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REVIEW ARTICLE

Evidence based medicine: lessons learned from the NATO Military Medical Center of Excellence

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Abstract: *Evidenced-based medicine drives best practices. The Lessons Learned (LL) process in clinical medicine for deployed and military support services drive the NATO Military Medical Center of Excellence (MILMED COE). This review article focuses on the Lessons Learned process and its use in NATO and partner countries medical services. Organizational learning drives development and progress; capturing lessons from mistakes, colleagues' interactions and institutional experience can be lost without an organized lesson learned process. Therefore, in 2014, NATO institutions and Centers of Excellence across disciplines began to focus on the quality management, information sharing and evidence-based practices to maximize outcomes. Since this inception, NATO has implemented the Lessons Learned process and expanded the impact across the alliance in order to save life and prevent illness. The Lessons Learned process and sharing of experience is also a way to improve the quality of care in the military medicine, from preventive, epidemiological, trauma related, casualty evacuation and forward surgical care, among many others, to the medical standardization and organization of military medical services. The Lessons Learned process is an undertaking and an instrument that can also be used to achieve better international and civil-military cooperation. Finally, we deal with the current situation and use of the information obtained from the areas of military health care.*

Keywords: *evidenced-based medicine, knowledge management, lessons learned, Military Medical Service, NATO*

INTRODUCTION – APPLICATION OF THEORY OF LEARNING

Each scientific discipline must be driven by data. One of the areas from which information can be drawn is Lessons Learned, through analysis and a constant cycle of learning and sharing data. This is most applicable in the military medicine and across the healthcare sector, where shared information can be used from various areas, rooted in preventive medicine, epidemiology, traumatology, and others adding to military medicine and healthcare organization and administration.

Institutions that promote health act as microcosms of organism that can evolve through adaptation. As Charles Darwin posited, it's not the strongest survivor, not even the most intelligent, but the one who can best adapt. Every living organism adapts best by learning from past mistakes. In a broader sense, it is about adapting to the environment, as well as the active role of the individual and the choice based on challenges. But learning is not mere adaptation, but it is an active process in which an individual acquires (changes, adapts, and repeats) something that is new. Learning outcomes are actively created personal hypotheses and meanings of reality [1].

There are many theories of learning, but the process we describe in this paper focuses on the theory of Classical Conditioning (I.P. Pavlov), Thorndike's theory of Instrumental Conditioning, Skinner's theory of Programmed Learning, and the theory of Learning through Imitation. Simply put, we

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will do, repeat and develop what we have done and have some positive effect in a particular area. Conversely, we discuss what happened and had some negative consequences that should not be repeated. Based on applying these hypothesis listed above and core knowledge, every organization that wants to survive must behave to the basic strategy of learning from past mistakes.

THE WAY OF THE LESSONS LEARNED PROCESS TO MEDICAL SERVICES OF THE NATO ARMIES

In the early years of the 21st century, NATO understood the importance of transformation and has become a learning organization that has the ability to be constantly flexible and adaptive to remain the central core of European and North Atlantic Security structures in the promotion of safety and security across international communities. For this reason, NATO has issued guidelines outlining the process of learning and sharing experiences, with the clear aim of providing a standardized structure and process that enables this ability in all alliance command structures [2].

Moreover, as outlined within the Armed Forces Declaration, signed by the NATO Heads of State during the NATO Summit, Wales 2014, NATO was directed to enhance the sharing of best practices and lessons learned in support of its Armed Forces personnel and their families [3]. Through the Military Committee (MC), the Committee of the Chiefs of Military Medical Services in NATO (COMEDS) requested that the NATO Centre of Excellence for Military Medicine (MILMED COE) prepare a way ahead to be presented at the 42nd COMEDS Plenary. The proposal was approved and subsequently endorsed by the International Military Staff (IMS) and Military Committee (MC) [4].

