difficult nature of combat in built up areas, we have tended to avoid operating in them except when necessity requires. Over the past 30 years, global demographics have been characterized by two key phenomena: 1) an exponential rise in the world' s population and 2) the migration of mankind from rural areas to the cities. This so-called "urbanization" is taking place on such a scale that many experts predict over half the world' s population will live in cities by 2005. [3] Africa will have gone from an urban population of fifteen percent in 1950 to fifty-four percent in 2010. South America will parallel this trend with an increase it' s urban numbers from forty-three percent to ninety percent during the same time period .[4] Given this scenario, one military commentator is probably correct in writing "The future of warfare lies in the streets, sewers, high-rise buildings, industrial parks and the sprawl of houses, shacks and shelters that form the broken cities of our world". [5]

For the United States Marine Corps, this future scenario has particular significance. History shows that since World War II, US Naval and Marine forces have responded to over two hundred crises worldwide and ninety percent have involved operations in an urban environment. Furthermore, estimates suggest that three quarters of the cities in the future will be on the littorals of the world. To this end, the US Marine Corps' Commandants' Warfighting Laboratory is currently undertaking a detailed study, URBAN WARRIOR, to identify the key capabilities necessary to conduct a spectrum of sea-based, naval expeditionary operations, in the unique environment of the urban littoral, from Operations Other Than War (OOTWA) to mid-intensity conflict. The purpose of this Paper is to contribute to the Study by examining specific issues of Health Service Support to such expeditions.

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[1] Book of Deuteronomy, Chapter 20, Verses 10, 12

[2] Maj Gen Rupert Smith Commander 1(UK) Armd Div, Operation Desert Storm, 1991

[3] Strategic Horizons: The Military Implications of Future Alternatives. Steven Metz

[4] Data from the World resources Center 1994

[5] Ralph Peters, ' Our Soldiers their Cities", Parameters, Vol. 26, No1, Spring 1996, p.43.

REQUIREMENT

To identify unique factors in urban casualty patterns and care, which could form the basis for the development of a health care principals that support future urban operations conducted by US Naval and Marine expeditionary forces from the sea.

PHASED APPROACH

The Project will be developed in two phases, this paper deals in detail only with Phase 1:

PHASE 1

1. Review existing studies and databases to extract key data in the estimation of casualty numbers and patterns of wounding in urban warfare scenarios.

2. Identify and study a number of relevant urban campaigns or operations to identify a range of dependent, independent and confounding variables.

3. Develop a methodology for estimating the severity and time-dependent lethality of injuries sustained in an urban operational environment.

PHASE 2

Phase 2 will be the subject of further work and will aim to broaden the Phase 1 project. It will include the effects of emerging technologies and warfighting concepts on the provision of operational health care support and develop a medical planning tool for urban operations from the sea.

EXISTING STUDIES AND DATABASES

The Project first undertook a review of existing studies and databases with the aim of extracting key data that has been used or recommended for use in the estimation of:

- Casualty numbers - using the traditional planning tools of casualty rates and estimates and
- Patterns of wounding - utilizing wound and ballistic data.

CASUALTY RATES AND ESTIMATES

"This is a difficult and a vexed question (calculation of casualties). No very clear instructions for our guidance are to be discovered in any official publication. The volume of the "Medical History of the War" (WW1) dealing with statistics, is a mine of information but lacks a summing-up of the lessons to be learnt from a study of these figures.
One is supposed to obtain one's figures from "G3", but it is not advisable to rely too implicitly, even if they can be obtained. Every "G3" officer very naturally hopes that his battle is going to be successful and this is liable to induce him to give an estimate of a somewhat optimistic character. It is a well known fact that an unsuccessful attack is a very expensive affair, and it behooves us to bear this in mind as it will not do for us to be unprepared. Previous to the War we were taught to use the estimate made by an Austrian General Cron. His formula was based upon a study of casualties in European warfare before his time. Conditions have changed since then; new groupings of troops, new tactics, new weapons and the employment of gas have rendered his formula unreliable. It is, however, better than nothing." [6]

The task of producing casualty rates and estimates for any type of military operation has bedeviled military planners throughout recent history. Military medical histories are replete with anecdotes, advice, and direction. Few, however, sum up the problem better than the above extract from a British Military Medical Manual, circa 1936. Despite the considerable data and the necessary information technology available for contemporary planners to examine it, nothing seems to have changed much in over 60 years. Yet, the traditional doctrine of the U.S. military medical services and most other military medical services of advanced nations, require that operational medical support structures and casualty replacement pools be designed, predicated upon mathematical extrapolations of casualty rates multiplied by the force size and the structure at risk to produce figures known as casualty estimates. If the rates are too high, huge assets can be wasted. Conversely, extremely low rates may indicate inadequate medical force structures and accordingly, an increase in lives lost.

GROUND FORCE CASUALTY RATE PATTERNS

The first modern attempt at a scientific approach to predicting casualty rates came in a landmark work by George W.S. Kuhn in his three volume study of casualties arising from WWII, The Korean War, and the Arab-Israeli wars of 1967 and 1973 undertaken in 1989-1991.[7] This study remains the definitive work on the estimation of casualties available to the US military, NATO and perhaps world-wide. Despite the undisputed quality of the work it has many detractors in the planning staffs of both DOD and NATO. The reasons are best described by a recent medical plans analyst in the DOD Joint Staff's J4, Logistic Directorate, who together with other planners, developed Kuhn's work into an operational planning tool known as the Medical Planning Module (MPM). "There are two basic communities that work with casualty and patient rates: developers and users. While using terms such as standard deviation, levels of confidence, Poisson Distribution and piece-wise rectilinear curves, the developers have tried to convey the methods by which their particular set of rates were compiled and how they might be properly applied. While using terms such as OPPLAN, CONOPS, time-based combat intensities and suspense, users have hurried off with the numbers, thrown them into MPM, turned the crank and produced casualty estimates that bear no resemblance to real world

[6] Organization, Strategy and Tactics of the Army Medical Services in War, Nicholls T.B. Bailliere, Tindall and Cox, 1937
[7] Ground Forces Battle Casualty Rate Patterns, George W.S. Kuhn, Logistic Management Institute, 1991

experience. On rare occasions, when developers and users meet, there is a mutual glazing of eyes without communication." [8]

By Kuhn's own admission, the task of producing a model based upon historical data that would have genuine utility for modern staff planners, was a difficult task. "The study was grounded in the view that casualty rates are so complex in their generation, and that we know so little of the actual relationships of the many dependent variables involved in their generation, that the only reliable sense of them is gained from their actual occurrence. Of course the only genuine source of data on actual casualty occurrence is the historical record." [9]

In simple terms, the published rates in Kuhn's work are neither right nor wrong, rather they have either been applied reasonably or unreasonably. To use the Kuhn data and its classic planning tool reasonably, there must be a match between application technique and development technique. The criteria for such a match are described by Kuhn [10] as:

- Force size and composition by echelons,
- Time periods considered, and
- Overall operational scenario and its set of force missions as operations evolve.

The parameters described are similar to the planning criteria "Mission Enemy Terrain, Troops, – Time" (METT-T) used by commanders and planners at all levels.

