DND Photo IS2002-2004 by Master Corporal Brian Walsh

US Military Hospital, Landstuhl, Germany: Her Excellency Governor General Adrienne Clarkson paying a visit to Master Corporal Curtis Hollister and Corporal Brian Decaire, two of the eight members of 3 PPCLI wounded in the 'friendly fire' incident in Afghanistan in April 2002.

PROGNOSIS 2020: A MILITARY MEDICAL STRATEGY FOR THE CANADIAN FORCES

by Colonel David Salisbury and Dr. Allan English

The next twenty years will see major changes in military operational doctrine and tactics, some of which have already been foreshadowed in the ongoing "war on terror."[1] To address these changes, the Canadian Forces' (CF) blueprint for the future, *Strategy 2020*, tells us that the CF intends "to position the force structure of the CF to provide Canada with modern, task-tailored, and globally deployable combat-capable forces that can respond quickly to crises at home and abroad, in joint or combined operations." These goals will have profound effects on the provision of military health support to the CF. The changing nature of the battlefield will not only change the type and number of casualties, it will also change their dispersion on the battlefield. Traditional methods of providing medical support on the battlefield will no longer be the most efficient and effective way of providing trauma care. Therefore, to realize the vision of *Strategy 2020* a strategy for dealing with the medical issues of sustaining troops on the battlefield of the future must be formulated.

The purpose of this paper is to examine the issues that will affect the formulation of a military medical strategy by looking at future trends in military operations and other factors that will affect the CF Health Services. Factors such as the trends in civilian health care that will affect military medicine, changes in military operations brought about by the Revolution in Military Affairs (RMA) and technological changes in providing health care will be examined for their implications for the CF Health Services of 2020. The paper concludes that in the future the current concentration of effort and tiered support may not be the most effective means of providing timely care for CF personnel. Advancements in medical care will not only provide a more robust response to battlefield casualties, but they will also pose ethical and legal challenges to military medicine. The CF's senior leadership will need to understand these issues so that they can develop optimal logistical support plans for the CF of 2020.

In the past, casualties from disease more often decided the outcome of campaigns than operational art. It is only within the last 100 years that military medicine has significantly reduced the number of deaths and injury among military forces. In the First World War, the Canadian Expeditionary Force suffered the following fatal casualties: 39,488 killed in action and 12,048 died of wounds. But it was a "medical miracle" that 154,361 survived their wounds and that four out of

Colonel David Salisbury, MD, *is the Commanding Officer of the Canadian Forces Environmental Medicine Establishment and Deputy Director General of DRDC Toronto. The original draft of this paper was submitted as part of the academic requirement for the National Security Studies Course at the Canadian Forces College.* Dr. Allan English *teaches at the Canadian Forces College and Queen's University and he is a Senior Research Fellow at the Canadian Forces Leadership Institute.*

five soldiers returned to active service. The miracle was that in the First World War, for the first time in a major war, death by enemy action took a heavier toll than disease.[2] Yet the threat of defeat by disease has been a constant companion to modern commanders. For example, it could be argued that Rommel, often considered to be the master of the operational art, defeated himself in North Africa by his inattention to the health of his forces. For every German soldier lost to battle injury in that theatre of operations, three were lost to disease (a return to pre-First World War loss rates). Overall, Rommel lost to disease, temporarily or permanently, a force equal to twice his average strength, and German soldiers were almost three times as likely to become ineffective for health reasons as their British opponents. Rommel himself was evacuated twice to Germany because of hepatitis. On the other hand, General Sir William Slim understood that the health of troops was a commander's responsibility. When he took over Fourteenth Army in Burma in late 1943, the malaria rate was 84 percent per annum of the total strength of the Army. Slim aggressively tackled medical discipline. He believed that more than half the battle against disease was fought by regimental officers not doctors, and he fired regimental officers who did not ensure that malaria prophylaxis measures were taken. As a result of Slim's actions, his Army's disease attrition rate dropped from 360 men per 1,000 per month in 1943, to 30 men per 1,000 per month in 1945.[3] More recently, during the Soviet-Afghan War, the Soviet 40th Army paid a price for its poor hygiene practices. Of the 620,000 Soviet troops who served in Afghanistan, 67 percent required hospitalization for a serious illness. At one point, between October and December 1981, the entire 5th Motorized Rifle Division was combat ineffective when more than 3,000 of its men were simultaneously stricken with hepatitis.[4] The recent experience of coalition forces on operations in Afghanistan confirms that these health issues are still vital to maintaining force effectiveness. The loss of a significant cadre of men in the UK International Stabilization Force Afghanistan (ISAF) contingent due to a common viral illness demonstrates that even a well prepared and well immunized army can still be done in by the bugs!