LESSONS LEARNED PROCESS AS A PART OF KNOWLEDGE MANAGEMENT

Lessons Learned is defined as a major component of Knowledge Management (KM), not only in the military, but also in government and commercial organizations [5]. The priority objective of Knowledge Management is to achieve higher performance of the organization in fulfilling its tasks in a dynamic, asymmetric and unstable environment (i.e. across the domains of land, sea, air, space and cyber). Therefore, gaining knowledge and experience is a process whereby the Lessons Learned are explored in order to find the best way to deal with the situation and share the outcome to all stakeholders who can benefit from it, and preferably mitigate and reduce mortality and morbidity.

In addition, it is a process allows an organization to learn from its mistakes or use its achievements. Thus, Lessons Learned is an instrument for the continuous process of improving each organization based on evidence [6]. The essence of this process is that it reduces the risk of error repetition in the organization, and the likelihood of repetition of success increases. The introduction of this process within the military health service is important not only for updating the core doctrine that drives best practices, but also for the comprehensive preparation of units in both peacetime and deployed operations.

According to the NATO Bi-Strategic Command Directive 080-006 [7], which is a strategic document of the Lessons Learned process, the following components – the pillars through which the process is implemented – are needed (Figure 1):

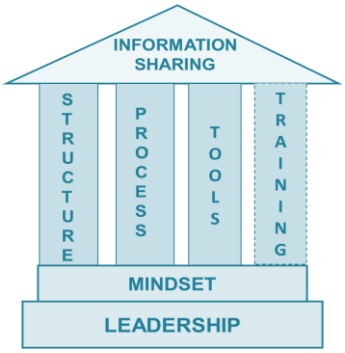
• Processes – links between elements to implement the process, standardize the process to ensure its compatibility and universality both in the NATO structure and in collaboration with other partners.

• Structure – elements (bodies) that are responsible for individual subprocesses and which guarantee an efficient and smooth course.

• Tools – technology, selection and use of appropriate support tools and their optimization to support the Lessons Learned process and its subprocesses.

• Training and education – the main sponsor activities needed to understand the importance of this process.

Figure 1: Components of the Lessons Learned System (NATO, 2016, p. 9)



The ceiling of this process is the very important sharing of information that represents the culmination of the entire Lessons Learned process. However, the most important are the cornerstones of the whole process, without which this process could not work effectively. The base of the Lessons Learned process is made up of commander's support – leadership, with senior military management knowing and understanding the benefits of the process. Then it is the commitment and thought of all involved. It is therefore

necessary to achieve a state where all the participants will understand the importance of this process and, in addition, the support of the commander will be clear to all [8].

The goal of the lessons learned proces

The general objective of the Lessons Learned process is to preserve the organization's knowledge, is to transform the individual's experience into the knowledge of the organization so that other members of the organization can use their experience in the absence of the expert [5].

Therefore, using lessons learned can positively influence other processes of the organization on a continuous cycle of improvement.

Scheme of lessons learned process

The NATO Bi-Strategic Command Directive 080-006 describes the individual parts and sequence of the Lessons Learned process, which is then illustrated in Figure 2.

Observation

This is an identified problem that requires action to be taken to improve the status or best practice for reuse. These are precisely described facts, events, claims, statements that are based on the evaluation of information that describes a certain activity of units, immediate causes, effects or effects.

Knowledge can be Raw Observation, which requires further study or analysis to understand the cause of the event and to supplement the information, or the Mature Observation, to which there is sufficient information, or the cause of the event is known and is not needed its further study and analysis [5, 6, 7].

Analysis

It is a study of the whole through careful examination of its individual parts and their interrelationships [5, 6, 7].

For the purposes of the Lessons Learned process, it is about describing a given phenomenon, its causes and consequences, including the initial design of measures to prevent repetition of inappropriate practices or to make repetition of the appropriate ones.

Lesson identified

Identified experience because of knowledge analysis. In addition to describing the event, the causes and the consequences, it includes a proposal for remedial measures, concrete steps and responsibilities for implementing these measures [5, 6, 7].

Lesson learned

It is the result of the implementation of measures that have increased the ability of a particular element [5, 6, 7].

Knowledge

Newly generated information, whether in the form of knowledge, identified or generalized experience has an individual value for the user corresponding to his/her knowledge (5). Interpreting such information in interaction with experience, facts, individual value, thought processes, and meanings can be understood as knowledge.