One of the authors of this Study has had considerable experience in using Kuhn's Study as a medical planning tool, the MPM, and has examined the data in detail. There is no doubt that, although it was designed to meet the operational requirements of a NATO/Warsaw Pact, it has much greater utility than the Cold-war scenario and remains a valuable planning tool even in today's environment of "low-cost/no cost" conflict. Many of the operational scenarios examined involved battles, campaigns, and their casualty rates in urban and built-up environments, particularly those in allied operations in WWII on the Western Front, from Italy and post D-Day. Used reasonably, the data and the MPM have much to offer in the planning of casualty rates and estimates for the types of urban operations from the sea envisioned in URBAN WARRIOR.

[8] "So The Casualty Rates Are Wrong…" Lt Col Scott Eyestone, USAF, BSC The Joint Staff, J4 Logistics Directorate, Medical Readiness Division

[9] Ground Forces Battle Casualty Rate Patterns, George W.S. Kuhn. Paper prepared for Military Operations Research Society's 1992 60th Symposium *Proceedings*

[10] Ibid

MODERN "LOW COST/NO COST" CONFLICT

One of the principal confounding factors in contemporary casualty rate planning is the operational imperative to conduct modern operations at "low cost/no cost" in terms of casualties. There are a number of compelling reasons why the United States and many advanced nations are forced to consider casualty rates as a major factor in their planning. The first is the modern phenomenon of an acceptable risk of casualties matched against the perceived "worth" of the operation in the public's eyes. Where the nation feels its national security or interest is threatened e.g. Desert Storm, then the public acceptance of casualties is usually higher than when the nation's vital interests are not involved, as in Somalia or Bosnia.

The second more pragmatic problem concerns the nature of modern high tech combat and the relationship between combat power and manpower. Modern combat, as conducted by the US military and its allies, involves relatively small numbers of highly trained warfighters. They are costly to obtain, train, and difficult to replace. Moreover, the loss of even small numbers of personnel from combat units may drastically effect combat power and the ability of a force to complete a mission. This shift in the correlation between manpower and combat power makes casualty estimation more problematic. For example, the loss of 100 marines from an infantry battalion represents a loss of a company's worth of combat power to the commander and significant casualties for the medical support organization. The loss of eight COBRA gunships would be a considerable loss of combat power to the commander but it would have little impact on the medical support workload.

There is compelling need for Warfighters and their medical advisors in all four Services to discuss this issue and to develop an acceptable, workable, and operating framework for the development of an adequate operational heath care support, within the constraints of the "low cost/no cost" conflict.

NEW PLANNING TOOL

The demands of modern medical planning require a much more sophisticated approach to estimating casualty rates and numbers than ever before and it is not surprising that against this background, planning staffs find limited utility in the Kuhn Study and the MPM. There are great mathematical risks in attempting to compile and transfer rates from a high volume of empirical data such as that involved in the Kuhn Study, to small sets of rates for deterministic models such as those envisaged in the majority of URBAN WARRIOR scenarios. Such operations should be approached as unique planning tasks with a unique population-at-threat requiring unique casualty planning factors. To meet these demands there is a need to produce a more precise planning tool, able to apply the specific-to-task data contained in the Kuhn Study, within a METT-T driven scenario. The outline model of such a planning tool is shown in Annex A. Used together with Kuhn data for urban operations, this would provide a reasonable basis for planning casualty rates and estimates for urban operations from the sea.

CONCLUSION

The Study found no evidence that studies or databases exist which deal uniquely with the subject of casualty rates and estimates in urban operations. A number of articles were found in the archives but the rates and the estimates were specific to an operation. Most were also considered too dated and narrow in their perspective to provide guidance for the future. The Study concluded that the Kuhn[11] Study and the databases and tools deriving from it had real application in urban operations of the type envisaged in URBAN WARRIOR. However, the volume and format of the data needs to be shaped to provide for the more specific needs of the Naval Expeditionary forces. Future studies should concentrate on developing the planning tool demonstrated in Annex A in concert with the Kuhn data.

PATTERNS OF WOUNDING

An extensive review of the known literature and databases has failed to identify a comprehensive database or body of literature dealing with wounding and injuries unique to urban warfare. Many of the individual papers available on particular urban operations appear to have no common agreement that these operations produce unique patterns or types of injury.

WOUND DATA MUNITIONS EFFECTIVENESS TEAM

Scrutiny of the limited data offered by these papers on combat injuries and deaths in urban operations or battles since 1945 show little variance from the data provided in the seminal work done by Dr Ronald Bellamy in his analysis of WDMET (Wound Data Munitions Effectiveness Team) Study at the Borden Institute, Walter Reed Army Medical Center. Although this data results from combat injuries and deaths in mainly rural operations in Vietnam, there are a number of cases resulting from urban operations in this conflict. Most notably is the Battle of Hue, a month-long urban operation which occurred January,1968. Whilst this is an excellent insight into the medical support issues, the only available analysis of combat casualties from this operation identifies casualty and DNBI rates; there are no analyses of wound and injury patterns.[12] Given this lack of urban-specific casualty data, the data contained in Dr Bellamy' s analyses are considered to be the most valuable material currently available and are illustrated in Annex B. The aim of future work will be to extrapolate from the WDMET data specific to urban operations and use this as a basis on which to build a unique database through data-mining of smaller, less data-intensive papers and studies.

US ISRAELI STUDY

[11] Ibid

[12] Christopher G. Blood, The Battle for Hue: Casualty and Disease Rates During Urban Warfare. Military Medicine, Vol 159. September 1994

One particular paper, co-authored by a distinguished US authority on military medicine and a former Israeli Surgeon General, suggests that such patterns are to be found:

"Wounds of head, neck and chest caused by small arms will increase, as will wounds from small fragments and secondary missiles such as masonry, glass etc. Burns from building fires, fractures from falls amidst the rubbled buildings and increased eye injuries due to dust, smoke and spall can all be expected…."[13]

There appears to be no single or even collected work that supports this assertion, though it seems likely that this would be the case. The Study is drawn to conclude that the bases of these authors' conclusions are, in part, from personal experience and from conventional wisdom. They offer no supporting data, which parallel the findings in the contemporary military medical literature.

LEBANON WAR 1982

The Study, however, did review one first-rate paper on Israeli operations in the Lebanon War in 1982 which refutes the assertion that injury patterns in urban warfare are uniquely different.

> "In the Lebanon War of 1982, most of the casualties (in urban warfare) were due to wounding in the lower part of the body, while in non-urban operations injuries to the upper body were more likely (70%)…Chest injuries were found less in urban operations (8.5%) than in non-urban areas (9.9%). Lower extremities were more injured in urban (30.9%) than non-urban. Eye injuries during the War occurred more in non-urban (twice as much) than in urban areas." [14]

The author notes the disparity and suggests that a number of factors such as the greater use of body armor, the early availability of expert medical care, and rapid evacuation in the urban operations may have significantly altered traditional casualty patterns. This is explored further in the Paper.

CONCLUSION

The Study concluded that there currently exists no database or body of literature dealing specifically with wounding and injuries that result from operations in urban areas. Of those studies and papers identified, there were few that provided convincing wound data. Those that did indicated no real commonality of findings and one in particular suggested that current thinking may be erroneous. The WDMET data and work derived from it still appears to be the best basis for further work. The Study believes this should take the form of extrapolation of

[13] Col Craig Llewellyn MD MC USA., Brig Gen (Retd) Eran Dolev, MD, MC, IDF, "Health Service Support for Military Operations in Urbanized Terrain". Medical Bulletin Vol 42, No 6, June 1985

[14] Col Besser Yheskel , Military Operations in Urbanized Terrain (MOUT), Medical Aspects, Lebanon War 1982 - A Case Study. Occasional Paper, August 1985

urban-specific wound data in addition to expanding the search to include other nation' s databases.