DND Photo ISD01-9708 by Master Corporal Brian Walsh

Arabian Sea: Lieutenant-Commander Heather MacKinnon, medical officer aboard HMCS *Halifax*, working on a simulated casualty during a battle-problem exercise.

The CF Health Services is charged with the responsibility of maintaining the health of Canada's military on operations. It has been referred to as Canada's 14th Health Care System, employing close to 4,500 Regular and Reserve Force personnel as well as over 600 civilians, with an annual expenditure of close to $200 million.[5] It is currently undergoing major reform in response to a number of reports and studies that found deficiencies in the care provided to CF members.[6] Although many of these reforms have focused on a future force structure, the predominant focus has been on fixing current and past deficiencies. The notable exception has been the work of the Standing Committee on Operational Medicine Review (SCOMR) that has looked at what the future CF Health Services should do.[7] SCOMR has also tried to identify current capability and technology gaps, and it has suggested a way ahead at the tactical and operational level. However, the CF still has not articulated a comprehensive military medical strategy.

One of the first questions one might ask in formulating such a strategy is why have a military health system at all? A substantial military medical capability sends four important messages to Canadians. First, it tells the people of this country that their leaders have prepared appropriate means to care for their sons and daughters sent in harm's way. Second, it tells the world that the force is a credible and sustainable fighting force. Third, it tells commanders that they will be supported and sustained. Finally, and perhaps most importantly, it tells the troops that we as a nation care about them. For "in the absence of medical readiness we can have no assurance that our troops, the flesh-and-blood elements of our weapon systems, will retain the will to fight, which is the crucial factor in the equation for victory."[8]

While the foregoing argues that adequate medical care must be provided for all military organizations, it does not present a cogent argument that the care be provided by a military

health care system. To do that one must ask if there any unique characteristics to military medicine that makes it different than civilian medicine practised for military members? A leading American commentator, Captain Arthur Smith, USN, contends that there are unique aspects to the practice of military medicine that can be illustrated with two examples. First, the treatment of wounds on the battlefield must be different than the treatment of similar types of wounds found in civilian care. If battlefield wounds are immediately closed, there is a substantial risk of gas gangrene. This is quite different from civilian care where primary closure is the standard procedure. Second, in civilian health care, the assignment of resources is usually done on the basis of greatest individual need because, except in the most exceptional cases, all patients will receive adequate care eventually. In military medicine and some civilian mass casualty situations, the neediest patients must at times be sacrificed in order to save the maximum number of wounded. As US Navy Captain A.M. Smith, professor of Emergency Medicine at the Uniformed Forces University School of Medicine, says: "to do more than is necessary to stabilize patients and preserve life and limb (if the latter is even possible in the rush of large numbers of casualties) might well effect the lives of many other subsequent patients."[9]

Therefore most nations accept that a military medical heath care system is a necessity.[10] However, some of the models of military health care projected by other countries are inappropriate for Canada. In the case of the United States, the size, magnitude and responsibilities of its medical health care system are quite different from ours. The CF Health Services, unlike their American counterparts, are only responsible for care to uniformed personnel. While Canada can, therefore, concentrate its military medical resources on purely military medical needs, the CF still depends on the Canadian civilian health care system to provide for other needs, such as some aspects of in-garrison primary care, specialist support and the reception of casualties from overseas operations. Thus the state of civilian health care in Canada will have a major impact on the full provision of health care to the CF.

CIVILIAN HEALTH CARE TRENDS

The civilian health care system in Canada is widely considered to be in crisis. The Government of Canada established a Royal Commission on the future of health care, popularly known as the Romanow Commission. This Commission looked at this crisis, developed a dialogue with Canadians on their health care system and made recommendations to the federal government on a way ahead. The Commission also addressed Canadian values and how they are and should be reflected in the *Canada Health Act*. Its recommendations have a major focus on sustainability, funding, maintenance of quality, and access to health care as well as issues of leadership, collaboration, and responsibility in the Canadian health care system.[11] All of these issues will be of intense interest and import to the CF health care system as changes in any of these dimensions will shape the milieu in which military medicine in Canada operates.

Of the many challenges facing health care in Canada, perhaps the most serious are funding, demographics (the aging population) and the shortage of health care personnel. Furthermore, like the United States, there are rising expectations of what health care can and should do for people. Technological changes in informatics, diagnostic imaging and the ongoing biotechnology revolution are profoundly changing the nature of health care delivery and driving up costs.

