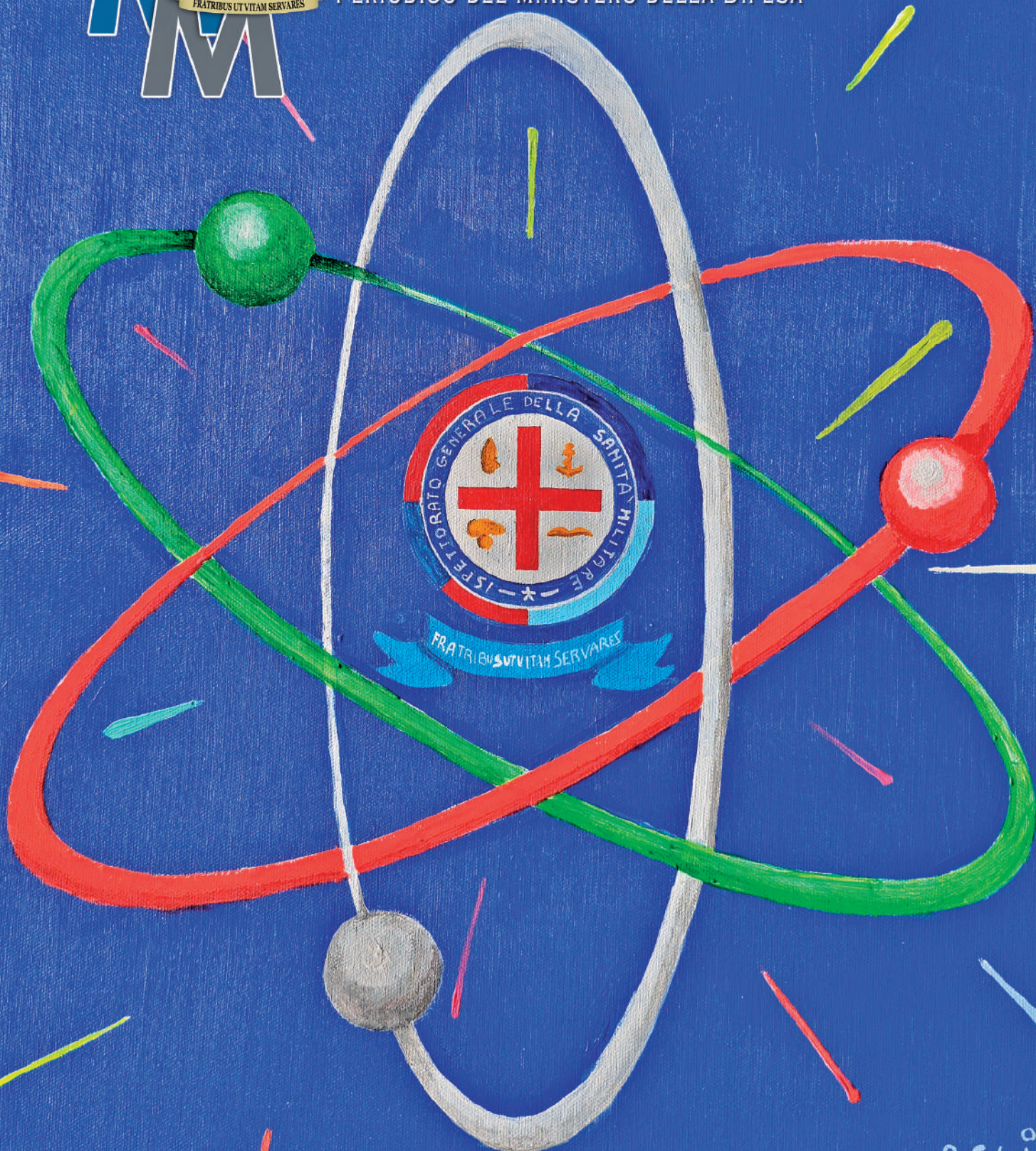




GIORNALE DI MEDICINA MILITARE - ANNO 175° FASCICOLO 2/2025 - MAGGIO - AGOSTO 2025



A cura dell'Ispettorato Generale della Sanità Militare

ASLI⁹



Organizzazione del servizio
territoriale dopo l'aggiunta di un altro livello
della seconda Guerra mondiale: gli ambasciatori





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Original study

113 *Key Personality Traits for Military Excellence: A Study on Cadets and Officers Serving in the Italian Army*

Tratti chiave della personalità per l'eccellenza militare: uno studio sui cadetti e sugli ufficiali in servizio nell'Esercito Italiano. La selezione del personale militare dovrebbe essere quanto più predittiva possibile riguardo al successo professionale. In questa prospettiva, la presente ricerca quali-quantitativa vuole analizzare i tratti di personalità legati al successo e al fallimento dei cadetti e degli ufficiali in servizio permanente, nel quadro di un sistema di selezione e reclutamento di qualità nell'organizzazione militare.

The military personnel recruitment should be a predictive system regarding, as possible, the professional success. In this qualitative-quantitative descriptive study it was analyzed the personality traits related to the success and failure of cadets and officers, within the framework of a quality selection and recruitment system in the military organization.

MARIANO PIZZO, ANDREA CHIRICO, MARCO MARIANI, SERENA CESI, VINCENZA IODICE, FABIO CIPPITELLI

122 *Thirteen Years of Drug Testing at the DMML in Rome: analytical results*

Tredici anni di Drug Test presso il DMML di Roma: risultati analitici

Questo studio epidemiologico retrospettivo condotto presso il Dipartimento di Medicina Legale di Roma ha descritto oltre 13 anni di test EMIT su sostanze d'abuso (drug test) e benzodiazepine (BZD), in ambito sia di screening per Esercito e Civili, che medico-legale in sede di accertamento d'idoneità per il personale di tutte le FF.AA. e Corpi Armati dello Stato afferenti al bacino d'utenza di questo DMML (Italia centrale/Sud).

This retrospective epidemiological study conducted at the Department of Forensic Medicine (DMML) in Rome described over 13 years of EMIT tests on substances of abuse (drug test) and benzodiazepines (BZD), during the medical forensic screening for assessment of idoneity of Army and Civilians personnel.

VINCENZO CUTELLÈ, CLAUDIA SCARGIALI, MICAELA SANTINI, ROMOLO PICCIRILLO

Review

136 *Nursing management of psychiatric emergency or urgency: acute amphetamine-induced psychosis. A review of the literature*

Gestione infermieristica dell'emergenza-urgenza psichiatrica: la psicosi acuta indotta da anfetamine. Una revisione della letteratura. Questa revisione della letteratura analizza la gestione della psicosi acuta indotta da anfetamine nei contesti di emergenza psichiatrica, con particolare attenzione al ruolo infermieristico. È emerso che gli infermieri svolgono un ruolo chiave nel riconoscimento precoce e negli interventi di de-escalation, ma affrontano criticità legate alla formazione e alle condizioni lavorative.

This literature review examines the management of acute amphetamine-induced psychosis in psychiatric emergency settings, with particular attention to the nursing role. It emerged that nurses play a key role in early recognition and de-escalation, but address training and working conditions issues.

GAIA CUCCHIARONI, GIUSEPPE CACCIAPUOTI, FRANCESCO MAZZUCCHI

Case report

145 *Lionfish Poisoning: a rare clinical case*

Avvelenamento da pesce leone: un raro caso clinico

L'avvelenamento da Scorpaenidae, tra cui il pesce leone, è un evento raro e tipico dei paesi tropicali sebbene in letteratura siano descritti molteplici casi di lesioni causate da Scorpaenidae anche in aree non tropicali. Si riporta un caso clinico avvenuto nel pronto soccorso dell'Ospedale Militare di Beirut trattato dai team sanitari italiani.

Poisoning by Scorpaenidae, including lionfish, is a rare event typical of tropical countries although multiple cases of lesions caused by Scorpaenidae have been described in literature even in non-tropical areas. A clinical case occurred in the emergency room of the Military Hospital of Beirut treated by Italian health teams is reported.

MARGHERITA MORETTI, JOLE SERRA

152 *Operation 'Levante': pro radial sural nerve transplant on a 38 year-old civilian woman*

Operazione Levante: trapianto nervoso del nervo surale pro nervo radiale su donna civile di 38 anni

In caso di lesioni nervose dei nervi periferici degli arti superiori è possibile provare ad effettuare un trapianto utilizzando nervi sensitivi prelevati da altre sedi. Questo case report dimostra che anche in Teatro Operativo, nonostante notevoli criticità, è possibile effettuare una chirurgia specialistica avanzata.

Cases of nerve damage to the peripheral nerves of the upper limbs can be treated via transplant using sensory nerves taken from other sites. This case report demonstrates that, even within the confines of an operating theatre and despite the presence of significant criticality, advanced specialist surgery can be performed.

VALERIO STROPPA

157 *Emerging evidence in diabetic foot wound care: a paradigmatic study*

Evidenze emergenti in vulnologia del piede diabetico: uno studio paradigmatico

Le ulcere cutanee rappresentano una tematica clinica di prioritaria importanza per gli operatori sanitari di tutto il mondo, rappresentando un condiviso problema di sicurezza per i pazienti. Questo case report ha consentito di evidenziare e consolidare quali siano le evidenze emergenti in ambito del wound care e soprattutto dell'importanza dell'equipe multidisciplinare nella pianificazione e trattamento delle ferite complesse, quali quelle diabetiche.

Skin ulcers are a priority clinical issue for healthcare professionals worldwide, representing a shared patient safety concern. These case reports have highlighted and consolidated the emerging evidence in the field of wound care and above all the importance of the multidisciplinary team in the planning and treatment of complex wounds, such as diabetic wounds.