DEPENDENT, INDEPENDENT AND CONFOUNDING VARIABLES

The Study examined 17 conflicts/operations spanning the period 1939 to 1995 and covering the spectrum of operations from low-intensity counter-terrorism to mid-intensity major conflict. The intention was to draw common threads from the operations and to determine dependent, independent and confounding variables. In the event there proved to be little data on casualty rates or wounding patterns for many of the operations, though the combat data was in some cases excellent. The operations/battles examined are :

	Battle	**Date**	**Sources**
1.	Warsaw	1939	Excellent German; Polish Unknown.
2.	Rostov	1941	Excellent German; Good Russian.
3.	Dieppe	1942	Excellent German & Canadian.
4.	Stalingrad	1942	Excellent German; Good Russian.
5.	Kharakov	1943	Good German & Russian.
6.	Novorossisk	1943	Good German & Russian.
7.	St Lo	1944	Mediocre German; Excellent U.S.
8.	Boulogne	1944	Mediocre German; Excellent U.K.
9.	Aachen	1944	Mediocre German; Excellent U.S.
10.	Seoul	1950	Excellent U.S.; NKPLA not known.
11.	Jerusalem	1967	No archival material available.
12.	Hue*	1968	Excellent U.S.; Vietnamese Unknown.
13.	Saigon	1968	Excellent US; Vietnamese Unknown.
14.	Suez City	1973	No archival material available.
15.	Lebanon*	1982	Excellent Israeli; No other Known.
16.	Mogadishu	1993	Excellent Israeli; No other Known.
17.	Grozny*	1995	No archival material available.

*3 of the listed operations provide sufficient material to elaborate upon in the Study.

THE BATTLE FOR HUE

The Study examined the available data on casualties incurred by US forces during the re-taking of the city of Hue during the Vietnam conflict. Hue was the cultural capital and third largest city in the then South Vietnam. During the Tet offensive of 1968, a division-sized force of the North Vietnamese Army (NVA) infiltrated and took control of most of the city. Three US Marine battalions and 13 South Vietnamese battalions were involved in the fighting to regain the city which began January, 1968 and lasted over a month. Given the mission of US forces and its allies, the enemy, the time frame, the terrain, and the troops involved, the Hue operation is a very good case-study of the casualty rates and patterns that might result from future urban operations.

Medical incidence data were obtained from a detailed paper published by Blood and Anderson in 1994.[15] The paper utilized data extracted from Unit Diaries of the three US Marine battalions (1/1/1, 1/5/1, 2/5/1) that took part in the operation. These diaries include records of the number wounded in action (WIA), wounded not evacuated (WIANE), killed in action (KIA), Disease and Non-battle Injuries (DNBI), and the unit strengths. Daily rates of wounded, killed, and incapacitated by disease, during the month-long operation, were computed and compared with pre- and post-Hue operations. Casualty rates were calculated per 1,000 troops per day.

Rates were examined for the three phases of the operation:

- Fighting south of the Huong River,
- Fighting in the inner Citadel, and
- Pursuit and "mopping up" operations.

Rates for the battle were also contrasted with casualty incidence during a four month peak of US Marine involvement in Vietnam (May through August, 1968).

[15] Christopher G. Blood and Marlisa E. Anderson. The Battle for Hue" Casualty and Disease Rates During Urban Warfare. Military Medicine. Vol 159. September 1994

RESULTS

Analysis of the data revealed the following:

Total Figures

An analysis of the overall casualty rates amongst infantry units before, during and after the battle (the period January 31 - March 2) for a total of 77,918 man-days showed:

Casualties	*Average Rate per 1,000*	*Range*
Daily Wounded	17.5	1.6 - 45.5
Daily KIA	2.2	0.0 - 9.6

Comparative Data

A comparison with a four month period (May - Aug 1968) of peak US Marine activity showed:

Casualties	*Average Rate per 1,000*	*Range*
Daily Wounded	2.50	0.0 - 13.9
Daily KIA	0.31	Not available

Huong River

Daily casualty rates amongst troops fighting in the urban area south of the Huong River, examined over an 8 day period, showed:

Casualties	*Average Rate per 1,000*
Daily Wounded	7.9
Daily KIA	3.1

* Average strength 755

Of the five individual companies fighting south of the river, all but one has a wounded rate exceeding 35 per 1,000 per day.

Citadel

Daily casualty rates amongst troops fighting in the Citadel, during the second phase of the battle, over a 10 day period showed:

Casualties	*Average Rate per 1,000*
Daily Wounded	44.4
Daily KIA	7.8

*Average strength 615

Of four individual companies fighting in the Citadel, the wounded rate requiring evacuation ranged from 23 to 35 per 1,000 per day.

Mop-up Operations

Daily rates amongst troops during the pursuit and mopping-up operations, over a 7 day period showed:

Casualties	*Average Rate per 1,000*
Daily Wounded	5.8
Daily KIA	0.93

*Average strength 2,315

Casualty rates amongst individual companies ranged from 0.0 to 38 per 1,000 per day.

CONCLUSION

US and allied forces fought house -to-house in the first battle of the Huong River, withdrawing at night only to have NVA sniper re-occupy the positions by morning. Fighting was at close quarters and slow. After 8 days the enemy was routed. Shortly after that, US forces moved into the city and re-took it in similar close combat fashion with similar casualty rates over ten days. Examination of this operation revealed only the casualty rates. They indicate that such combat produces higher rates than a non-urban operation conducted by like forces against the same enemy. The anecdotal evidence further suggests that well motivated and trained troops are better able to undertake this degree of operation. Additionally, the medical resources, although adequate and well trained in military medical skills, ***were not well prepared or organized for the special demands of urban operations***. In particular, there was a paucity of suitable

ground evacuation capability, in this case armored ambulances, and far-forward medical resources; the current doctrine being predicated upon evacuation by helicopter direct to hospital-level care. The Study was unable to extrapolate casualty patterns by wound types from the existing literature; however, given the unique nature of this battle, there is merit in a more detailed study to be undertaken in this area.

OPERATION ' PEACE FOR GALILEE' - LEBANON 1982

Unlike Israel' s previous wars, the heavy battles of the Lebanon War took place in built-up areas. The operation in Southern Lebanon was conducted by the Israeli defense Forces (IDF) in 15 weeks during the period June 6 – August 5, 1982. The operation was conducted in three stages:

Stage 1: 6 - 11 June 82. IDF advanced along four main routes:

Route 1 - Coastal Plain: One column fought the Palestinian Liberation Organization (PLO) in the urban areas of the coastal strip reaching up to Beirut International Airport.

Route 2 - Lebanon Ridge: Second column fought the PLO forces along the high ground in the Nabitiye region.

Route 3 - Shuff Mountains: The Third column fought the Syrian Army in the mountainous area north of the Aauali River.

Route 4 - Bequaa Valley: Main forces of the IDF fought in the Central region of the Bequaa Valley against the Syrian Army.

Stage 2 : 22 - 25 June 82 IDF effort in two main operational areas:

Coastal Plain: IDF advanced into Eastern Beirut (Christian held areas); captured of towns of Kfar Chima and Baabda and established free access to Eastern Beirut via Damascus Highway.