The CF Health Services have not been immune to these challenges, and they, along with others, have been raised in a number of government reports.[12] The CF has also embarked on a major project called Rx2000 to reform the CF Health Services.[13] This paper will not address Rx2000 directly as its reforms are in response to current and past conditions. Nevertheless, these reforms will shape the ability of the CF Health Services to respond to future operational changes and demands, and they must be implemented with an eye to the future. A future in which the needs for military health care will be quite different from today.

Any debate on health care in Canada, including one on military health care, must address the five principles of Medicare enunciated in the *Canada Health Act*: the need for *Public Administration*, *Comprehensiveness* of care, *Universality* of coverage, *Portability* of coverage and *Accessibility* to necessary physician and hospital services.[14]

The *Canada Health Act* specifically excludes CF members from coverage under the various provincial Medicare plans. However CF members, quite rightly, expect that they will receive the same care and entitlements that all other Canadians receive. Military health care is of course publicly administered, and issues of comprehensiveness are addressed in the spectrum of care offered to CF members that is comparable to provincial plans.[15] Universality is provided to all Regular Force members but is at times problematic for members of the Reserve Force who are only covered by the CF medical system while on certain classes of service. Portability is generally not a problem in Canada for military care although accessibility often is problematic. While the provision of all these services in Canada is no less a challenge to the military health care system than to the civilian health care system, providing the same level and spectrum of care in the many and varied places the CF is deployed around the world is a daunting task. Like the United States, health care in Canada is shifting from an emphasis on hospital based 'sick' care to a primary care, prevention-based model with an increasing emphasis on patient (or client) responsibility.[16] This shift in emphasis will profoundly affect military medicine. There is, however, a potential danger that these wider societal changes and the necessary focus of military health care practitioners on meeting civilian norms will erode important military medicine concepts that will result in "the practice of medicine in the military rather than military medicine."[17] For example, civilian care is patient-centric while of necessity, especially in times of war, military medicine must focus on what is the best for the most.

"In military medicine and some civilian mass casualty situations, the neediest patients must at times be sacrificed in order to save the maximum number of wounded."

DND Photo ISD01-0072a by Master Corporal Danielle Bernier

Senafe, Eritrea: Medical Assistant Leading Seaman Richard Ford taking an NCO's blood pressure.

Perhaps no single change in civilian health care is more important than the changes in the professions that provide care. The two largest regulated professions, nurses and physicians, are re-defining their roles in the system. Nurses are taking on primary care roles previously the sole domain of the doctors and para-professionals are playing increasing roles in the delivery of care. Physicians, on the other hand, are tending towards more specialization and there is a shortage of family physicians in Canada.[18] The CF is currently experiencing an extreme shortage of medical officers. While this may be ameliorated by current initiatives, the long term picture for physician availability in Canada points to continuing challenges in this area. Innovative use of the Reserves, civilian health care providers in-garrison, and physician extenders such as nurse practitioners and independent duty medics will help. In the long term, though, it appears that the mix of providers will have to change. Due to operational necessity, the CF Health Services may have to lead this change, rather than follow civilian practice.

Writing in *Parameters*, S. Beaty has emphasized the need for and future of "brilliant medics" on the modern battlefield. He points out that the dispersal of combatants, the scarcity of physicians and surgeons, and the need for rapid stabilization and transport of casualties will necessitate a fundamental change in the way care is delivered on the battlefield of the future.[19] The increasing use of Special Forces, where the protections of the Geneva Conventions for medical personnel may be ambiguous or irrelevant,[20] will probably dictate the development of the combat medic within the CF. That is, a combatant with sufficient medical training to assist and stabilize fellow combatants on the battlefield. This medic will need to have skills in airway management, haemorrhage control, and the establishment of intravenous infusions that will be applied until the casualty can be evacuated to a medical facility. Such a person will need to be able to fight as a primary role and only provide care as a secondary role. This will be an expanded capability well beyond the current first aid and buddy-care model. Innovations in communications, individual monitoring capability and telemedicine will extend the reach of medical personnel and provide more expert and rapid care to the point of wounding to assist the combat medic. But any initiative to develop combat medics will face the same difficulties in licensing and training that the CF encountered with Search and Rescue Technicians (SAR Techs). However, the success the CF has enjoyed with the training and certification of SAR Techs demonstrates that such a concept is feasible.[21]

Nevertheless, preparing military medical personnel for the battlefield will continue to be a challenge. A number of authors have emphasized how even the provision of civilian trauma care does not prepare one for the provision of battlefield care.[22] Furthermore, the difficulty in training CF surgeons is even more acute than that of their American confreres as the incidence of gunshot wounds and other penetrating trauma is so much less in Canada than in the United States.