Share

One of the most important part of the Lessons Learned process, which is intertwined with the process, is sharing. If NATO really wants to work based on a learning organization, it is necessary for individual Member States to share knowledge with others.

Database of knowledge and experience

In addition, to centrally store, manage, share, and access the knowledge, national and international databases have been created to enable registered users to easily access the information they need.

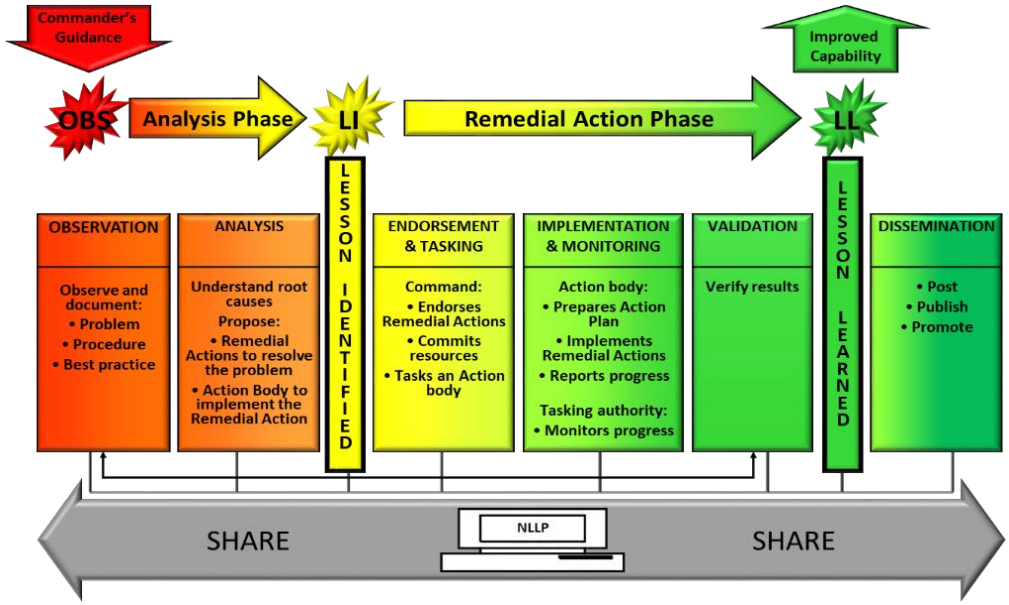
IMPROVING THE QUALITY OF MEDICAL SERVICES ACCORDING TO THE NATO MEDICAL LESSONS LEARNED PROCESS

First, quality in healthcare can be elusive and very complex in the military medical paradigm. The World Health Organization (WHO) defines the quality of health care as the extent to which health services provided to individuals and patient populations improve health outcomes [9]. For this purpose, healthcare must meet these key properties for all. It must be safe, efficient, timely, effective, and fair and focused on people – all activities must be driven by data and evidence based clinical practice. Health care quality can also be explained as a continuous improvement in the quality of health services provided, the ultimate goal of which is to improve health, improve the quality of life and satisfaction of the people they care for [10].

Thus, the Health Care Quality System includes the entire process of creating procedures, collecting information, setting clinical standards and assessing health care, health services and most importantly healthcare outcomes. It is also worth noting that a quality system is an intrinsically interconnected concept of quality elements that should help health organizations meet the goals of their mission [11]. In general terms, this applies to both civilian and military healthcare that the objective of a particular quality system in healthcare is always to improve the quality of health and related care provided in accordance with individual needs

and patient requirements and is rooted in evidence and best practice. In military medical operations, duty of care for warfighters and deployed personnel is the burden of the countries involved and the alliance; this is extended to the combatants and civilian population as outlined in the UN and Geneva Conventions and international norms. This includes the provision of healthcare to all at a standard of care as close to and in keeping with clinical standards provided at peacetime found in the participating countries [12]. This is an extremely difficult task for the provision of medicine for deployed personnel in the dynamic environment that is war, conflict and peacekeeping in remote, austere and resource challenged environment.