GAIA MAESTOSO, SONIA MASULLO, PIETRO ANTONINO RENDA, IVAN SCJARRETTA, FRANCESCO PICCIRILLI, ALBERTO SERRA



Perspective

- 165 *S100B and Health: from the brain to plants via milk*
S100B e Salute: dal cervello alle piante passando dal latte.
La proteina S100B fu inizialmente scoperta nel cervello durante gli anni '60. Per decenni è stata studiata nell'uomo e altri vertebrati, in diversi organi e tessuti. S100B appare un promettente strumento per rinforzare la salute e ripristinare squilibri, anche in condizioni di stress per l'organismo.
The S100B protein was initially discovered in the brain during the 1960s. For several decades, research has been conducted on both humans and other vertebrates. S100B exploitation appears a promising tool for strengthening health and restoring imbalances, even under stressful conditions.
VINCENZO ROMANO SPICA, FABRIZIO MICHETTI
- 172 *Application of the Haddon Matrix to Civil-Military interaction in disaster relief operations*
Applicazione della Matrice di Haddon ad Operazioni di disaster relief con interazione civile-militare
L'interazione civile-militare contribuisce alle operazioni di disaster relief umanitarie. Queste operazioni possono essere analizzate con rapporti strutturati post-evento che consentano un continuo processo di miglioramento in termini di pianificazione in risposta ai disastri. La Matrice di Haddon appare come uno strumento di analisi utile nella valutazione dell'effetto sinergico derivato dall'interazione civile-militare nell'ambito del ciclo dei disastri.
Civil-Military interaction contributes to humanitarian disaster relief operations. These operations can be analyzed with structured post-event reports that allow a continuous improvement process in terms of planning in response to disasters. The Haddon Matrix appears as a useful analysis tool in evaluating the synergistic effect derived from civil-military interaction within the disaster cycle.
ELISABETTA GALATI

Medicina Veterinaria

- 183 *Study of infectious pathogen sand endoparasites in two populations of Montecristo goat (capra aegagrus hircus) in the free state and in permanent captivation*
Studio di agenti patogeni infettivi e di endoparassiti in due popolazioni di capra di Montecristo (*capra aegagrus hircus*) allo stato libero e in captivazione permanente
La Capra di Montecristo (*Capra aegagrus hircus*) rappresenta l'unico esempio selvatico residuale vivente in Italia e uno dei pochi nel bacino del Mediterraneo. Tale lavoro è finalizzato ad ottimizzare la gestione delle capre all'interno di strutture ex situ e garantire ai soggetti ospitati un management nel pieno rispetto del benessere animale.
The Montecristo Goat (Capra aegagrus hircus) represents the only remaining wild example living in Italy and one of the few in the Mediterranean basin. This work is aimed at optimizing the management of goats within ex situ structures and ensuring that the hosted subjects are managed in full compliance with animal welfare.
CARLO ALBERTO MINNITI, PATRIZIA PONZIO

Esperienze sul campo

- 197 Gestione efficace delle crisi e sicurezza sanitaria a lungo periodo: cooperazione sanitaria civile-militare in Italia in chiave One Health.
In un contesto globale segnato da crisi sanitarie complesse e interconnesse, tra cui pandemie, conflitti armati, emergenze CBRN e resistenze antimicrobiche, l'integrazione tra sanità civile e militare rappresenta una risorsa strategica. Questo report, esplora le potenzialità della cooperazione civile-militare in sanità attraverso il paradigma One Health, un approccio che riconosce l'interconnessione tra salute umana, animale e ambientale.
NORAN KHALIL

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PAOLO CADEDDU

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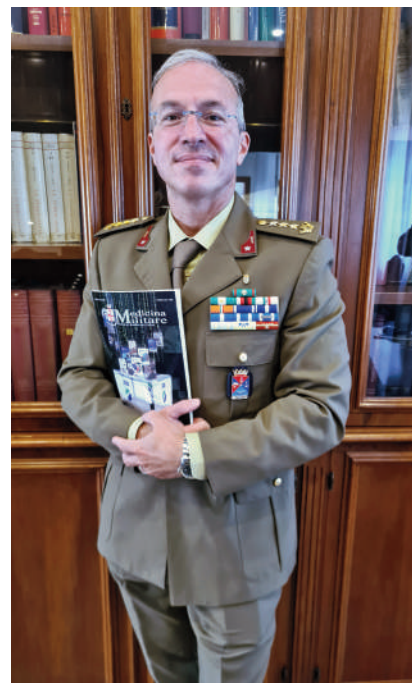
EDITORIALE



Care lettrici, cari lettori,

questa Redazione già da molti anni introduce periodicamente delle novità stilistiche o tematiche con l'auspicio che a voi siano gradite e con l'intento di progredire verso una rivista più compiutamente scientifica, senza abbandonare le tematiche che storicamente hanno contraddistinto l'attuale linea editoriale.

In questo numero tale processo evolutivo compie un nuovo balzo in avanti: gli articoli prettamente scientifici saranno pubblicati da adesso esclusivamente in lingua inglese, conservando il titolo ed il riassunto anche in italiano. Questa scelta deriva da una duplice esigenza: *in primis* uniformarsi all'editoria medica indicizzata che riconosce quale unica lingua accettata quella inglese, *in secundis* consentire la pubblicazione di un maggior numero di contributi scientifici, indice del fatto che il Giornale è divenuto il punto di riferimento di molti autori, militari e civili, che candidano i propri lavori per la pubblicazione. A tale manifestazione di interesse la Redazione deve doverosamente rispondere in tempi adeguati di pubblicazione, evitando al contempo di produrre fascicoli "enciclopedici", poco fruibili. Da qui la necessità di snellire *original studies*, *reviews*, *case reports* e *perspectives* pubblicandone la sola versione inglese; siamo certi, comunque, che i lettori interessati ad approfondire gli argomenti offerti avranno l'adeguata padronanza dell'albionico idioma per comprendere il testo.



In previsione dell'annunciata riforma interforze della Sanità Militare, il Giornale si propone con ancor maggiore convinzione quale voce ufficiale della Medicina Militare e come tale deve essere riconosciuto dagli enti clinici e di ricerca del Dicastero ed offrirsi nei modi e negli spazi adeguati quale vetrina delle attività che qui si svolgono.

Del resto, la connotazione scientifica e storica contraddistingue il periodico anche nell'ambito più generale dell'editoria militare, anch'essa prossima ad una trasformazione in senso centripeto. Infatti, è in valutazione un progetto di accentramento delle varie testate del Ministero della Difesa sotto il controllo di un unico editore, Difesa Servizi, con un'ottimizzazione delle risorse che preveda la condivisione della logistica e dell'amministrazione. In questo ambito, le peculiarità del Giornale sono già state riconosciute quali valori da preservare e valorizzare.

In attesa delle vostre sincere e schiette reazioni circa il cammino intrapreso, vi auguro buona lettura e, in considerazione dei tempi di pubblicazione, buone ferie.

In copertina: "Sanità Militare e Ricerca Scientifica". La Medicina militare, oltre a gestire la sanità sul terreno è anche leader nella ricerca scientifica, declinata nelle varie aree operative, relative anche alle rispettive Forze Armate. Gli anelli rappresentano la molteplicità della Ricerca Scientifica e delle anime della Sanità Militare.



EDITORIAL



Dear readers,

for many years, this Editorial Staff has periodically introduced stylistic or thematic innovations, hoping you will appreciate them and aiming to progress toward a more fully scientific journal, without abandoning the themes that have historically distinguished the current editorial line.

This evolutionary process takes a further leap forward in this issue: strictly scientific articles will now be published exclusively in English, while retaining the title and abstract in Italian. This choice stems from a dual need: first, to conform to the indexed medical publishing world, which recognizes English as the only accepted language; second, to allow the publication of a greater number of scientific contributions, a sign that the Journal has become a point of reference for many authors, both military and civilian, who submit their works for publication. The Editorial Staff must dutifully respond to such expressions of interest within adequate publication times, while avoiding producing «encyclopedic» issues that are difficult to use. Hence the need to streamline original studies, reviews, case reports, and perspectives by publishing only the English version; we are confident, however, that readers interested in learning more about the topics presented will be confident with English language to understand the text.



In anticipation of the announced joint reform of the Military Health Service, the Journal asserts itself with even greater conviction as the official voice of Military Medicine and, as such, must be recognized by the Ministry's clinical and research institutions and present itself in appropriate ways and spaces as a showcase for the activities carried out there.

Moreover, the periodical's scientific and historical focus also distinguishes it within the broader military publishing landscape, which is also undergoing a centripetal transformation. Indeed, a project is currently under consideration to centralize the various Ministry of Defense publications under a single publisher, Difesa Servizi, with an optimization of resources that includes shared logistics and administration. In this context, the Giornale's unique characteristics have already been recognized as values to be preserved and enhanced.

Awaiting your sincere and frank reactions regarding the path it has taken, I wish you happy reading and, considering the publication date, happy holidays.

On the cover: "Military Health and Scientific Research". Military Medicine, in addition to managing health on the ground, is also a leader in scientific research, declined in the various operational areas, also related to the respective Armed Forces. The rings represent the multiplicity of Scientific Research and the souls of Military Health.