The speed of modern combat and the rapidity with which operations will come to an end will not allow enough time for the past methods of learning of the lessons of combat surgery, in the first few days of combat, on the job. This means that surgeons must be trained in peacetime, but as we have seen, the procedures they must master are not appropriate to civilian peacetime trauma medicine.

MILITARY OPERATIONAL TRENDS

In order for the leaders of a military medicine system to devise a strategy for the future, the operational activities and strategic goals of the force as a whole must be understood. *Strategy 2020* and other documents provide some guidance to them, but the strategic visions enunciated in both *Strategy 2020* and the newly released *Army Strategy*[23] have profound implications for the military medical support of the CF. In particular, the move to lighter weight forces that are globally deployable, the "early in, early out" concept, and the increasing use of Special Forces with their unique support demands will require innovative and technologically sophisticated medical support solutions.[24]

The RMA has already affected thinking about the future CF, as some believe it will produce "lighter" forces using modern information systems and precision weapons to act rapidly and decisively on the high tech battlefield.[25] While sophisticated technology may enable fewer personnel to be used to achieve the same combat effect, high tech solutions are not necessarily cheaper. A reduced number of very skilled personnel operating these systems means fewer personnel are "at risk" for injury. However, the loss of even one person may have a

"The leadership of the CF must be aware of the risks of going 'light' on health support."

serious impact on mission outcomes. Therefore, commanders need to be wary of how light the medical support footprint can become, as the RMA may increase the need for highly efficient and effective personnel support functions such as health care. As US Navy Captain Smith warns: "To meet the modern mandate for compactness and simplicity in manoeuvre units, unrealistic medical support expectations have been attached to a warfighting strategy that allows for only minimal medical support function ashore."[26] This is a significant issue for the CF given recent cutbacks and downsizing.

Given the CF's lack of dedicated tactical medical airlift and Canada's overall shortage of strategic airlift, the CF could be entirely dependent on its coalition partners (especially the United States) for acceptable military medical care to deployed forces. This reality would dictate a need for not just interoperability but for commonality in equipment, doctrine and information systems so that CF patients could fit seamlessly into the American health support system. Fortunately, North American health care training standards and practices would make this conceptually easy to achieve; however, lack of independent stand-alone capability would limit the options for employment of the CF without coincident American deployment. But even if coalition partners are prepared to provide necessary medical support to the CF, the more important question is whether Canada is prepared to risk the welfare of its sons and daughters, "placed in harm's way," to the medical coverage and support supplied by another nation.

In the past this has aroused great passions in this country. During the First World War the provision of what was perceived to be inadequate medical care by British Volunteer Aid Detachments and during the Second World War the treatment of cases of "flying stress" and "lack of morale fibre" in Canadian aircrew by the British military caused such a furore that the Canadian government was forced to intervene.[27] It is ironic that the same governments that had denied adequate resources to the Canadian military to deal with these issues, then demanded immediate solutions in response to the public's insistence that something be done.

The question of the treatment of Canadian military personnel by other nations is exacerbated by the fact that military health systems around the world are experiencing problems with recruiting and re-designing their concept of operations to meet the modern battlefield need.[28] Canada cannot assume that our allies will always provide for us, and the leadership of the CF must be aware of the risks of going "light" on

LFAA Public Affairs Photo LH2002-012-092 by Private Lori Ganeau

CFB Gagetown: Militia Medical Assistants preparing a member of the Prince Edward Island Regiment for a simulated casualty evacuation during the Area Reserve Concentration in August 2002.

health support. Our allies may provide some portions of deployed military health care, but we cannot assume that this will be sufficient. Also, past experience has shown that CF members have unique medical requirements that only a CF military medical system with Canadian practitioners can meet. Moreover, from a moral point of view, we have an obligation to provide care to our own. The question then becomes, for whom will we be providing care?

FUTURE MILITARY HEALTH CLIENTS

There are indications that the Canadian population is changing. It is therefore reasonable to assume that CF recruits of the future will have some different social and psychological characteristics from their predecessors. Several American researchers have postulated that future warfighters will "come from homes where changes in social values and lifestyles have made them physically and psychologically 'softer' than their forefathers."[29] Demographic projections for Canada indicate that the CF will be drawing its members from a somewhat smaller population base coming from several distinct 'tribes' with attitudes and experiences that will shape both their health care needs and their response to health challenges such as injury and the psychological effects of operations. Imagine the effect of a permanent disability, such as a limb loss, on a soldier with a high need for autonomy and control of his (or her) destiny, what Michael Adams, author of *Sex in the Snow*, calls the "Autonomous Post-Materialists."[30] In addition to the expected anger and shock such an injury inflicts on any patient, this cohort of young Canadians has attitudes that will heighten that response. Canadian military health care will need to prepare itself to deal with these attitudes, the divergent attitudes of the other 'tribes', and the consequent psychological and psychiatric challenges their involvement in combat operations will bring.