Central Region: Encirclement operations were to cut the Beirut Damascus Highway, capture suburban towns of Aley and Bhamdun and blockade the City.

Stage 3: 2 - 5 August 82 Operations were located in the deeply urban areas of West Beirut, fighting against the Syrian and the PLO forces. This phase was the most destructive and bloody operation of the war, employing the full array of modern weapons in close combat in a modern city in true urban warfare. The final outcome was achieved by a combination of international political effort and the effects of a combat losses and a stalemate for both sides. A

cease-fire was agreed and evacuation of the PLO and Syrian Forces took place on 21st August 1982.

COMBAT CASUALTY RATES AND PATTERNS

In preparation for OPERATION FREE GALILEE, the IDF Medical Corps developed a comprehensive medical plan to provide operational medical support of the highest standards. In addition to the operational plan and assets, the IDF MC designed a system to allow the closest possible scrutiny of the overall medical management of casualties from point of injury, through definitive hospital care and rehabilitation. This was carried out by surveying all combat casualties that were evacuated for secondary or tertiary treatment (total 1,561) in rear hospitals according to a computerized questionnaire. A team of medical students was assigned to each of the receiving hospitals as interviewers. In addition, each KIA (total 271) was the subject of a detailed examination by pathologists to determine the cause of death, the causative weapon or agent and where possible the combat conditions involved. The result was the first comprehensive casualty database since the US WDMET Study of the Vietnam War, although nowhere near the same size. The Study was unable to access the full database at this juncture. However, the authors believe that there is great merit in approaching the Israeli authorities to examine the utility of combining the relevant data from the Israeli Study with the WDNET and the Kuhn Study. This would produce a truly unique and modern database on casualty rates and patterns in urban operations. Such a database is an essential pre-requisite for focus planning of resource, materiel and combat needs for the JV2010 scenarios.

CASUALTY TOTALS

The total number of hospitalized casualties over the 15 week period was 1, 953 of which the Israeli database has detailed records for 1,561 (80%). These casualties were Israeli military only. There is no data on enemy wounded, civilian or Israeli civilian. The majority of the wounded, 53%, were regular personnel, 47% were Reservist. The infantry formed the largest group of wounded, comprising 30% of the total casualties, 1.8 times higher than the October War of 1973. There were far fewer tank crew casualties, 14.1% of total casualties as compared with 28% in the 1973 War. The totals are elaborated in Table 1. Most of the casualties resulted from artillery fire with a large proportion due to light weapon injuries. Cluster bombs were a frequent cause of injury or death (3.7%), either fired direct from aircraft or artillery or as secondary munitions exploding on the battlefield. Detail of wounding agents are shown at Table 2.

Table 1: Distribution of casualties by military task.

Task	*No of casualties*	*% Total*
Infantry	468	30.0
Armor	221	14.1
Commanders	181	11.6
Drivers	142	9.1
Logistics	143	9.1
Medical	77	4.9
Signals	65	4.2
Artillery	64	4.1
Armored infantry	56	3.6
Engineers	31	2.0
Staff officers	26	1.7
Others	87	5.6
Totals	1561	100.0

Table 2: Distribution of wounding agents.

Cause	*No of Casualties*	*% of Total*
Shell/mortar/ cannon/rocket	827	53.0
Bullet	181	11.6
Blast	36	2.3
Mixed	75	4.8
Others	130	8.3
Not defined	312	20.0
Totals	1,561	100.0

DATA ANALYSIS

One particular study of the Lebanon War has produced detailed and interesting data that the Study believes contributes considerably to both the understanding of combat casualties and the unique effects of urban combat on war injury rates and patterns. [16] Yheskel' s Study attempts to compare combat in both urban and non-urban operations during the war. The data is shown in percentages and absolute numbers. 2x2 and 2xR tables have been constructed to compare relevant variables. Only those data which demonstrate significant differences between the two operational environments have been included in this paper. The data analysis used the standard techniques with a number of variations to identify independent and dependent variables.

Chi^2 analysis was used for testing the Null hypothesis (H) that there is no difference between combat terrain. The Chi^2 for each cell was given the expression:

$$Chi^2 - \frac{(Observed - Expected)^2}{Expected}$$

Test statistics used to investigate the hypothesis were in the following form:

$$x^2 = \frac{(Observed - Expected)^2}{Expected}$$

Contingency tables were tested by the Chi square analysis using (r-1) (c-1) degrees of freedom.

Log Linear Models were utilized to analyze some of the three dimensional tables. This provided a unified approach to the analysis across the classified data system when all the variables of interest were discrete.

DEPENDENT AND INDEPENDENT VARIABLES

The use of dependent and independent variables is one of the most valuable assets of the Yheskel' s study. Terrain was used as an independent variable in all tables. Other variables were used as both dependent and independent variables for different aspects of the analysis.

URBAN TERRAIN

[16] Col Besser Yheskel , Military Operations in Urbanized Terrain (MOUT), Medical Aspects, Lebanon War 1982 - A Case Study. Occasional Paper, August 1985

Military operations in urban terrain were defined as all operations planned and conducted on a terrain where manmade construction impacted on the tactical options available to the commander. In the Lebanon War this referred to three main categories of terrain:

- Strip Areas - Rachidye, Nabitiye
- Towns and small cities - Tyre, Sidon, Jessin
- Large city with suburbs - Beirut, Bhamdun, Aley

Non-urban combat was defined as combat in all other parts of Lebanon.

CASUALTIES – OUTCOME

In Yheskel' s Study only two kinds of casualties were defined: 1) those who died in action (KIA) and 2) those who survived (WIA). A broader definition would have been:

> Killed in Action - Those casualties killed outright or died before medical intervention was available.
>
> Wounded in Action - Those who were wounded but survived, excluding those who treated and return to unit without evacuation to hospital.

CASUALTY CHARACTERISTICS AND CIRCUMSTANCES

Casualty characteristics were defined by their Corps and combat assignment. Circumstances of injury were attributed to the following:

- Geographical area where injury occurred,
- Tactical situation in which casualty occurred,
- Vehicle in which casualty occurred (if any),
- Battle posture, and
- Time of Injury.

CAUSE OF INJURY AND PROTECTIVE COUNTERMEASURES

Cause of injury was determined as the weapon or munition that inflicted the injury. Distinction was made for 11 categories of weapons. Narrowing the spectrum identified two main categories: guided and non-guided munitions. Protective vests, helmets, and eye protection were defined as protective countermeasures.

MANAGEMENT OF CASUALTIES

This was divided into three task areas:

Health Service Support: This was defined as any medical team headed by a physician which delivered medical care within the various medical echelons of the battlefield. Medical care was examined from the following aspects:

- First medical treatment facility that delivered medical care,
- Time elapsed till first medical care given,
- First care given by a medic, and
- Fluids by type and amount given during treatment and evacuation.

Evacuation: The movement of casualties from point of wounding throughout the system was studied from the following aspects:

- Evacuation to first medical treatment facility,
- Time elapsed until evacuation began, and
- Delays in evacuation.

Severity & Type of Injury: The following aspects of combat injury were studied:

- Burns caused in battle,
- Severity of wounding,
- Injuries by location, and
- Combat stress casualties.

OUTLINE ANALYSIS OF VARIABLES

Yheshkel' s Study developed a detailed examination of each of the variables, supported by two and three dimensional tables to demonstrate urban and non-urban combat outcomes. In summary the data indicated the following:

Distribution of Injuries by Military Task: The infantry suffered the highest fraction of casualty injuries in both urban and non-urban combat, 56% and 43% respectively (Table 3).