ORIGINAL STUDY



Key personality traits for military excellence: a study on cadets and officers serving in the Italian Army

Tratti chiave della personalità per l'eccellenza militare: uno studio sui cadetti e sugli ufficiali in servizio nell'Esercito Italiano

Mariano Pizzo * Andrea Chirico[°] Marco Mariani[^] Serena Cesi ** Vincenza Iodice ***
Fabio Cippitelli ****

Abstract - The selection of military personnel should be as predictive as possible regarding professional success. In this perspective, the present qualitative-quantitative research aims to analyse the personality traits linked to success and failure of cadets and officers on permanent duty, with a view to quality selection and the recruitment system in the military organisation. The study involved 458 senior officers, 28 junior officers and 32 cadets of the Italian Army. There were two main phases: the first involved focus groups and individual interviews; the second involved surveys to define Knowledge, Skills, Abilities and Other Characteristics. Consistently with scientific literature, the results highlighted three cross-cutting personality traits shared by both cadets and officers: «Values-based Conscientiousness», «Organisational Leadership» and «Selfishness/Work Immaturity».

Riassunto - La selezione del personale militare dovrebbe essere quanto più predittiva possibile riguardo al successo professionale. In questa prospettiva, la presente ricerca quali-quantitativa vuole analizzare i tratti di personalità legati al successo e al fallimento dei Cadetti e degli Ufficiali in servizio permanente, nel quadro di un sistema di selezione e reclutamento di qualità nell'organizzazione militare. Lo studio ha coinvolto 458 Ufficiali Superiori, 28 Ufficiali Inferiori e 32 Cadetti dell'Esercito Italiano. Le fasi principali sono state due: la prima prevedeva focus group e interviste individuali; la seconda prevedeva indagini per definire Conoscenze, Abilità, Capacità e Altre caratteristiche. In linea con la letteratura scientifica, i risultati hanno evidenziato tre tratti trasversali comuni della personalità tra Cadetti e Ufficiali in servizio: «Coscientiosità basata sui valori», «Leadership organizzativa» ed «Egoismo/Immaturità lavorativa».

Keywords: military, selection, recruitment, personality traits.

Key messages:

- A bottom-up approach specific to military forces useful to understand the specificity and uniqueness of Italian Army units.
- Qualitative-quantitative research provides a complete characterisation of an ideal Italian army cadet and officer.

Introduction

The Italian Army constitutes the operational land component of the Joint Military Instrument and, in this capacity,

ensures the defence of the State and its vital interests, contributing to the achievement of international peace and security and the safeguarding of free institutions (1).

Within this framework, the availability of adequate human resources is the first requirement for the service to be able to meet the increasingly complex and extensive challenges at national and

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international level.

The human component is, in fact, the real strength of the military organisation (2), which is why the selection of military personnel must be based on scientific and methodological rigour, consistently with the principles of fairness and transparency (3).

In Italy, the Army's personnel recruitment process, which is complex and demanding (4), aims to select people with above all adequate psychophysical balance and possessing specific personality traits (5,6,7).

In view of the current social, geopolitical, organisational and technological changes and within the framework of the quality selection and recruitment system for military personnel, the aim of this research was to investigate the personality characteristics of success and failure of cadets and officers in permanent service, based on the results obtained within the reference organisational culture. The term 'recruitment' can be understood as the process encompassing the recruitment and selection of personnel within the labour market, aimed at identifying candidates who meet specific requirements to be employed within an organisation (8).

Paying attention to this process enables organisations to enhance human capital as a strategic asset and key factor (9), facilitating processes of innovation and adaptation to new social and/or market contexts (10).

In this regard, in Italy, the recruitment process of military personnel takes place through competitions, as established by the Italian Constitution. Therefore, the careful definition of professional profiles is essential to successfully identify suitable candidates to fill specific organisational positions (11).

In particular, the professional profile is

composed of a list of a priori defined individual characteristics, both objective (e.g. biographical data, education and training, professional requirements) and subjective, including personality traits. In general, it should be reviewed and periodically updated, especially taking into account the organisational, social and technological changes that occur over time (12).

Profile definition is part of job-analysis practices. More specifically, the worker-oriented mode was chosen, aimed at identifying the various characteristics of people fit for performing a given role to the best of their ability (13,14). In this sense, the classic model called KSAOs Knowledge, Skills, Abilities and Other characteristics was used as a reference (15). It refers, in a broader sense, to professional knowledge, to skills engaged in performance, to abilities (e.g. spatial, verbal, synthesis, etc.) and 'other personal characteristics' (e.g. work motivation, emotional states or self-awareness traits such as self-efficacy and self-esteem), which are latent variables, not directly observable.

The qualitative-quantitative research, originally aiming to investigate the characteristics of success and failure of cadets and officers in a perspective of skills and values, followed a bottom-up data collection and processing strategy (16,17), i.e. from cadets up to the top of the Armed Forces. This was done to identify common ground between the two roles and make the selection of cadets as predictive as possible in terms of their future success as officers.

In this regard, although literature provides several anecdotal examples of what the characteristics of a good soldier are (18,19,20), studies aimed at predicting success factors for officers are limited and scarcely exhaustive (21,22).

Particularly in our country, it is necessary to carry out this type of scientific research.

Materials and Methods

This study, promoted by the Military Psychology and Psychiatry Branch of the Army General Staff, and carried out in collaboration with Universities "La Sapienza" in Rome and «Alma Mater Studiorum» in Bologna, developed through two main phases, over a period of about 10 months, from January 2022 to October 2022. Preliminarily, following the instructions of the Army top brass, a research project was drafted and approved defining the various stages and the material to be used (interviews and focus groups) based on a sector-specific bibliography. To guarantee the trustworthiness of research and of the results obtained in the specific military context, a non-theory-driven study methodology was adopted to enhance the specificity of the information, knowledge, opinions and experiences of the personnel involved.

PHASE 1- Focus groups and individual interviews

The first phase took place at the Modena Military Academy. It primarily aimed at carrying out an initial survey to collect the necessary information regarding KSAOs, i.e. to identify the characteristics of success and failure of the Army cadets and officers in terms of skills, competencies and motivational aspects. The collection of information in this phase allowed to define a set of items for the development of the research questionnaire designed to investigate the characteristics of success and failure of the cadets and officers.

28 junior officers and 32 cadets partici-



pated. They were grouped by level of experience and classified into homogeneous groups, differentiated according to their position to facilitate free discussion. In particular, 7 focus groups were carried out, involving a maximum of 8 subjects, comprising: military and civil teachers, Company Commanders, Platoon Commanders and the Military Academy cadets. In addition, 5 individual semi-structured interviews (for senior officers) were carried out with the key elements of the Military Academy itself (Academy, Regiment and Battalion Commanders). The participants, on a voluntary basis, in the focus groups and individual interviews were informed that the purpose of the research was to collect, based on their experience, some information that could allow the definition of the personality and motivational characteristics of success and failure of cadets and officers. Furthermore, that all the information collected would be anonymous, used only for the purposes of the research and that the themes and answers that emerged would be processed in absolute confidentiality.

Data collection tools

Focus group: as homogeneous and structured an instrument as possible, adapted to the target group, characterised by the definition of a maximum time (90 minutes) and developing through the following main phases: introduction (15 minutes), introductory questions (10 minutes), core questions and brief discussion (55 minutes); conclusion (10 minutes), with the definition of instructions and questions for the moderator. In particular, the core questions were:

- what are, in your opinion, the personality traits that a cadet should have in order to succeed at the Academy?

- what personality traits do you think an officer should have in order to be successful during his/her career?
- what are, in your opinion, the personality characteristics of a cadet that may hinder or lead to failure in the academy?
- what do you think are the personality characteristics of an officer that may hinder or lead to failure during his career?
- what motivates cadets the most to continue their training?
- what motivates cadets the least to continue their training?

Semi-structured or guided interview: as homogeneous and structured an instrument as possible, with a maximum time of 60 minutes and consisting of the following main phases: introduction (10 minutes), introductory questions (5 minutes), core questions (40 minutes), end of interview (5 minutes).

In particular, the essential questions were:

- what are, in your opinion, the personality characteristics that a cadet should have to be successful at the Academy?
- what personality traits do you think an Officer should have to be successful in his/her career?
- what are, in your opinion, the personality characteristics of a cadet that may hinder or lead to failure at the Academy?
- what do you think are the personality characteristics of an officer that may hinder or lead to failure during his/her career?
- In your experience, what motivates cadets the most to continue their training?
- In your experience, what motivates cadets the least to continue their training?

A content analysis was performed on the transcripts of the coded recordings by three psychologist officers: two independent coders and a third comparator.

PHASE 2 - Survey to define KSAOs

The second phase took place at the Army Staff and within various Army bodies/divisions. It consisted in conducting individual interviews with the top echelons of the Army, including some officers as key elements of the Army Staff, and administering the Research Questionnaire.

458 Senior Officers with sound command experience were selected and divided into three main categories according to the bodies in which they serve: operational (183), training (77) and logistics (198) to represent the three main areas of employment. 5 General Officers were selected to represent the institutional leadership. The Psychologist Officer administered the Research Questionnaire in a confidential environment, to 7 groups of about 30 Officers each, on a voluntary basis and in paper form, at their place of duty. Every time, detailed instructions were given, specifying the absolute confidentiality of the information to be collected. The guided interviews were also conducted in a confidential and protected environment. At the end of the interview, the Research Questionnaire was administered.

Data collection tools

The Research Questionnaire (Fig. 2): as details show, it consists of a delivery part, a description of the likert scale for scoring and 79 items, which represent the characteristics and values of success and failure referring to a Cadet (item 1 to item 40) and an Officer (item 41 to item 79).



RESEARCH QUESTIONNAIRE

Below you will find a list of characteristics and values related to the personality of the **Officer Cadet** and, subsequently, of the **Officer**. On the basis of your experience, please indicate, with increasing values from 1 to 5 (1 = not at all important ÷ 5 = completely important), how important each of them considers to successfully face the training process of the Military Academy of Modena / career as an Officer.