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Another change in attitudes from the past is that our society has come to expect military success at the smallest possible cost. The low mortality figures in the Gulf War (148 for the United States, 0 for Canada) have engendered both an expectation of and a low tolerance for combat deaths.[31] Failure to provide adequate health services to achieve this end would not be tolerated by the Canadian public. The response of Canadians to the recent combat casualties in Afghanistan demonstrated a degree of acceptance by the Canadian public of "the cost of doing business" but it is uncertain what limits there are to such forbearance. It is clear from the Croatia Board of Inquiry and the continuing public concern with Gulf War-related illnesses, that at certain times in the past Canadians have had little tolerance for a health system that does not respond promptly and adequately to the health concerns of CF members. To address these issues the CF Health Services and the US Military Health Services have learned similar lessons, albeit in slightly different ways, about what has now come to be known as Force Health Protection (FHP) and what is expected of modern military medical support. In summary those lessons are:

- **Improved Communication.** There is a need for clear communication of risk about both combat, infectious, and environmental health hazards and treatments such as immunizations and disease prophylaxis. The need has been shown by such diverse issues as anthrax immunization and malaria prophylaxis with mefloquine. This communication strategy must not only inform the potential patients but the wider community as well.

- **Health Surveillance:** There is a clear opportunity in the information age to improve the epidemiological knowledge of both the rates of diseases and the potential cause factors.

- **Health Records:** Linked with lesson number two is the need for improved medical record keeping and operational exposure data. The hope (as yet unrealized by any system) is that the computerized medical record will achieve the needed comprehensiveness, timeliness and accessibility.

- **Biomedical Research.** The need for military healthcare research above and beyond civilian healthcare research base is clear. From improved counter-measures to the Chemical Biological, Nuclear Radiological (CBNR) threat to improved combat casualty care with the products of the ongoing biotechnology revolution, research for specific military medical issues is imperative.

- **Interagency Coordination.** The coordination of care between the Regular Force, the civilian health care system, and Veterans Affairs Canada (VAC) has never been more important. Disease and injury effects do not end with the end of deployment or even a service career. The need for a seamless transition to non-military caregivers is clear.[32]

These lessons have been incorporated into existing and planned changes to the CF Health Services,[33] but the trends these lessons represent in the need for client focus and information management will intensify with the increasing education level of CF members and the increasing availability of health information on the internet. The day of the all-knowing health practitioner doling out unquestioned wisdom is gone.

FUTURE CASUALTY TRENDS

Both the RMA and what has become known as Operations Other than War (OOTW) will have major effects on casualty rates, and this will pose challenges to existing military medical planning procedures and doctrine. For years NATO has used SHAPE planning figures to estimate casualty rates and hence the need for military medical health support. The SHAPE figures were based on a large conventional conflict in Central Europe, but as the Balkan Peacekeeping Mission and the

DND Photo HS03258d09 by Corporal M.D. Selig

Gulf of Oman: A civilian seaman suffering from burns is loaded aboard HMCS *Fredericton's* Sea King for transfer to the nearest hospital ashore, May 2003.

Gulf War have shown these planning figures are inadequate to the task of predicting health care needs in modern military operations. Overestimation of need unnecessarily increases the logistics load and may lead planners to forego certain force package options. Underestimation puts deployed forces at undue risk. The IFOR mission afforded the opportunity to compare SHAPE planning figures to actual data (from the EPINATO database[34]) based on the experience of the Multi-National Division Southwest (MND(SW)) deployed to the Former Yugoslavia, January to September 1998. In summary, disease occurrence was approximately 70 percent of the planning figures, and the non-battle injury rate was five times the projected rate.[35]

The key issue here is that the type of casualty seen and the diseases suffered were completely different than what was initially planned for.[36] Modern peacekeeping and peacemaking operations produce a need for medical care that is different in both scope and magnitude from traditional war fighting. Unless these needs are accurately predicted and planned for an unnecessary logistic load on the overall operation and the possibility of deploying inappropriate medical care specialty mixes may result. In an excellent review of recent military operations and the resulting casualty experience, S.F. Gouge of the US Army War College has analyzed the casualty experience of several recent military operations.