Table 3: Injuries by Military Task

	Urban		*Non-Urban*		*Total*	
	N	%	N	%	N	%
Infantry	340	56.0	389	43.0	729	48.0
Armor	104	17.1	315	34.8	419	27.7
Support	128	21.1	150	16.6	278	18.4
Airforce	17	2.8	15	1.7	32	2.1
Logistics	18	3.0	35	3.9	53	3.5
Total	607	100.0	904	100.0	1511	100.0

Distribution of Casualties by Tactical Situation and Terrain: The type of combat situation did not significantly affect the distribution of casualties, whether combat was in an urban or a non-urban environment. The exception was the affects of air attack which were greater in non-urban combat
(Table 4).

Table 4: Casualties by Tactics and Terrain

	Terrain					
	Urban		Non-	Urban	Total	
	N	%	N	%	N	%
Inf. v Inf.	251	47.1	254	34.5	510	39.7
Artillery	128	24.0	117	15.6	245	19.1
Armor vs. Inf.	79	14.8	141	18.8	220	17.1
Air Attack	16	3.0	122	16.2	138	10.7
Deployment	25	4.7	34	4.5	59	4.6
Other	34	6.4	78	10.4	112	8.7
Totals	533	100.0	751	100.0	112	100.0

Weapons Effects: Artillery, 105mm, 155mm, and the range of field mortars, is the most significant weapon for causing casualties in the urban combat environment (86% of all injuries). (Table 5) The risk of being injured by artillery in an urban environment was 20 times higher than in non-urban battle. Troops in APCs were at greater risk to injury from Rocket Propelled Grenades (RPG) 50mm, 90mm, and 120mm in urban than non-urban battle. SAGGER ATGW missiles caused more injuries in non-urban combat
(Table 6).

Table 5: Casualties by Artillery and Other Weapons

	Terrain					
	Urban		Non-Urban		Total	
	N	%	N	%	N	%
Artillery	142	86.6	99	23.1	241	40.6
Other	22	13.4	330	76.9	352	59.4
Total	164	100.0	429	100.0	543	100.0

Table 6: Casualties by AT Missiles

Missile	***Terrain***					
	Urban		Non-Urban		Total	
	N	%	N	%	N	%
RPG	16	88.9	14	62.4	30	58.8
SAGGER	2	11.1	9	38.6	11	41.2
Total	18	100.0	23	100.0	41	100.0

Protective Countermeasures: Ballistic protection vests appear to have affected injury rates more in urban operations than non-urban. Less combatants wearing vests were injured in urban (44.6%) than non-urban (63.1%). Of those who did not wear vests, more were injured in urban (55.4%) than in non-urban (36.9%) (Table 7). Helmet usage was greater in non-urban areas (76%) than in urban operations (70%) (Table 8).

Table 7. Use of Ballistic Protection Vests by Casualties and Terrain

Vest	***Terrain***					
	Urban		Non-	Urban	Total	
	N	%	N	%	N	%
Yes	50	44.6	410	63.1	460	60.4
No	62	55.4	240	36.9	302	39.6
Total	112	100.0	650	100.0	100	100.0

Table 8. Use of Helmets by Casualties by Terrain

Helmet	***Terrain***					
	Urban		Non-	Urban	Total	
	N	%	N	%	N	%
Yes	315	70	420	76.4	735	73.5
No	135	30	130	23.6	265	26.5
Total	450	100.0	550	100.0	1000	100.0

Casualty Management: ***"Buddy" or self-aid was more prevalent in non-urban than in urban operations (Table 9). Medics provided more "first-responder" care in urban than non- urban operations. No difference in medical treatment was observed between terrain***. Treatment was significantly more prompt in urban than non-urban areas (Table 10). More comprehensive medical care was provided and more IV fluids given in urban than non-urban operations.

Table 9. Distribution of First Responder by Terrain

Responder	***Terrain***					
	Urban		Non - Urban		Total	
	N	%	N	%	N	%
Buddy	92	18.2	155	22.4	247	20.6
Self	46	9.1	92	13.3	138	11.5
Medic	263	52.0	305	44.1	568	47.4
Surgeon	53	10.5	77	11.1	130	10.9
Medical Company	26	5.1	26	3.8	52	4.3
Surgeon in Med. Co	26	5.1	37	5.3	63	5.3
Total	506	100.0	692	100.0	1198	100.0

Table 10. Distribution of Time Elapsed to "First" Treatment by Terrain.

	Terrain					
	Urban		Non - Urban		Total	
	N	%	N	%	N	%
0< 1hr	143	91.1	209	78.0	352	82.8
1hr-4hr	8	5.1	37	13.8	45	10.6
5hr-12hr	1	0.6	13	4.9	14	3.3
12hr->	5	3.2	9	3.4	14	3.3
Total	157	100.0	268	100.0	425	100.0

Evacuation: Evacuation directly to surgical facilities was more common in urban than non-urban combat environments. (Table 11) BAS was the most common first treatment facility in non-urban ops. Evacuation time was significantly faster in urban ops. (Table 12)

Table 11. Distribution to First Medical treatment Facility by Terrain.

Unit	*Terrain*					
	Urban		Non - Urban		Total	
	N	%	N	%	N	%
BAS	402	80.1	609	87.0	1011	84.1
Med. Co	38	7.6	29	4.1	67	5.6
Surgical Co	47	9.4	19	2.7	66	5.5
Helicopter	10	2.0	40	5.7	50	4.2
Rear Hosp.	5	1.0	3	0.4	8	0.7
Total	502	100.0	700	100.0	1202	100.0

Table 12. Distribution of Time Elapsed till Evacuation to First Medical Treatment Facility by Terrain.

Time	*Terrain*					
	Urban		Non - Urban		Total	
	N	%	N	%	N	%
0>1hr	401	81.8	513	75.6	914	78.2
1hr-4hr	49	10.0	106	15.6	155	13.3
5hr-12hr	26	5.3	32	4.7	58	5.0
13hr>	14	2.9	28	4.1	42	3.6
Total	490	100.0	679	100.0	1169	100.0

Casualty Patterns and Types: Apparent differences exist between injury patterns and types of injuries in different operational terrain. Surprisingly, the data show that eye injuries and combat stress occur less in urban ops. Non-urban ops have greater burns and lower body injuries. Artillery produced the largest number of casualties in both environments, but again, small arms fire caused more wounds in the non-urban environment. Small arms fire was a significant cause of death in both environments (Tables 13-17).

Table 13. Distribution of Eye Injuries by Terrain among Casualties.

Eye	***Terrain***					
	Urban		Non-Urban		Total	
	N	%	N	%	N	%
Yes	6	4.2	11	1.1	17	7.0
No	138	95.8	88	88.9	226	93.0
Total	144	100.0	99	100.0	243	100.0

Table 14. Distribution of Burns by Terrain among Casualties.

Burns	***Terrain***					
	Urban		Non-Urban		Total	
	N	%	N	%	N	%
Yes	26	5.0	65	9.1	91	7.4
No	490	95.0	653	90.9	1143	92.6
Total	516	100.0	718	100.0	1238	100.0

Table 15. Distribution of Injury to Body Area by Terrain.