The questionnaire is anonymous. The information contained will be treated with the utmost confidentiality and protected by professional secrecy.

1	2	3	4	5
Not at all important	Unimportant	Quite important	Very important	Quite important

To successfully face the training process of the Academy, how important do you think it is that an OFFICIAL STUDENT possesses:							
FEATURES	1.	Communication skills	1	2	3	4	5
	2.	Adaptation	1	2	3	4	5
	3.	Extraversion/exuberance	1	2	3	4	5
	4.	Ambition	1	2	3	4	5
	5.	Openness to new experiences	1	2	3	4	5
	6.	Arrogance	1	2	3	4	5
	7.	High expectations	1	2	3	4	5
	8.	Self-criticism	1	2	3	4	5
	9.	Self-efficacy	1	2	3	4	5
	10.	Organizational Capacity	1	2	3	4	5
	11.	Charisma	1	2	3	4	5
	12.	Cooperation	1	2	3	4	5
	13.	Courage/boldness	1	2	3	4	5
	14.	Conscientiousness	1	2	3	4	5
	15.	Difficulty managing stress/anxiety	1	2	3	4	5
	16.	Litigiousness	1	2	3	4	5
	17.	Egoism	1	2	3	4	5
	18.	Energy	1	2	3	4	5
	19.	Managing emotions	1	2	3	4	5
	20.	Individualism	1	2	3	4	5
	21.	Insecurity	1	2	3	4	5
	22.	Perseverance towards the goal	1	2	3	4	5
	23.	Conceit	1	2	3	4	5
	24.	Propensity to learn	1	2	3	4	5
	25.	Resilience	1	2	3	4	5
	26.	Responsibility/Reliability	1	2	3	4	5
	27.	Low motivation	1	2	3	4	5
	28.	Superficiality	1	2	3	4	5
	29.	Tendency to work alone	1	2	3	4	5
	30.	Shyness	1	2	3	4	5
	31.	Disorganization	1	2	3	4	5
	32.	Empathy/affection	1	2	3	4	5
	33.	Emotional tranquility/stability	1	2	3	4	5
	34.	Habituality/traditionalism	1	2	3	4	5
VALUES	35.	Discipline	1	2	3	4	5
	36.	Loyalty	1	2	3	4	5
	37.	Respect	1	2	3	4	5
	38.	Sense of duty	1	2	3	4	5
	39.	Solidarity	1	2	3	4	5
	40.	Spirit of sacrifice	1	2	3	4	5

Fig. 2 - Research questionnaire used in the second part of the study.

Specifically, participants were asked to express, based on personal experience, on a scale from 1 (not at all important) to 5 (completely important), how successful or unsuccessful they found the personality traits and values of the questionnaire to be in facing the training process at the Military Academy and the subsequent career in the Armed Forces. This phase was carried out with the support of Armed Force Psychologist Officers serving in Divisions throughout the country.

The semi-structured or guided interview, like the one already described and carried out in the previous phase, was only adapted in relation to the circumstance of use, while maintaining the core questions unaltered.

A descriptive analysis of the items in the research questionnaire was carried out (**Tables 1a and 1b**).

The data gathered in a dataset were sorted according to the characteristics indicated as most successful (mean value > 4) or most unsuccessful (mean value < 1.5), for each of the two parts of the questionnaire (23). Subsequently, an Exploratory Factor Analysis (EFA) with oblique rotation (*oblimin*) was conducted using the statistical programme «Jamovi» (2021) (24). The results of the model fit indices were evaluated according to the conventional criteria, i.e. the Tucker Levis Index (TLI) value greater than .9 and the RMSEA value less than .06. Analysis was performed against a conventional statis-

tical significance corresponding to $\alpha=.05$. In addition, to recognise any differences between the characteristics that emerged from the survey, an independent-samples t-test analysis was carried out, which allows the comparison between the individual factors of the first and second part of the questionnaire, i.e. between the KSAOs of Cadets and Officers.

Results

In the first phase of the study, several common issues emerged that were identified as indicators of success by all groups, e.g. self-criticism, charisma, willingness to learn, discipline, loyalty and courage (**Fig. 1**). Conversely, examples of

To successfully face their professional career, how important do they consider it that an OFFICER possesses:						
FEATURES	41. Arrogance	1	2	3	4	5
	42. Self-criticism	1	2	3	4	5
	43. Openness to new experiences	1	2	3	4	5
	44. Extraversion/exuberance	1	2	3	4	5
	45. Communication skills	1	2	3	4	5
	46. Charisma	1	2	3	4	5
	47. Coherence	1	2	3	4	5
	48. Determination	1	2	3	4	5
	49. Education	1	2	3	4	5
	50. Empathy/affection	1	2	3	4	5
	51. Balance	1	2	3	4	5
	52. Be an example	1	2	3	4	5
	53. Being disrespectful	1	2	3	4	5
	54. Being inflexible	1	2	3	4	5
	55. Avoid making decisions	1	2	3	4	5
	56. Leadership	1	2	3	4	5
	57. Motivation	1	2	3	4	5
	58. Propensity for professional updating	1	2	3	4	5
	59. Rationality	1	2	3	4	5
	60. Rigidity in personal relationships	1	2	3	4	5
	61. Knowing how to delegate	1	2	3	4	5
	62. Know how to manage groups	1	2	3	4	5
	63. Distrust of one's collaborators	1	2	3	4	5
	64. Safety	1	2	3	4	5
	65. Litigiousness	1	2	3	4	5
	66. Anxiety	1	2	3	4	5
	67. Reliability	1	2	3	4	5
	68. Disorganization	1	2	3	4	5
	69. Courage	1	2	3	4	5
	70. Humility	1	2	3	4	5
VALUES	71. Discipline	1	2	3	4	5
	72. Fidelity	1	2	3	4	5
	73. Commitment	1	2	3	4	5
	74. Loyalty	1	2	3	4	5
	75. Pride	1	2	3	4	5
	76. Sense of duty	1	2	3	4	5
	77. Sense of responsibility	1	2	3	4	5
	78. Esprit de corps	1	2	3	4	5
	79. Spirit of sacrifice	1	2	3	4	5

Thank you for your precious availability and collaboration!



potential indicators of failure included: *interpersonal difficulties, lack of open-mindedness and difficulties in dealing with stress*. From this initial analysis, the most frequently reiterated issues constituted the items of the questionnaire used in phase 2.

In phase 2, taking a saturation level of 0.3 or higher as a criterion, the results showed 3 factors for both the Cadet's and Officer's characteristics. The three factors, as far as the content of the items is concerned, can be considered very similar (**Tab. 2a and 2b**).

Specifically, the three factors were named as follows:

- Factor 1: *Values conscientiousness* (e.g. item: Sense of duty; Loyalty), by which is meant the predisposition to embrace the ethical values of the Armed Forces, in a scrupulous and

Tab. 1a - Descriptive items for Cadets.

Item	Media	Std Dev.
1. Communication skills	4.13	0.836
2. Adaptation	4.71	0.512
3. Extroversion/exuberance	2.85	0.919
4. Ambition	3.87	0.892
5. Open-mindedness	4.51	0.730
6. Arrogance	1.36	0.771
7. High expectations	3.37	1.057
8. Self-criticism	4.09	0.806
9. Self-efficacy	4.02	0.793
10. Organisational ability	4.50	0.762
11. Charisma	4.11	0.921
12. Collaboration	4.41	0.722
13. Courage/audacity	4.29	0.779
14. Conscientiousness	4.36	0.740
15. Difficulties in dealing with stress/anxiety	2.63	1.769
16. Litigiousness	1.27	0.583
17. Selfishness	1.37	0.714
18. Energy	4.50	0.610
19. Managing emotions	4.29	0.708
20. Individualism	2.10	1.035
21. Insecurity	1.29	0.731
22. Perseverance towards the goal	4.53	0.694
23. Presumption	1.83	1.014
24. Propensity to learn	4.55	0.601
25. Resilience	4.46	0.723
26. Accountability/reliability	4.62	0.660
27. Poor motivation	1.17	0.659
28. Superficiality	1.21	0.687
29. Tendency to work alone	1.94	0.963
30. Shyness	1.64	0.717
31. Disorganisation	1.23	0.683
32. Empathy/affection	3.47	0.953
33. Tranquillity/emotional stability	4.33	0.725
34. Custom/traditionalism	2.50	1.006
35 Discipline	4.69	0.552
36. Loyalty	4.82	0.480
37. Respect	4.75	0.519
38. Sense of duty	4.80	0.460
39. Solidarity	4.26	0.827
40 Spirit of sacrifice	4.74	0.542

Tab. 1b - Descriptive items for Officers.