In Afghanistan, Soviet Forces demonstrated once again the value of rapid evacuation to definitive surgical care. This created a need for more intensive-care beds in-theatre. They also demonstrated the value of moving surgical teams closer to the fighting, a strategy that reduced the "died of wounds" (DOW) rate from 4.3 to 2 percent.[37] Yet, as we have seen, without appropriate preventive medicine practices, medical resources could be overwhelmed by disease casualties.[38]

In the Falklands War, the United Kingdom lacked air superiority and this impeded helicopter casualty evacuation. The planning models for this war used Second World War data and woefully underestimated the number of burn casualties that would be encountered in a seaborne assault force, particularly if ships came under attack. Yet, Forward Surgical Teams were used to great effect and again demonstrated that quick surgical care saves lives.[39]

The medical plan for the American Panama mission involved an immediate evacuation policy (zero days of holding in-theatre). Casualties were treated by Forward Surgical Teams in Panama, and then they were promptly air evacuated to San Antonio, Texas. Although a six-hour flight, only two of 258 evacuees died en route and evacuation was not judged to be a contributory factor to their deaths.[40]

"From a moral point of view, we have an obligation to provide care to our own."

The Gulf War campaign was clearly affected by Combat Medical Support considerations. Major ground operations were delayed until sufficient medical resources were in place and the enormous casualty estimates (as high as 40,000) resulted in two hospital ships, 63 hospitals and 18,000 beds being deployed in-theatre. Despite all the preparations, medical vehicles were unable to keep up with the armoured advance, and the doctrinally imposed tiered evacuation system proved to be inefficient and essentially was ignored. The US Army Medical Department (AMEDD) was challenged by the vast distances involved, the speed of the attack, the number of enemy prisoners of war and refugees. It was concluded that Forward Surgical Teams, Combat Stress Control teams and combat lifesavers were beneficial. The 60-bed MASH, however, proved too large and too slow for its doctrinal role.[41]

The American experience in Somalia was quite different from the Canadian experience. The disastrous Army Ranger raid into Mogadishu demonstrated the enormous difficulties in handling casualties in an urban warfare setting. It also showed the need for the USAF to develop the Critical Care Augmentation Team (CCAT) which deals with stabilized (more critical) as opposed to the more traditional stable patient in an air evacuation.[42]

The American experience in Bosnia mirrors the Canadian experience. In such a theatre, combat injuries are too infrequent to improve or even maintain the experience level of deployed surgeons. Telemedicine proved useful only for transmitting x-rays to be read by a radiologist, as none were deployed in-theatre.[43]

In summary, it appears that future conflict will produce highly variable casualty rates and morbidity patterns. This will make the planning of adequate medical support for operations extremely difficult. There is no evident casualty pattern that can be discerned from recent experience or historical records. Nevertheless, it is clear that rapid surgical treatment of wounded combatants as close as possible to the point of wounding saves lives. Air evacuation of severely wounded personnel prior to definitive treatment can be carried out with the provision of adequate onboard equipment and expertise, thus limiting the need for extensive in-theatre bed space and a large medical logistic footprint.[44]

The lessons of the continuing need for preventive medicine will undoubtedly be learned and re-learned, as the changing nature of combat will not fundamentally change the biology of infectious disease risk to deployed forces. The use of biological warfare by some combatants would change the nature of the risk but not the biology. The challenge of providing medical care to military personnel in difficult-to-predict scenarios may seem insurmountable, but new technology may provide some answers.

EFFECTS OF NEW TECHNOLOGY ON BATTLEFIELD MEDICINE

The effects of the information revolution on health care will continue as health care personnel at all levels will have increased access to the medical literature and to patient-specific information. Health planners will be able to have a better picture of what is going on in operations and of what demands will be made on the military health care system. Furthermore, telemedicine will extend health care expertise further out onto the battlefield.

Advances in the control of bleeding, advances in resuscitation fluids and artificial blood will change the dynamic of trauma care, enabling first responders to do more and allowing more severely wounded patients to be stabilized for transport. Miniaturized medical equipment, individualized monitors, and communication technologies will increase the efficiency and effectiveness of triage. New, single-dose multivalent vaccines,[45] genomic-based[46] therapeutics, and new antibiotics will provide more and better response to traditional battlefield infectious diseases and the CBRN threat. Improved diagnostics that will allow for rapid identification of chemical and biological threats will facilitate treatment and prophylaxis.

"Future conflict will produce highly variable casualty rates and morbidity patterns. This will make the planning of adequate medical support for operations extremely difficult."