Body Area	***Terrain***					
	Urban		Non-	Urban	Total	
	N	%	N	%	N	%
Upper	476	64.2	752	69.8	1228	76.5
Lower	265	35.8	326	30.2	591	32.5
Total	741	100.0	1078	100.0	1819	100.0

Table 16. Distribution of Combat Stress Reaction (CSR) by Terrain.

	Terrain					
	Urban		Non-	Urban	Total	
	N	%	N	%	N	%
Injury w/o CSR	471	95.5	638	92.9	1109	94.0
Injury w/ CSR	17	3.4	25	3.6	42	3.6
CSR w/o Injury	5	1.0	24	3.5	29	2.5
Total	493	100.0	687	100.0	1180	100.0

Table 17. Distribution of Casualties by Causative Weapon and Terrain.

Terrain	*Weapon*	*Outcome*					
		WIA		KIA		Total	
		N	%	N	%	N	%
URBAN	Arty	155	32.1	36	37.1	191	32.9
	Small arms	82	17.0	22	22.7	104	17.9
	RPG	98	0.3	12	12.4	110	19.0
	Air Bombs	9	1.9	1	1.0	10	1.7
	Rocket	23	4.8	6	6.2	29	5.0
	Grenade	33	6.8	3	3.1	36	6.2
	Mine	17	3.5	5	5.2	22	3.8
	Tank Rd	12	2.5	3	3.1	15	2.6
	Boobytrap	10	2.1	0	0.0	10	1.7
	Antitank	6	1.2	3	3.1	9	1.6
	Other	38	7.9	6	6.2	44	7.6
	Total	483	100.0	97	100.0	580	100.0
OTHER	Arty	109	17.1	33	8.2	142	17.3
	Small arms	116	18.2	55	30.4	171	20.9
	RPG	67	10.5	11	6.1	78	9.5
	Air Bombs	74	11.6	23	12.7	97	11.8
	Rocket	54	8.5	19	10.5	73	8.9
	Grenade	29	4.5	7	3.9	36	4.4
	Mine	29	4.5	1	0.6	30	3.7
	Tank Rd	28	4.4	8	4.4	36	4.4
	Boobytrap	8	1.3	2	1.1	10	1.2
	Antitank	25	3.9	13	7.2	38	4.6
	Other	100	15.6	9	5.0	109	13.3
	Total	639	100.0	181	100.0	820	100.0

CONCLUSION

The results of the Yheskel Study provide a valuable insight into the provision of medical support to a relatively recent mid-intensity conflict in an urban environment. The data supplied raises some interesting questions regarding the long-held views that urban warfare produces unique patterns and types of casualties. Although the data suggest that the casualty number in urban operations was higher than non-urban, it is not possible to draw absolute conclusions. What can be said is that casualties occurred more often in urban than non-urban environments. However, the death toll was higher in non-urban operations. It can also be concluded that more infantry were casualties than any other Arm of the Service. This leads one to conclude that Urban ops are infantry-heavy operations. The higher casualty rate may have been in part due to the higher concentration of infantry in urban ops, three to five times higher than in open terrain operations. The battle of Beirut in particular produced heavy casualties. The chances of being injured in this operation was 49 times higher than any other operation. Whilst artillery was the single greatest cause of injury, the cause of death due to injury of the upper body was highest where snipers and anti-tank missiles were used more effectively (e.g. in the Coastal areas and open terrain rather than in the cities where the three dimensional terrain gave infantry more cover). ***APCs and tanks where very vulnerable in urban areas and consequently produced a significant number of casualties.***

Most interesting, wounding data does not support the conventional wisdom that urban ops produce more wounds of the upper body, burns eye injuries etc. than non-urban ops. This may be because of the effectiveness of body armor, helmets, NOMEX suits, and eye protection. The use of artillery, Mortar, and RPGs which tend to produce shrapnel injuries to the whole body and against which the troops had only upper body protection, may have been a significant factor. Small arms fired from rifle and machine guns contributed most significantly to the number of deaths in battle.

The characteristics of urban warfare and anticipated medical problems led to the IDF MC deploying considerable amounts of medical support as far forward as possible. Moreover the quality and capability of this far-forward deployment was immensely greater than in past operations. Consequently, medics provide a greater proportion of first-responder care than in past conflicts and particularly in the urban phases, ***surgeons treated casualties at the second echelon level sometimes 200 meters behind the fighting troops***. During the Beirut operation, ***an Evacuation hospital operated 3 kilometers south of the city***. Overall, care was found to be of the highest standard at every level but major ***problems existed in locating and evacuating casualties, particularly under fire***. Radio communications were often difficult to establish. Evacuation by M113 APC ambulance was dangerous due to its slow speed, light protection and large size. H***elicopter evacuation from the city and suburbs was very dangerous and limited***. Often the Merkava tank was the best means of moving casualties out of danger, but mostly casualties were carried to a safe area.

The questions raised by the study of the Lebanon war have yet to be fully examined and answered. It may be that that urban operations do not produce the numbers and types of

casualties traditionally thought. It does, however, merit further study and incorporation into broader studies required for URBAN WARRIOR. In particular, there is an urgent need to determine the maximum potential effectiveness of far-forward surgical capability. Triage guidelines should be developed to enable medical teams to concentrate on those for whom such heroic surgery far-forward is of maximum value and does not result in an undue logistic liability in terms of critical care support. Such guidelines could be extrapolated from the available data as soon as possible.

RUSSIAN MILITARY OPERATIONS IN CHECHNYA

The Study decided to include some mention of recent Russian military operations in Chechnya, mainly because the combat operations conducted to capture the city of Grozny appears, at first glance, to demonstrate all that can go wrong in this type of operation, including the medical consequences. There is currently a dearth of data regarding the casualty rates and wounding patterns from this conflict. The Study did, however, find some details in a short paper[17] which provide some interesting insights worthy of examination.

The Russian Army performance in Chechnya was remarkably poor. Arguably, the best performance by an Arm or Service was provided by the medical services in their care for the wounded. Three weeks prior to the Russian operation, the medical services began the training of special emergency medical units in each military district. Four of these were deployed to Chechnya in support of maneuver units.

Initial combat involved two months fighting for control of the capital city, Grozny. Consequently, Russian troops were concentrated in and around the city in combat for which their tactics training or organizations were ill-prepared. The ground forces therefore, utilized their normal treatment and evacuation system designed for conventional non-urban operations. They did, however, opt for ground evacuation as the safest and most dependable form of medical evacuation. Each maneuver company was reinforced with a physician' s assistant and each battalion had a physician plus an ambulance section. The regimental medical organization was reinforced by an advanced surgical team comprised of surgeons and support staff.

Wounded were normally evacuated to the Regimental medical facility by armored ambulance (BTR-80). Those requiring more immediate and extensive care were evacuated by air, using specially equipped medevac helicopters and fixed wing aircraft. Forward air-evac was used less than previous operations in Afghanistan, particularly after the Chechnyans shot down a number of medevac helicopters.