Item	Media	Std.Dev.
41. Arrogance	1.40	0.782
42. Self-criticism	4.23	0.863
43. Open-mindedness	4.49	0.624
44. Extroversion/exuberance	3.28	0.994
45. Communication skills	4.68	0.525
46. Charisma	4.63	0.611
47. Consistency	4.69	0.598
48. Determination	4.72	0.492
49. Politeness	4.62	0.641
50. Empathy/affection	3.82	0.891
51. Balance	4.65	0.566
52. Setting an example	4.81	0.488
53. Being respectful	1.24	0.840
54. Being scarcely flexible	1.39	0.686
55. Avoiding making decisions	1.20	0.688
56. Leadership	4.63	0.588
57. Motivation	4.70	0.529
58. Propensity for professional development	4.50	0.645
59. Rationality	4.37	0.701
60. Rigidity in personal relationships	1.75	0.867
61. Knowing how to delegate	3.83	0.901
62. Group management ability	4.44	0.642
63. Distrust towards one's co-workers	1.28	0.710
64. Assuredness	4.39	0.649
65. Litigiousness	1.23	0.551
66. Anxiety	1.24	0.602
67. Reliability	4.66	0.653
68. Disorganisation	1.12	0.484
69. Courage	4.40	0.746
70. Humility	4.28	0.845
71. Discipline	4.69	0.549
72. Fidelity	4.74	0.531
73. Commitment	4.75	0.480
74. Loyalty	4.85	0.422
75. Pride	3.90	0.992
76. Sense of duty	4.78	0.474
77. Sense of responsibility	4.85	0.392
78. Esprit de corps	4.58	0.654
79. Spirit of sacrifice	4.73	0.548



OFFICER CADETS		
PERSONALITY CHARACTERISTICS	SELF-CRITICISM	EGOISM
	COMMUNICABILITY	ENERGY
	ADAPTATION	EMOTIONAL MANAGEMENT
	AMBITION	INDIVIDUALISM
	OPENNESS	INSECURITY
	ARROGANCE	PERSEVERANCE TOWARDS THE GOAL
	HIGH EXPECTATIONS	RESILIENCE
	SELF-EFFICACY	RESPONSIBILITY
	ORGANIZATIONAL CAPACITY	LOW MOTIVATION
	CHARISMA	SUPERFICIALITY
	COOPERATION	TENDENCY TO WORK ALONE
	COURAGE	SHYNESS
	CONSCIENTIOUSNESS	
	DIFFICULTY MANAGING STRESS	
	RELATIONAL DIFFICULTIES	
VALUES		
VALUES	DISCIPLINE	
	LOYALTY	
	RESPECT	
	SENSE OF DUTY	
	SOLIDARITY	
	SPIRIT OF SACRIFICE	

CAREER OFFICERS		
PERSONALITY CHARACTERISTICS	SELF-CRITICISM	PRIDE
	COMMUNICABILITY	PROPENSITY FOR PROFESSIONAL UPDATING
	ARROGANCE	RATIONALITY
	CHARISMA	RIGIDITY IN INTERPERSONAL RELATIONSHIPS
	COHERENCE	KNOWING HOW TO DELEGATE
	COURAGE	KNOWING HOW TO MANAGE GROUPS
	DETERMINATION	DISTRUST OF ONE'S COLLABORATORS
	EDUCATION	SAFETY
	EMPATHY	HUMILITY
	BALANCE	
	BE AN EXAMPLE	
	BE DISRESPECTFUL	
	BEING INFLEXIBLE	
	AVOID MAKING DECISIONS	
	COMMITMENT	
	LEADERSHIP	
	MOTIVATION	
VALUES		
VALUES	DISCIPLINE	
	FIDELITY	
	LOYALTY	
	SENSE OF DUTY	
	SENSE OF RESPONSIBILITY	
	ESPRIT DE CORPS	
	SPIRIT OF SACRIFICE	

Fig. 1 - Characteristics of success and failure of Cadets and Officers in the Army.

Tab. 2a - EFA item results for Officer Trainees.

	Factorial saturation		
	1	2	3
38. Sense of duty	0.790		
40 Spirit of sacrifice	0.699		
36. Loyalty	0.666		
26. Accountability/reliability	0.483		
24. Propensity to learn	0.370		
10. Organisational ability		0.760	
11. Charisma		0.720	
1. Communication skills		0.621	
16. Litigiousness			0.712
17. Selfishness			0.712
6. Arrogance			0.586

Tab. 2b - EFA item results for Officers.

	Factorial saturation		
	1	2	3
76. Sense of duty	0.818		
74. Loyalty	0.731		
79. Spirit of sacrifice	0.681		
58. Propensity for professional development	0.539		
67. Reliability	0.433		
65. Litigiousness		0.653	
41. Arrogance		0.517	
54. Being scarcely flexible		0.404	
45. Communication skills			0.630
46. Charisma			0.415
64. Security			0.360

Factor 1: Values conscientiousness; Factor 2: Organisational leadership; Factor 3: Selfishness/work immaturity.

responsible manner, acting, during one's career, in a manner consistent with them by adopting certain behaviours.

- Factor 2: *Organisational Leadership*

(e.g. item: Charisma; Extroversion), characterised by the officer's skills and traits that determine a responsible, organised and proactive action within the service, aimed at strategi-

cally managing men, materials and means.

- Factor 3: *Selfishness/work immaturity* (e.g. item: Arrogance; Litigiousness), which encompasses person-



ality traits that are not appropriate to the role, undermine relationships and negatively interfere with effective and efficient leadership, also highlighting instability related to low control of emotions.

For these three factors, the TLI index was 0.938 for Cadets and 0.944 for career officers. The RMSEA index was 0.052 for Cadets and 0.0436 for Officers. These values demonstrate good statistical validity of the analysis.

Analysis by independent sample t-test showed that:

- with reference to factor 1 'Values conscientiousness', no statistically significant differences emerged; therefore, adherence to the value set of military identity is to be considered equally important for both Cadets and Officers;
- with regard to factor 2 'Organisational Leadership', a statistically significant difference emerged between the average of Cadets and Officers ($t = 12.634$; $df = 454$; $p < .001$; Mean Diff. 0.35; d Cohen = 0.60). This can be explained by the fact that leadership is fundamental to the role of an officer in a military context. Conversely, for a Cadet it appears important but in terms of 'leadership aptitude', i.e. as a predisposition to develop this capacity, the effective expression of which is congenial only at the end of the training period, i.e. when the trainee definitively assumes the status of Officer and therefore of Commander of men;
- with respect to factor 3 'Selfishness/work immaturity', the comparison of averages shows no significant differences, suggesting that for both categories aspects of selfishness and immaturity in the work

context are negative factors for career success.

Discussion

By referring to the organisational culture of the Italian Army, the study identified three key factors that link the cross-cutting personality traits (soft skills) of cadets and serving officers. The first two determine success while the third determine unsuccess. These factors are: «Values Conscientiousness», «Organisational Leadership» and «Selfishness/Working Immaturity».

Regarding the first factor, scientific literature reports that conscientiousness, as a personality trait in the Big Five model, was found to be predictive of job performance in both civilian (25) and military (26, 27) samples. More specifically, a survey of 60 young officers who had completed a course found that high conscientiousness was positively correlated with 'planning performance' ($r = .27$) (28). All of this is supported by evidence from existing literature and reinforces the results of the present research.

With regard to the second factor, concerning organisational leadership, research (29) indicates that this area, which can be partly associated to the Extroversion trait of the Big Five model, can also bring added value to these military figures, correlating positively with performance ($r = .16$). These indications from existing literature corroborate the study findings.

Considering the third factor, however, also from the perspective of neuroticism and low emotional stability and in light of the Big Five model, a study carried out in an Indian Military Academy indicates that these constructs are negatively associated with success in military training

(30). The most recent literature confirms validity of the findings of this research, which was carried out in a bottom-up and not theory-driven manner.

Conclusions

In term of relevance, the results of this study, particularly the success factors, had an immediate practical implication. In fact, they were used to revise the profile of the Cadet's personality traits used in the psycho-aptitude selection phase of the recruitment process, which gets to reflect more accurately current reality and is therefore consistent and predictive with respect to the positive performance of a future officer.

The participatory mode of the research also allowed for 'secondary' effects within the institutional context, in particular:

- the participation of the Army top brass, who are in fact the principals of the entire selection process, was a significant opportunity for reflection and the definition of the Army's expectations for future officers, who are to be selected and trained in line with the development and continuous adaptation prospects of the military instrument;
- the involvement of some members of the organisation, such as military teachers, in the profiling process was instrumental in enriching their views on the subject, as well as strengthening their sense of belonging, motivation and responsibility;
- it was possible to initiate scientific analysis of the issues related the psycho-aptitude selection of military personnel to meet actual organisational requirements as far as possible.



Further research, either by enlarging and differentiating the study sample or also using a theory-driven (or mixed) approach, will be necessary to further develop knowledge in this specific field.

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ORIGINAL STUDY



Thirteen years of drug testing at the department of military forensic medicine in Rome: analytical results

Tredici anni di Drug Test presso il DMML di Roma: risultati analitici

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Abstract - The drug phenomenon has bio-psycho-social connotations that must always be borne in mind when assessing the health status of a military community as part of the wider population in which it operates. This retrospective epidemiological study, conducted at the DMML – Dipartimento Militare di Medicina Legale (Department of Military Forensic Medicine) in Rome, described over 13 years of EMIT tests on substances of abuse (drug tests) and benzodiazepines (BZDs), carried out for screening purposes on both military and civilian personnel and for medico-legal screening purposes on personnel of the Armed Forces and of State Corps referring to the DMML (central/southern Italy). An analytical study was also carried out on frozen samples stored at this Department, to assess any decay in the concentration of metabolites previously found positive and confirmed by the 2nd level test in previous years.

A positivity of 10.75% for BZDs emerged out of a total of about 4,700 samples and 1.10% for drug tests.

There were no drastic decreases in concentration in the tested substances after storage at different temperatures, even though storage at freezer temperature (-20°C and without excessive temperature fluctuations) is optimal compared to that in the refrigerator. There were also few changes between storage at refrigerator temperature and room temperature.

The extrapolated data from the years considered revealed a consistent level of abuse within the Armed Forces, as well as an increasing trend, primarily affecting the State and Police Corps. Notably, the latter are not subject to random checks. The high number of positive tests for BZDs is a factor deserving attention that opens an employment and occupational scenario on the motivations that drive State Corps and Police personnel to use/abuse such substances.