Genomics will provide the health care system with an increased ability to screen for disease and the propensity for disease. However, without concomitant treatment capabilities this may pose ethical and legal challenges to military medicine. For example, if we know a potential recruit is susceptible to certain diseases, which she or he will only be exposed to under certain very specific combat conditions, can we deny him or her entry to the CF? If we allow that person to enrol are we ethically obliged to prevent him or her from being exposed to such combat conditions? Since all immunization schemes pose some risk to the recipients, what are the ethics of immunizing for a disease threat that will only occur if others choose to violate accepted norms of war? How are these risks balanced against needs of the organization to maintain combat capability and the often unpredictable risk of exposure to the causative agent? Anthrax is the current best example of this problem, but smallpox and other diseases loom on the horizon.

IMPLICATIONS FOR THE CF HEALTH SERVICES

Future trends in military operations, civilian health care, the RMA and technological changes in providing health care will have profound effects on the provision of health services to the CF. The implications for the CF care system will be summarized here.

Health care provider shortages in Canada will continue, and the CF will need to use the civilian health care system for both primary care and specialist support in-garrison and to receive casualties sent home from operations. The mix of providers within the CF will change as medics and nurses will assume roles traditionally done only by physicians.

On the battlefield, non-traditional providers such as combat medics, who can provide immediate life sustaining care to fellow combatants, will play an increasing role. The linear evacuation of casualties will evolve to a 'hub and spoke' model, i.e., intense initial stabilization will occur very close to the point of wounding. The combat medic will accomplish this with some of the new casualty treatment technologies that are 'on the horizon'. Alternatively, rapidly deployed medical teams with "brilliant capabilities"[47] will fly to the casualty who will then be directly evacuated to definitive surgical care. This will bring into question the existence and role of the Field Ambulance, as it currently exists. Small forward surgical teams with only one operating table and no patient holding capacity will be necessary to effect timely care. Casualty evacuation by vertical lift (helicopters or tilt-rotor aircraft) will become increasingly important to provide timely and effective care on the dispersed battlefield of tomorrow. Mass casualties are unlikely, and thus the deployment of the entire field hospital as it currently exists is unlikely, and modules of the field hospital similar to the current Advanced Surgical Centres (ASCs) will become the norm.

The nature and intensity of peacetime and peacekeeping operations argues for the use of the Reserves to furnish the maximum possible number of medical specialists (surgeons, anaesthetists, etc.) for the CF. Current casualty rates and in-garrison patient demand are insufficient to maintain clinical competence in the Regular Force without almost continuous exposure to a pool of civilian patients. However, the current limitations on the employment of Reserves under the *National Defence Act*, which in effect precludes compulsory call-out, make this a risky if not impossible policy to follow for Canada.

Biotechnology advances will allow the CF Health Services to screen for many more diseases and disease potentials, and advances in information technology holds the promise of better population surveillance and ultimately better care. While this potentially will ensure a fitter and healthier force, there are problems with the application of these technologies. These advances will pose legal, moral and ethical challenges in determining member fitness to serve.

Modern technology offers some hope for diminishing the traditional infectious disease scourges of the battlefield, but history and recent Canadian experience shows that we must be constantly vigilant to the threat of disease. Commanders will need to plan for optimum casualty management that emphasizes speed of treatment and rapid evacuation over the ability to handle masses of casualties in a linear tiered fashion. To ensure optimum casualty management the CF will need to develop even closer links with its primary health care partner – the United States.

Finally, while it might be tempting to go extremely light on CF medical support and plan for it to be provided by our allies, this is a risky and immoral stance to take. If Canada wishes to put its military personnel in harm's way, then it must be prepared to sustain them medically with appropriate Canadian military health care support. To achieve this goal, health care providers must continue to engage those involved in operations in a dialogue on the need for and the limitations of health care in maintaining operational capability. But, if we accept that "Military Healthcare is too important to be left to military healthcare professionals,"[48] then the senior leadership of DND must understand these issues if they are to ensure that CF personnel receive the kind of care Canadians demand both now and in the future.

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NOTES

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12. See for example R.G. Mclellan, *The Care of Injured Personnel and their Families Review* (Ottawa: DND, 1997); Thomas, L., *The Thomas Report* (Ottawa: DND, 2000); Standing Committee on National Defence and Veterans Affairs (SCONDVA), *Moving Forward: A Strategic Plan for Quality of Life Improvements in the Canadian Forces* (Ottawa,1998); and DND, *Final Report Croatia Board of Inquiry*, (Ottawa: DND, 2000) <http://www.forces.ca/hr/boi/engraph/about_boi_e.asp>.
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15. The Spectrum of Care for the Canadian Forces is generally based on the coverage of the Public Service Health Plan. The intent is to provide to CF members a comparable spectrum of care to what a majority of Canadians would be provided in their home provinces. There is no universal coverage plan in Canada.
16. R.A. Leitch, H.R. Champion and J.F. Navein, "The Future of U.S. Military Health Services in a Time of Great Change," in *Landpower Essay Series* (Arlington, VA: Institute of Land Warfare, 1998), pp. 1-8.
17. A.M. Smith, "Military Medicine: Not the Same as Practising Medicine in the Military," *Armed Forces and Society* 18, No. 4 (Summer 1992), p. 585.