Figure 2: Scheme of Lessons Learned
(NATO, 2016, p. 11)



APPLICATION OF LESSONS LEARNED PROCESS IN NATO MILITARY MEDICAL SERVICES

In October 2014, the NATO Center of Excellence for Military Medicine (MILMED COE) hosted the International Security Assistance Force (ISAF), the NATO-led security mission in Afghanistan, Medical Lessons Learned Workshop. This was performed in order to preserve the knowledge gained in ISAF and discuss health care expertise in ISAF in Afghanistan. Examples of the use of appropriate combat application tourniquets during severe limb bleeding have clearly shown that collecting knowledge and sharing Best Practices saves lives and improves the clinical outcomes of those injured on the battlefield. Additionally, on the basis of Lessons Learned from Afghanistan, there was a demand for safe removal by a light armored medical vehicle for evacuation purposes. The MEDEVAC (Medical Evacuation) system was also created based loosely on this process, which can skip individual stages of health care and from point of injury for the warfighter or enemy combatant to ensure they are appropriately evacuated as soon as possible directly to a Medical Treatment Facility (MTF) at a ROLE 2E or ROLE 3 facility.

A number of shortcomings have also been identified in the quality system of medical support; these are of special interest when making the entire system more robust, more resilient and capable of fighting the next battle with potentially different weapon systems and challenges than the current.

The results were presented to the Committee of Military Health Service Chiefs (COMEDS) at their 42nd session. At this meeting, it was decided that NATO MILMED COE would become the main contact and coordination center for the Lessons Learned process within the NATO military health service. Lessons Learned Process for NATO Health Support Centers is illustrated in Figure 3 [13]. In effect, the MATO MILMED COE LL has become the clearinghouse and central crossroads for all thing's best practices in NATO Military Medicine across the alliance.

By positioning itself as the coordinator and collector of observations and lessons, the Lessons Learned Branch of the MILMED COE adds value to the NATO system, processing and sharing Lessons and best practices for all members of the Coalition across the alliance. The LL Branch are building a roadmap to the future of the delivery of Health Support

Services through best practices and rooted in clinical evidence. The members of the alliance have delivered amazing health care, and we need to collect and share the Best Practices across the organization to ensure that everything that has been learned can continue to save lives, financial resources and sparse clinical resources [14].

Currently, the NATO MILMED COE Lessons Learned Branch is developing an inclusive process to improve the collection, processing, analysis, storage and sharing of military health-related knowledge. All the information presented and analyzed is uploaded and stored in the Library of Medical Lessons Learned MILMED COE Information and Knowledge Management (IKM), which is located on the MILMED COE website (http://www.coemed.org/medlldb). An important achievement from the third Medical Lessons Learned Workshop, which took place in 2015, was the establishment of the Multinational Medical Lessons Learned Team (MMLLT), where the Czech Military Medical Service is represented and hosted the second meeting as well. Participating countries agreed to share national information and documents related to military health through the MILMED COE IKM portal. The MILMED COE KM Portal is a good starting point for sharing across the alliance. Each contributing nation should decide on a national level what kind of document they would share. COMEDS has requested to rename the MMLLT, because this name is too similar and thus be confused with Medical Lessons Learned Core Team. With these changes, the new name of the body is Medical Sharing Group.

Figure 3: Lessons Learned Process for NATO Health Support Centres
(MILMED COE, 2015)