Riassunto - Il fenomeno della droga ha dei connotati bio-psico-sociali che devono essere sempre tenuti presenti quando si valuta lo stato di salute di una collettività militare che si inserisce nella più ampia popolazione in cui opera. Questo studio epidemiologico retrospettivo, condotto presso il DMML di Roma, ha descritto oltre 13 anni di test EMIT su sostanze d'abuso (drug test) e benzodiazepine (BZD), in ambito sia di screening per Esercito e Civili, che medico-legale in sede di accertamento d'idoneità per il personale di tutte le FF.AA e Corpi dello Stato afferenti al bacino d'utenza di questo DMML (Italia centrale/Sud); è stato altresì effettuato uno studio analitico in campioni congelati e conservati presso questo Dipartimento, onde valutare un eventuale decadimento in concentrazione dei metaboliti precedentemente riscontrati positivi ed anche confermati al test di 2° livello negli anni addietro.

È emersa una positività del 10.75% per le BZD su un totale di circa 4.700 campioni e del 1.10% per i drug test.

Non sono emersi drastici decrementi di concentrazione nelle sostanze esaminate dopo conservazioni a temperature diverse, pur in costanza del fatto che la conservazione a temperatura di congelatore (-20°C e senza eccessivi sbalzi termici) è ottimale rispetto a quella del frigorifero, e poco cambia tra quest'ultima e la temperatura ambiente.

I dati estrapolati dagli anni presi in considerazione hanno portato ad evidenziare un costante livello del fenomeno degli abusi in ambito FFAA ma anche un tendenziale incremento che riguarda soprattutto i Corpi dello Stato e di Polizia; personale, quest'ultimo, che non viene sottoposto a controlli randomici. Fattore che merita attenzione è l'elevato numero di positività alle BZD che apre uno scenario lavorativo ed occupazionale sulle motivazioni che spingerebbe il personale dei Corpi dello Stato e di Polizia all'uso/abuso di tali sostanze.

Keywords: drug test, BZB, army, EMIT method.

Key messages:

- The drug phenomenon has bio-psycho-social connotations that must always be kept in mind when assessing the health status of a military community.
- The abuse of cocaine and BZB in the analysed sample reflects the national trend.

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Introduction

The drug phenomenon has bio-psychosocial connotations that must always be kept in mind when assessing the health status of a military community that is part of the wider population in which it operates. At the laboratory of the Department of Forensic Medicine in Rome, a retrospective epidemiological study was carried out over a 13-year period (2012-2024) to assess the prevalence of drug addiction in our working environment based on data extrapolated from the Laboratory Information System (LIS). To this end, data was processed according to various criteria, bearing in mind that this specific environment is part of a broader one, not only within the Armed Forces and equivalent Corps, but also within the entire society of which they are part. Lastly, it was decided to submit 25 residual urine samples, which had already been subjected to Level 2 testing as positive, and which are now being disposed of due to the expiry of deadlines for possible counter-analysis by the interested parties. They were used for the re-determination of the substance(s) to which they were found positive at three different times and under different conditions. Data was compared in order to identify a pattern of concentration decay or, in any case, to ascertain the effects of long storage (more than two years) at the temperature required by law and, in some cases, of thermal stress due to the need to thaw the sample for the confirmation test and then re-storage it at -20°C for possible 'counter-analysis' for at least another three months as required by law. The period considered is quite long and there are various connotations of the variables that have occurred during this time frame. It follows that the results cannot be sugges-

tive, *tout-court*, of a clear increase/decrease of the drug phenomenon in the Armed Forces/State Corps compared to the rest of the population. However, it can be food for thought for a probabilistic reasoning to put in place appropriate measures in Preventive Medicine, especially in Primary Prevention.

Materials and Methods

In the relevant period, approximately 16,800 urine samples were screened for a total of approximately 100,000 determinations for the detection of urinary catabolites of drugs of abuse and benzodiazepines (BZD) by means of the EMIT (*Enzyme Multiplied Immunoassay Technique*) method using the *Abbott Architect c4000*[®] instrument at first and the *Abbott Alinity C*[®] instrument that allows quantitative determinations. In the report, the semi-quantitative determination emerges in relation to the automatic comparison, carried out between the instrument's computer and that of the LIS, between the stored result and the statutory cut-off, as programmed in advance. If the concentration is below the cut-off, the word '*Negative*' will be printed in the interfacing programme (and then in the report), otherwise '*Positive (waiting for confirmation test)*'. In the latter case, in addition to the repetition with method TLC (*Thin Layer Chromatography*) using the kit Alere[®] Multi-Drug Screen Cup with DxLINK Technology, the sample is stored at -20°C with the aliquot to be sent to the 2nd Level Laboratory. Tab.1 shows the legally required cut-offs of some substances of abuse and the average residence time in urine.

For the purposes of this study, data covering 13 years of activity, from 2012

(nine years) to 2024 were extracted from the LIS and, by means of MS-Excel[®] and MS-Access[®], unique records were obtained by person/date of execution with personal information, entity and service of affiliation and 1st and 2nd level results. Queries were then extracted in which grouping, 'filtering' and pivot tables were carried out, obtaining new tables on which to base graphs and tables. Where possible, statistical inference calculations were carried out, such as the Chi-square (χ^2) indicated for evaluating frequency distributions. With regard to the data concerning the year 2011 and the first three months of 2012, the statistics sent at the time were re-elaborated, while for data concerning the relapse for substance use in the year 2023, the statistics were extrapolated from the computer system in use at the Medical Commissions through the platform «Knowadge». The 4 quarterly tables were extrapolated, in Excel format[®] by merging them into a single table and then, through the «filter» function, the diagnoses inherent to the use of substances including alcohol were identified. Records were also filtered based on other data such as the service/State Corps, age (which can be obtained from the date of birth) and other. In comparing data with environments larger than the one considered, some meta-analyses of data extrapolated from relevant publications [1-3] were carried out. However, meta-analyses do not cancel out possible methodological biases. For example, population studies report relatively large samples but are often based on voluntary adhesion and adhesion rates that are affected by the varied distribution of healthcare facilities in the territory, with possible underestimates of the phenomenon.

With regard to the analytical re-determi-

nation of the 25 urine samples to be disposed of after the expiry of the legal storage periods and that were confirmed positive in many cases, the analytical determination was carried out on three successive dates, i.e. after de-freezing, the next day after approximately 24 hours of storage at refrigerator temperature (between 4 and 8°C) and the following day again after 24 hours of storage at room temperature. This was done to test the extent to which thermal stresses and storage time could affect the concentration of the substance. For obvious reasons of feasibility, only the first-level test was chosen. Finally, in order to obviate the possibility that results may have been affected by the blocking of the action of any urinary hydrolases, which may have been denatured by freezing, and thus inactivated, 1 sample that had been found positive was determined in duplicate the following day, dividing it into two aliquots: one stored at room temperature and the other at refrigerator temperature.

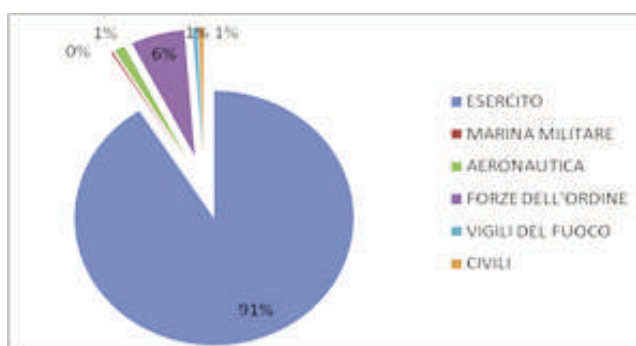
Results

During the period under review, approximately 16,800 urine samples were screened from about 12,000 persons. The apparent discrepancy in numbers between the number of samples and the number of people is often due to the same person being screened several times (for preventive and occupational medicine, and for recurrent positives). In the latter case (recurrence), especially if there is a sufficiently long time lapse with respect to the retention time of the metabolites in the urine (**Tab. 1**) between two determinations, any positivity is generally attributed to a new intake, which leads to the assumption that the use of substances is not occa-

Tab. 1 - Average urine residence time of certain substances and statutory cut-offs.

Metabolites	Average time in urine	Cut-Off 1st level*	Cut-off 2nd level**
Opiates	2-3 days	300 ng/ml	100 ng/ml
Cocaine	1-2 days	300 ng/ml	100 ng/ml
Cannabinoids	7 days if occasional use; 40 days if continuous use	50 ng/ml	15 ng/ml
Amphetamine	2-4 days	500 ng/ml	250 ng/ml
MDMA	1-5 days	500 ng/ml	250 ng/ml

* Annex A and, respectively, ** Annex B of the Regulation ([22]).



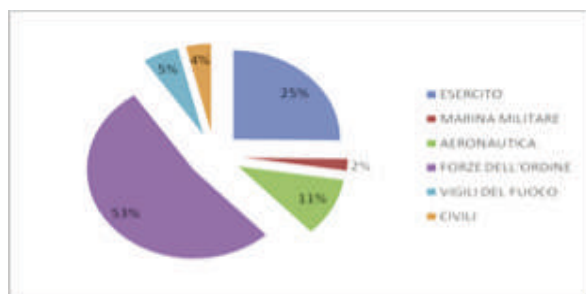
Graph. 1 - Overview of people screened.

sional. This is an element of undoubted prognostic and medico-legal value, naturally in connection with other variables. Requests for investigations, regardless of the reason, are broken down as follows (**Graph. 1**).