The paper[18] reports that combat in the city produced different sets of casualty rates and patterns than those normally experienced by the Russians. It supports this statement by quoting "Red Cross statistics for limited conflict" as usually reflecting 23% wounded by mines, 26% from bullets, 46% from shrapnel, 2% from burns and 3% from miscellaneous. In the fighting for Grozny, there was a higher incidence of burns and the majority of wounds were caused by mortar fire. (This appears to reflect the Red Cross figures of 46% shrapnel.) The majority of those killed were wounded in the head and upper body by snipers and shrapnel. It would appear that this number also includes those unprotected by helmets and ballistic vests, including

[17] LTC (Ret) Lester W. Grau and Dr William A. Jorgensen D.O. Handling the Wounded in a Counter-Guerrilla War: The Soviet/Russian Experience in Afghanistan and Chechnya. Foreign Military Studies Aug 97
[18] Ibid

civilians. The paper also notes a figure of three killed for every one wounded. . Medical evacuation was often made difficult and dangerous by snipers.

Table 18. Percentage of Wounds by Location in Various Wars [19]

Wound Site	*Great Patriotic War*	*Vietnam**	*Afghanistan*	*Chechnya*
Head & Neck	19.0	21.0	15.7	24.4
Chest	9.0	5.0	12.2	8.6
Stomach	5.0	18.0	7.1	2.3
Pelvis	-	-	3.8	1.6
Arms	30.0	20.0	26.3	27.3
Legs	37.0	36.0	34.9	35.8

*No source for Vietnam wound data was given

MEDICAL LESSONS LEARNED BY RUSSIANS

Russian military personnel emphasized the following points regarding combat in Chechnya:

- As the enemy became better armed, the proportion of shrapnel wounds to gunshot wounds increased.
- Mine injuries became a major threat
- ***Mine injuries presented multiple and complex injuries which were very difficult to manage.***
- In urban operations, evacuation particularly by helicopter was always difficult and dangerous.
- Armored ambulances were required for protection.
- Ambushes made even armored vehicle evacuation risky and slow.
- Despite the risks, air evacuation is still the preferred means of evacuation away from an operational area.
- Preparation for air medical evacuation needs to start in peacetime.
- More and better evacuation helicopters were needed during the war.
- A STOL medevac aircraft of the AN 72 type was sorely needed to operate forward, but from secure airfields out of range of direct urban combat.
- The need for a treatment capability at Echelon 2 of the traditional medical company configuration, i.e. capable of triage, resuscitation and stabilization for evacuation was questionable in the type of operations conducted around Grozny in particular.
- Evacuation in this type of operation is from Battalion Aid Stations direct to hospital by air.

[19] Ibid

- The need for "life and limb saving" surgical intervention far-forward was considered urgent enough to deploy forward surgical teams at the Regimental Medical.
- Well trained and equipped medical personnel need to be located as far-forward as possible.
- Medical resources in far-forward units and sub-units need re-enforcement
- Ground evacuation utilizing armored vehicles but not lightly armored ambulances appears the best option from far-forward combat areas.
- Burns, sniper wounds, and shrapnel wounds appeared to be the major injury patterns in Grozny.
- Medical units deployed far forward need extra physical protection and should be dug in or put in basements.

SUMMARY

LESSONS THAT EMERGE FROM PREVIOUS OPERATIONS

Key general medical lessons learned from the study of the literature and accounts of previous campaigns are:

- Urban operations require physically fit, well trained, equipped and motivated fighters.
- Personal protective equipment such as helmets, ballistic vests, flameproof clothing, and eye protection, appear to substantially mitigate casualty rates if used in urban combat.
- Combat is at close range and mainly conducted by small groups of combatants.
- Command, Control, and Communications are often very difficult to maintain in urban operations.
- Identification, location, and initial treatment of casualties is generally more difficult in urban than in non-urban operations.
- Combat units therefore need a high degree of autonomy. This includes self-sufficiency in medical support.
- Evacuation is often dangerous, slow, and delayed.
- The ability to provide skilled, initial care and to stabilize casualties far-forward is vital in urban operations.
- The means of evacuation may often be limited to heavily protected vehicles or stealth movement by foot.
- The traditional means of evacuating casualties from far-forward by helicopter will often be impossible in urban environments.
- Evacuation from safe areas away from the immediate combat zone to definitive care, will often be a lengthy journey and STOL or VSTOL aircraft are key to the mission.
- Given the dispersed nature of combat and problematic evacuation, there is a vital need for "life and limb saving" surgical capability well forward, probably at the traditional Echelon Two level.
- The key components of medical support to urban operations are the highest standards of "buddy aid" for a highly trained medic well forward with the fighting sub-units.
- None of the available contemporary literature, studies, or data sources show the impact of injured civilians or POWs on health care resource needs. This is a study area that requires detailed future attention.

The following observation can also be made regarding medical planning based on estimates of casualty numbers and types.

- There currently is no existing database of urban-specific casualty rates.

- There are a number of high quality sources worldwide that contain considerable data on casualties resulting from urban operations. However, the material is contained within comprehensive databases dealing with generic casualties in broad conflict scenarios. To date, there appears to have been no attempt to extract the relevant data for use in a specific study of urban operations.
- Although no specific database of urban rates exist, the Kuhn Study[20] has genuine application provided that it was shaped to meet the specific needs of urban operations.
- Predicted casualty rates were still the main tool used to design the shape, size and capability of operational health-care support.
- Emerging political and social attitudes regarding the acceptable levels of operational casualties were likely to impact dramatically on the planning of pragmatic casualty rates, which would, in turn, limit the shape, size, and capability of deployed health-care support.
- There is a need for a specific planning tool for the development of mission-specific operational health care support.
- As with casualty rates, there is no consolidated data source of urban–specific wounding patterns. When comparisons were made between the isolated findings in the existing literature, there appeared to be conflicting conclusions, particularly over findings on wounding patterns.
- The WDMET, held at the Borden Institute, appears to be the best source currently available, although the urban specific data requires extraction. Of the other data sources, the most valuable appear to be the U.K. database on operations in Northern Ireland and the Falklands, the Israeli database from the Lebanon War, the Russian data from Chechnya and Bosnian data.
- The campaign by the Israeli Defense Forces in Lebanon has many valuable lessons to be learned and would make an ideal addition to the WDMET data.
- The specific wound data from the Battle for Hue requires extraction from the WDMET database.
- The Russian campaign in Chechnya and specifically the battle for Grozny has much promise as a specific source of data for urban combat and should be examined further.

ESTIMATING CASUALTY RATES IN URBAN OPERATIONS

The authors suggest that it is possible to substantially improve upon the existing number and wound-specific estimates by performing a meta-analysis of urban casualties from the existing data sources. The authors further suggest that JV 2010 allow for a flexible rapid need based combat zone resourcing. An outline matrix is shown in the tables 19, 20, and 21 below.

Table 19: Casualty Estimate Profile for Offensive Urban Operations*

[20] Ground Force Battle Casualty Rate Patterns, George W.S. Kuhn, Logistic Management Institute, 1991

FORCE	CASUALTY ESTIMATE	MEDICAL SUPPORT	COMMENTS
Platoon	<1	Integral	Squad Medic
Company	<5	Integral +	ASSTEC available
Battalion	25	Integral ++	ASSTEC in support
Brigade	250	Integral +++	<10 x ASSTEC [@]

* Based on rates of 30-50 casualties per 1,000 troops per day
[@] Assumes same-day evacuation to Theater-support hospital

Table 20. Casualty Estimate Profile for Transitional Urban Operations.

FORCE	CASUALTY ESTIMATE	MEDICAL SUPPORT	COMMENTS
Platoon	<1	Integral	
Company	<5	Integral	
Battalion	<15	Integral +	ASSTEC in support
Brigade	<150	Integral +	ASSTEC in support [@]

* Based on rates of 15-30 casualties per 1,000 troops per day
[@] Assumes same-day evacuation to Theater-support hospital

Table 21. Casualty Estimate Profile for Defensive Urban Operations.