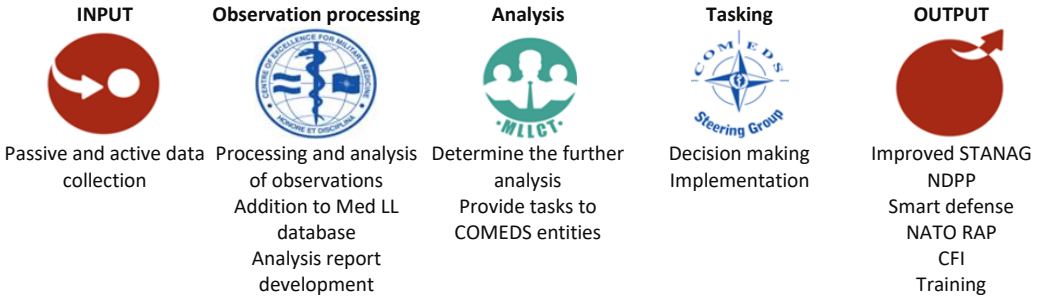
Moreover, the aim of the Medical Sharing Group is to establish the capability to share Lessons Learned information and knowledge across the Alliance [2]. Specifically, the Group members are responsible for reviewing Observations, Lessons Identified, and Lessons Learned information and knowledge within their national or organizational system and for forwarding any item to the NATO Medical Lessons Learned process that is considered beneficial to other Alliance Nations or to the Alliance as a whole. The intent is to empower the exchange of locally identified solutions or Best Practices with the goal of optimizing performance in current and future activities. The type and level of items to be shared will be established by the providing nation or organization and does not need to be the same for every participant. Additionally, the type and level of input provided by a participating entity does not have to remain the same over time and no formal process for change is required, enabling faster sharing of vital information [4]. The Medical Lessons Learned Process, an ongoing effort to improve process, is shown below in Figure 4.

Medical lessons learned conference on civilian – military interaction

A conference on civilian military cooperation has also been held several times. The main aim was to invite civilian and military organizations recently involved in Crisis Management, Humanitarian Assistance and relevant NATO, EU operations and share experiences, best practices and lessons learned. The last event was attended by 36 delegates from 12 nations and 13 organizations. A growing number of Crisis Management and Humanitarian Assistance missions/ events have been resulting in increasing demand for well-organized Civil-Military Interaction. Sharing individual perspectives on the situation and root causes of a crisis is the first step towards de-conflicting actions and complementing

each other's efforts, in effect to remove a duplication of effort. For the successful Civil-Military Interaction sharing of information is key importance to develop a common understanding about the situation and necessary measures.

Figure 4: Medical Lessons Learned Process
(MILMED COE, 2018)



Knowledge and tools of information collection

During the multinational medical exercise Vigorous Warrior 2017 a total of 391 pieces of observations were collected and analyzed. Five focus topics for further analysis were identified: Exercise Development, Interoperability, Patient Evacuation Coordination Cell, Bio-responsiveness and Experimentation [15]. Furthermore, a new tool for collecting and retrieving observations via smartphones was also introduced – the Observation, Discussion, Conclusion, Recommendation (ODCR) application, which was one of the tools for gaining knowledge (also those responsible for collecting knowledge - Office of Primary Responsibility (OPR) LL and paper and electronic forms). This application is fully functional in ANDROID and Apple´s iOS system (free download from Google play and AppStore). The previously mentioned Medical Knowledge Management Portal is a very important tool for preserving and sharing of observations and lessons. Today, there are over 1234 lessons from various areas of military and civilian health care (Exercises, Operations, UN, Ebola and others). Currently, the observations from the latest large-scale international medical exercise, Vigorous Warrior 2019, where 38 NATO and partner countries participated, are being analyzed within these new frameworks. The total number of primary findings is 464, of course, not all of the observations will be uploaded to the KM Portal avoiding repetition, and analysis will follow a standard approach.

DISCUSSION AND CONCLUSION

Evidenced-based medicine drives best practices. Knowledge sharing is an important prerequisite for the functioning and improvement of quality at all levels of healthcare within the deployment of medical units and medical teams across NATO operations. The quality of planning, which often takes place under time constraints and in a hostile environment, is improving and maximizes efforts across the NATO Alliance. The Lessons Learned (LL) process in clinical medicine for deployed and military support services drive the NATO Military Medical Center of Excellence (MILMED COE). This paper describes the Lessons Learned process and its use in NATO and partner countries medical services. Organizational learning drives development and progress and capturing lessons learned improves the quality of care in military medicine on a preventive, epidemiological, trauma, casualty evacuation and forward surgical care basis. The Lessons Learned process is an undertaking and an instrument that can also be used to achieve better international and civil-military cooperation. Lessons Learned process is one of the key elements of developing medical services in line with the changing operating environment.

Acknowledgment
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Conflict of interests
Authors state no conflict of interests.

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