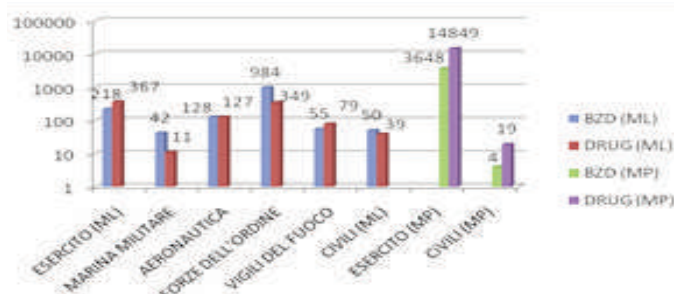
The preponderance of Italian Army personnel (91%) is evident, with the Police Forces (Carabinieri, Guardia di Finanza, State Police and Penitentiary Police) in a leading position (about 6%) compared with the other two services, the Fire Brigade and civilian personnel (about 1% each). However, it must be considered that there is a similar preponderance, for the Army, of preventive services («spot» checks, checks for military licences and for Occupational Medicine) that our laboratory carries out for external personnel at the request of

the various bodies in the area of responsibility, in addition to analytical determinations carried out at the request of the medical authorities (medical commissions and Observation Department) within this DMML as part of a medico-legal assessment.

Excluding, therefore, the analytical services delivered to external personnel (preventive rationale), those delivered in the medico-legal field become more comparable among all the Services/Corps, as shown in **Graph. 2**: here the Army covers a 25% proportion. With regard to processed requests, results related to drug-testing or/and BZD and broken down by Service/Corps are shown in **Graph 3**: first of all, to make the quantities comparable, given the numerical preponderance of Preventive



Graph. 2 - Overview of people screened in FM assessment.



Graph. 3 - Overview of examinations by Service/Corps.

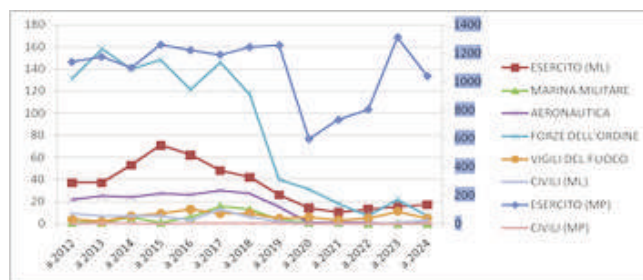
Medicine (PM) services for the Army, the «y» axis of the values was expressed in logarithmic terms on a base of 10; for the rest, PM services were also carried out for civilian personnel, although residual. Considering only internal analyses (left-hand side of the graph), in the forensic field (FM) the request for urinary BZD determination generally prevails over that for drug testing (with which it is often also associated), especially in the Police and State Corps.

Considering the trend of requests processed over time, the picture shown in **Graph. 4** emerges, which is a combination in which the PM performance trend for the Armed Forces, with its value axis on the right, has been superimposed on everything else to better visualise the curve obtained, allowing easier comparison. This shows, among other things, a relative preponderance of requests in the FM area for the Police Forces, which, as shown above, mainly concerned BZD. However, this was relatively constant until 2018, with a drastic decline in the following years and a minimum in 2022. This can be explained by the fact that it was at this time that the Psychiatric Service of this Department decreased its requests for drug tests and urinary BZDs. On the other hand, as far as the Army is concerned, we observe a peak in forensic and preventive medicine services in 2015, followed by a clear decline, partic-

ularly in preventive medicine, in 2020. There was a slow recovery in subsequent years, with a substantial restoration of the previous trend. This is evidently to be attributed to the reduction of activities during the COVID-19 lock-down. For the other services, the Fire Brigade and civilians, the trend after 2020 must be considered stationary.

In light of these results, apart from 92 samples (0.54% of the total) which were rejected due to unsuitability for analysis at level 1 or for some other reason (sample not received or removal of the subject during collection), there were 611 samples positive for at least one substance, i.e. approximately 3.64% of the total, divided between 454 BZDs (2.70% of the total) and 174 drug tests (1.03% of the total), which were often associated. Considering that the total number of BZDs and drug tests/person is around 4,700 and 14,600 respectively, the percentage of positivity of the total between drug tests and BZDs will be 1.10% and 10.75% respectively, the latter concerning mainly the medico-legal field. A synoptic overview of the above is given in **Tab. 2**.

Given the numerical, positivity and even conceptual gap between the two types of substances, illicit drugs being drugs and medicinal drugs (except for 'self-medication') BZDs, it is advisable to consider them separately, even though sometimes, as will be seen, positives can be associated in the same person, but are not always indicative of actual BZD consumption, since high doses of the metabolites of all drugs can lead to a false positive result for BZDs. In any case, for economic and organisational reasons, this laboratory only requests a confirmatory test for drugs under the law. Generally speaking, the subject 'peacefully' admits to taking BZDs without the need for a medico-legal adversarial procedure, as in the case of drugs. The comparison between drug test positives and BZD positives shows first of all that positives recorded in connection with Preventive/Occupational Medicine and Forensic Medicine (FM) were only identified within the Army. A picture of raw posi-



Graph. 4 - Trend in testing procedures over the years.



Tab. 2 - Overview of results.

Analyses	Examined	Positives	% of positives on type of analytes tested*	% of positives on urine samples**
Drug testing	15800	174	1.10%	1.03%
Benzodiazepines	4220	454	10.75%	2.70%
Totals	20020***	628	3.13%	3.74%

* BZD or Substances of Abuse, tests often performed on the same urine sample, as required.

** These percentages are calculated based on the total of 16795 urine samples (net of rejected samples) on which BZD and/or substance of abuse catabolites were determined.

*** No. given by the sum of procedures, whether BZD is associated with a substance of abuse.

Tab. 3 - Overview of positives.

	Drug test No.	BZD No.
Army (PM)	64	6
Army (FM)	43	44
Navy	4	16
Air Force	9	27
Law Enforcement	37	343
Fire brigade	6	5
Civilians (FM)	2	17

tives therefore emerges as shown in **Tab. 3** and **Graph. 5**.

Graph. 5 shows a trend in positive results that is essentially parallel to that of requests in comparison with **Graph. 3**. This parallelism becomes clearer when considering only Forensic Medicine determinations: there is a reversal of the trend related to the more frequent positives for substances of abuse in PM compared to the higher frequency of

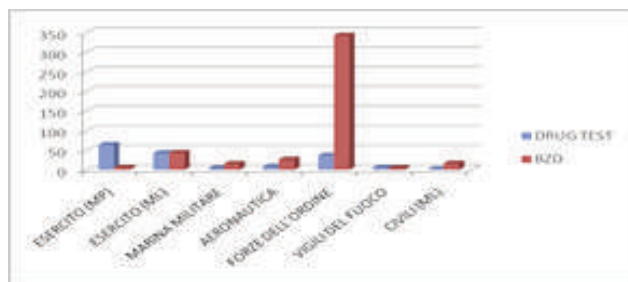
positives for BZD in FM. This trend appears to be more pronounced for law enforcement agencies, in line with the trend in requests highlighted above. When assessing the percentages of the annual total of determinations by type of substance (drug test or BZD), the picture in **Graph. 6** emerges, which is also of a combined type in that the order of magnitude of the percentages of drug test positivity (right-hand value axis), is

lower than that of BZDs (left-hand value axis) by a factor of 10.

A peak in benzodiazepine (BZD) positives in 2015, with

more than one positive result for every two determinations (55.88%), is evident, which then fades the following year until declining from 2017 to 2020.

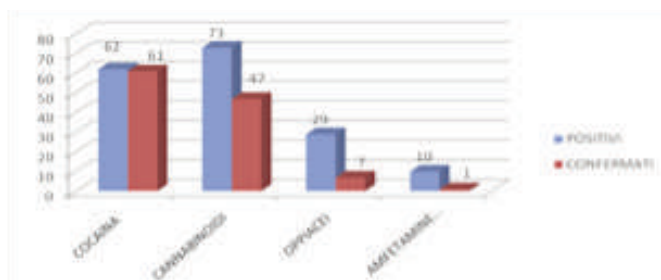
With regard to the analytes, it should be noted that the four basic substances of drugs according to the law (Amphetamines/Methamphetamines, Cannabinoids, Cocaine and Opiates) were taken into account, meaning that Methadone and Ecstasy (MDMA), for technical reasons, were incorporated into Opiates and Amphetamines/Methamphetamines respectively. It should be emphasised that a drug test positive indicated above will be confirmed by the Level 2 test. There were in fact several cases of false positive (**Graph. 7**). In one case the sample was not accepted due to flaws in the compilation of the accompanying documenta-



Graph. 5 - Samples tested positive at Level 1.



Graph. 6 - % BZD and drug positives on annual totals.



Graph. 7 - Comparison of positivity in the level 1 test and the confirmatory test.

tion.

A comparison of the number of positive samples per substance at Level 1 with the number of confirmations shows that, from cocaine to cannabinoids, opiates and amphetamines, the percentage of confirmations decreases progressively. In particular, only one sample of cocaine, out of a total of 62, was unconfirmed, while for cannabinoids the proportion of confirmed cases decreases markedly to the point where unconfirmed cases for opiates (9 out of 29 confirmations) and amphetamines/methamphetamines (only 1 out of 10 confirmations) predominate. It is evident that cannabinoids in this context are relatively frequent; however, in terms of true positivity, cocaine is of relevance. Substances that generally cross-react with cannabinoids, reported in the anamneses of Annex C (22), are mostly NSAIDs, (Ibuprofen, Niflumic acid); antihistamines, amiloride, sertraline, hyoscine are also reported in

anamneses.