FORCE	CASUALTY ESTIMATE	MEDICAL SUPPORT	COMMENTS
Platoon	0	Integral	
Company	<2	Integral	
Battalion	<20	Integral	
Brigade	<50	Integral +	ASSTEC in support [@]

* Based on rates of l0-15 casualties per 1,000 troops per day
[@] Assumes same-day evacuation to Theater-support hospital

CRITICAL MEDICAL THRESHOLD

Given the current tactical scenarios of dispersed low-intensity warfare, there is a minimal threshold of combat health care support. Below this "critical medical mass", it is not possible to provide either the spectrum of essential general medical capability or the ability to react to a crisis, e.g. a single incident producing a significant number of casualties. The Study' s findings, therefore, take into account realistic escalation of tactical medical support, but recommend that minimal mission specific integral skill based capabilities be in place to ensure ready availability of contemporary care.

RECOMMENDATIONS

To date, no attention has been given to developing concordance between JHSS for JV 2010 and the needs of the urban combat casualty. This should be addressed as a matter of urgency by:

(1) Sequential analysis of existing urban casualty subsets in contemporary conflicts (British, Bosnian, Israeli), in order that a composite meta-analysis can provide co-efficients for casualty estimate formulae.
(2) Develop and test a trauma index to enable the accurate characterization of wounds and the comparison and calibration of wounds and wounding agents and protective gear.
(3) Develop a comprehensive and flexible operational health care doctrine for urban combat as an essential and critical contribution to JHSS for JV2010.

This work should be used to develop a capability-based and scientifically validated medical training program for the provision of far-forward health care support

Annexes:

A. Planning Model for the Development of Operational Health Care Support
B. Epidemiology of Combat Injuries and Deaths

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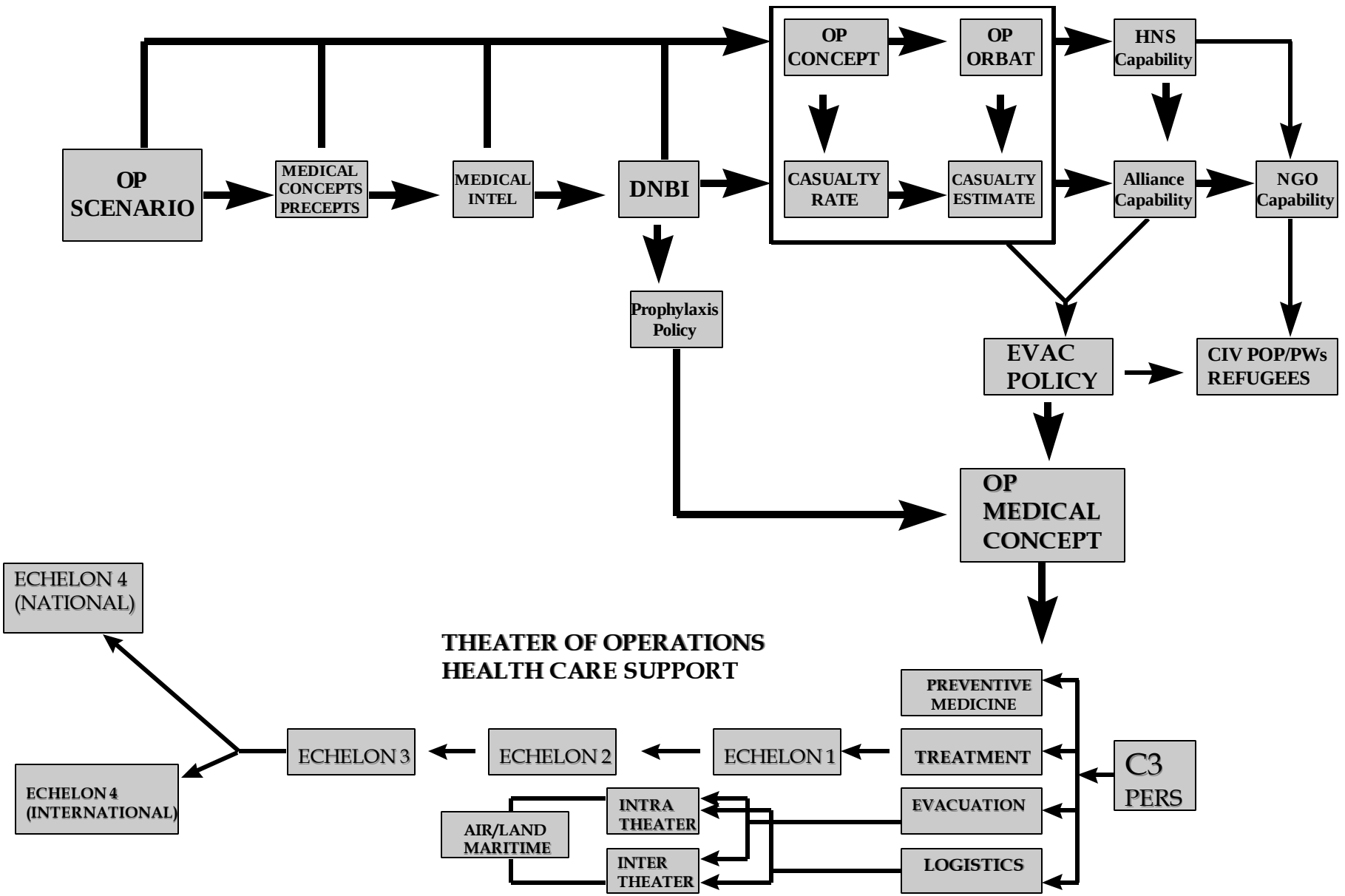
PLANNING MODEL FOR THE DEVELOPMENT OF OPERATIONAL HEALTH CARE SUPPORT



FACTORS EFFECTING OPERATIONAL HEALTH CARE APPRECIATIONS AND PLANNING

Mission	Enemy	Troops	Terrain	Time	J1	J2	J3	J4	J5	Medical	Output
Spectrum of Operations	Organization, Training, weapons Leadership, Morale, Experience, C3I, Logistics	Training, Experience, Weapons, Protective systems Size & composition of Forces ROE	Distance, Geography, Climate Weather Urbanization City layout Building constructions Roads infrastructure Elevation	Start by End by Duration Speed Tempo Day/Night	Morale National support, POWs Rules of War, UN/ICRC other International Agencies Media	General Intel Medical Intel	Concept of Operations Tactical Plan: Insertion Offensive Ops Defensive Ops Transitional Ops Surprise Speed of Action ROE Weapons available, Mobility C4I Media Political Constraints Alliance Orgs	Transport Air/Land Maritime Mobility Constraints on movement Host Nation Assistance Fuel, Food Water Resupply	Local Infrastructure NGOs Refugees Local Civilians	Endemic Disease Acclimatization Medical Trg/ Experience Treatment Capability Evac Capability Med Resup Capability	DNBI Prophylaxis Policy Casualty Rates Casualty Estimates Evacuation Policy Alliance) Health Care HNA) Capabilities/ NGO) Liabilities Medical Concept of Operations Preventive) Capability Treatment) at each Evacuation) Level Resupply) Air/Land/Maritime Evacuation Capability at each Level Inter/Intra - Theater Evacuation Capability