18. Canadian Institute of Health Information (CIHI), *Health Care in Canada 2002* (Ottawa: CIHI, Statistics Canada, 2002), p. 123.
19. S. Beaty, "The Revolution in Military Medical Affairs," *Parameters* 27, No. 4 (Winter 1997-8), pp. 60-72.
20. J.J Dougherty, "Operational Medical Support for the Tip of the Spear: The Heart of Air Force Special Operations Forces (AFSOF) Medicine," *Aerospace Power Journal* 15, No. 4 (Winter 2001), pp. 27-33.
21. Canadian Forces Search and Rescue (SAR) Technicians are trained in multiple skills including parachuting, survival, mountain climbing and SCUBA diving. For the last several years they have been trained in paramedic procedures at the Justice Institute in British Columbia where they receive similar training to advanced paramedics in the Ambulance Service of British Columbia.
22. See for example Smith, "Military Medicine," pp. 576-91; Leitch, "The Future of U.S. Military Health Services in a Time of Great Change," pp. 1-8; and Cecchine et al., *Army Medical Strategy*.
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25. See for example Leitch, "The Future of U.S. Military Health Services in a Time of Great Change"; and J.R. Blaker, *Understanding the Revolution in Military Affairs: A Guide to America's 21st Century Defense* (Washington, DC: Progressive Policy Institute,1997).
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29. Leitch, "The Future of U.S. Military Health Services in a Time of Great Change," pp. 1-8.
30. Michael Adams, *Sex in the Snow: Canadian Social Values at the End of the Millennium* (Toronto: Penguin Books 1998), pp. 42-57.
31. M.W. Alvis, "Understanding the Role of Casualties in U.S. Peace Operations," in *Landpower Essay Series* (Arlington, VA : Institute of Land Warfare,1998), pp. 1-16.
32. J.F. Mazzuchi, et al., "Force Health Protection: 10 Years of Lessons Learned by the Department of Defense," *Military Medicine* 167, No. 3 (March 2002), pp. 179-185.
33. DND, *Project Rx2000*; and DND, *Standing Committee on Operational Medicine Review, Phase One Final Report*.
34. EPINATO is a medical database system now widely in use in the alliance to collect near real time disease and injury data on deployed forces in a particular geographic area.
35. P.I. Raffaelli, "Medical Implications of Recent Strategic Political and Military Changes," *Journal of the Royal Naval Medical Service* 85, No. 1 (Spring 1999) pp. 25-30.
36. Personal Observation. Colonel Salisbury was Deputy Force Surgeon for IFOR June to December 1996.
37. S.F. Gouge, *Combat Health Support of the Transformation Force in 2015* (Carlisle Barracks, PA: US Army War College, 2001). Statistics from p. 11.
38. Grau and Jorgensen, "Beaten by the Bugs," pp. 30-37.
39. Gouge, *Combat Health Support of the Transformation Force in 2015*, p. 11.
40. *Ibid.* p. 12.
41. *Ibid.* p. 13.
42. *Ibid.* p. 14; and P.K. Carlton, "New Millennium, New Mind-Set: The Air Force Medical Services in the Air Expeditionary Era," *Aerospace Power Journal* 15, No. 4 (Winter 2001), pp. 8-13.
43. Gouge, *Combat Health Support*, p. 15.
44. Carlton, "New Millennium, New Mind-Set," pp. 8-13.
45. Vaccines against multiple infectious agents. For example, the current first vaccine in Canada for children is a pentavalent vaccine against Diphtheria, Pertussis, Tetanus, Polio and H. influenza.
46. Genomics or the study of human genetics will eventually enable therapies to be specifically tailored to the genetic makeup of the individual patient. Current therapies are based on what medical science judges is best for the majority or the average patient.
47. Beaty, "The Revolution in Military Medical Affairs," pp. 60-72.
48. Leitch, "The Future of U.S. Military Health Services in a Time of Great Change," pp. 1-8.

JSPA Combat Camera photo IS2003-2552a by Sergant Frank Hudec

Newly-arrived soldiers with the Canadian International Security Assistance Force (ISAF) in Kabul, Afghanistan.