Opiates often include codeine (i.e. methyl morphine) associated with NSAIDs, which is considered by some to be a drug at high doses, but which falls within the prescribing discretion of physicians. Beta-2 agonists are also reported. With regard to amphetamines and methamphetamines, triprolidine- and pseudo-

ephedrine-based preparations (zerinol[®], actigrip[®], Actifed[®]) as well as imodium[®], riopan[®], spasmomen[®], and unspecified supplements are reported in the anamnesis. **Tab. 4** shows the substances which, according to existing literature, cross-react with the substances in question, giving false positives.

In view of the above, **Graph. 8** shows the trend of confirmed positives in the

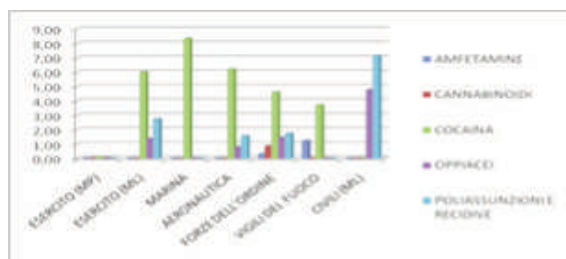
various Services/Corps in the years under review, in percentage against the number of determinations per Services/Corps per year.

When lumping all Preventive Medicine determinations together (those related to the Army plus the residual 19 determinations for civilian personnel with no positive results, **Graph. 3**) it may make sense to compare the Forensic Medicine positives and Preventive Medicine positives over the years, as shown in **Graph. 9**.

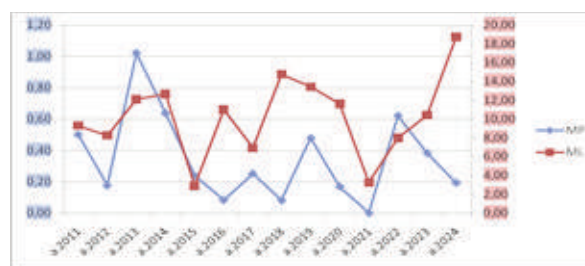
A peak of positives for external personnel emerges in 2013 (about 1/100 determinations) compared with a minimum of positives for internal personnel in 2015 and a maximum in 2024 bordering on 20%, meaning that 1 in 5 (20%) of drug tests in the medico-legal sphere were likely to have a positive result, later confirmed. All this is explained in the context of the different significance of a preventive, screening assessment compared to an assessment carried out in the medico-legal field. While the former identifies a possible positive in a relatively large number of persons, the latter tends to ascertain whether a subject, already known to have tested positive or suspected positive, re-presented this characteristic or whether the suspicion was confirmed.

Tab. 4 - Substances interfering with Level 1 analyses.

Test substance	Cross-reagent substances (possible sources of false positives)
Amphetamine	LabelatolRanitidinePseudoephedrine; Nafazolin nitrate; Chlorphenamine maletateTricyclic antidepressants
Cannabinoids	Niflumic acid; Ibuprofen
Cocaine	Lidocaine; Carbocaine (e.g., in dental extractions)
Opiates	Codeine (methyl morphine); Buprenorphine hydrochloride



Graph. 8 - Services/Corps positives as % of total determinations.



Graph. 9 - Positive % for drug tests in Preventive Medicine and Occupational Medicine.

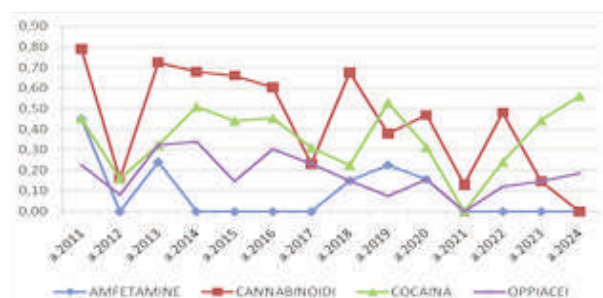
It is interesting to consider the trend of confirmed positives over time, as shown in **Graph. 10**, where it is evident that the preponderance of positives is attributable to cannabinoids and cocaine, amphetamines/methamphetamines being very residual, except for sporadic peaks. However, it is worth noting that, although cannabinoid positives had a relative preponderance in the years 2012-2018, it cannot be said that the phenomenon has decreased, given the fact that the number of requests for drug

tests in the medico-legal area also decreased from 2018 onwards. Despite this, the relative increase in positive tests for cocaine and for opiates is evident, which is consistent with the data in existing literature except for cannabinoids. For the latter the age factor may also be concealed.

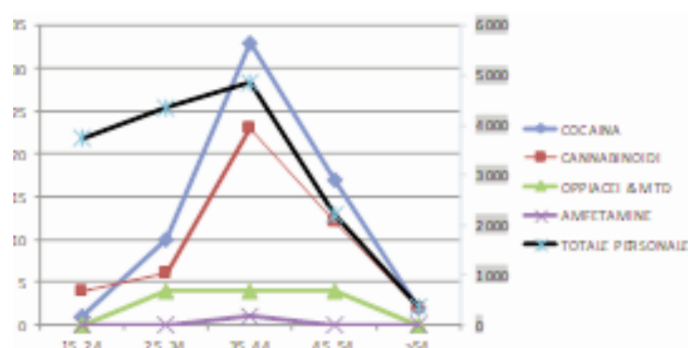
Graph. 11 shows that in the 15-24 age group the number of positives for cannabinoids is greater than for cocaine, but numerically this group is underrepresented (3,762 persons) in the sample

compared with the 25-34 age group (5,632 persons), given the fact that in the general population the use of cannabinoids is more common in young people (2, 23). The sample under review shows that the peak age of positives has shifted by one group age compared to what is reported in the literature (1).

Going back to Figure 8, some reflections should be made with regard to poly-drug use and recurrences. In all, there were 24 cases, which revealed positives for more than one substance, given mostly by



Graph. 10 - Trend in positives by substance.



Graph. 11 - Positivity by substance across age groups.

Tab. 5 - Overview of polydrug users and repeat users by substance and by Service/Corps.

	Cocaine	Canna-binoids	Opiates	Totals	Army	Air Force	Law Enforcement	Civilians	Totals
Polyaddicts	13	10	2	14	7	1	5	1	14
Repeat users	9	9	3	16	6	2	6	2	16
Totals	17 (21)	15 (19)	3 (5)	24 (30)	10 (13)	3	8 (11)	3	24 (30)



cocaine plus cannabinoids (8 cases + 4 recurrences of polydrug use), followed by cocaine plus opiates (2 cases), cocaine plus opiates and methadone (1 case) and methadone plus opiates (1 case). In one case there was a previous cocaine positive and a second cannabinoid positive. It should also be noted that in 16 cases positivity was recurrent in measurements so far apart as to suggest non-occasional intake (**Tab. 5**).

Although they cover a small percentage of the military population, the double positive cases and the tendency to relapse nevertheless concern people suffering from an overt abuse problem (addiction). This problem can only be eradicated with a multidisciplinary and continuous approach over time, given the high relapse rate among poly/multi-addicts. Regarding the breakdown of positives according to gender, it should be noted that only 3 women (2 in the State Police and 1 in the EI) tested positive, among them 1 (State Police) positive for cannabinoids due to reported therapeutic use of these substances. Applying the Chi square (χ^2) to ascertain whether there is a relationship between PM or FM

tests and substances or/and positivity with time periods, to calculate the theoretical frequencies to be used for the relevant calculations, values of less than unity were obtained. Similar results were obtained in the theoretical contingency tables FM/PM vs. years of analysis. For these reasons, it was not possible to consider this type of test reliable, the result of which gives a value of less than unity in any case. Applying the χ^2 test can be more useful and reliable in view of the findings in **Graph. 4**, focussing on the relevance of the period before and after 2019 and the positives in both PM and FM.

Against this background, it is evident that even if we merge the frequencies and thus obtain theoretical frequencies greater than unity, the χ^2 does not reach the critical value of 3.84 associated with the minimum α level of statistical significance at 5% for one degree of freedom. This confirms what is empirically ascertainable: no relevance emerges between increase in positivity and the period considered nor between positivity and armed forces. To get an idea of the dimensions of the phenomenon, an initial reference was made to what is

reported in the literature on the Armed Forces in Italy - over a more limited period than the one considered here - and the general population as a term of comparison (23) in the same period. Some elements of this assessment were compared with more recent data (2) referring to the age groups most compatible with those of this work, as shown in **Tab. 6**. It emerges that, between 2013 and 2022, annual drug use has almost doubled, with cannabis being the most widely used substance. However, the proportion compared to other substances varies, with an increase in cocaine and opiates, as well as the emergence of new psychoactive substances (NPS).

Taking as a starting point the predicted downward trend between 2010 and 2012 (1.23), the question was whether; by comparing the Reports to Parliament (2.23), it would continue to decline in the years up to 2022, resulting in a picture as in **Tab. 7** and **Graph. 13**. In the latter, to make the trends related to cannabis abuse and other substances comparable, it was necessary to rework the axis of values in logarithmic form on a base of 10 and, for this purpose, to multiply all

Tab. 6 - Contingency table - National situation comparison between 2013 and 2022.

Actual frequencies, relative totals and overall total				Expected frequencies	
	PM	FM	Total	PM	FM
Years 2011-2018	33	69	102	35,60	66,40
Years 2019-2024	19	28	47	16,40	30,60
Total	52	97	149	$\chi^2 = 0.91 < 3.84$	

	2014 Report to Parliament [23]	2023 Report to Parliament [2]
Use of an illegal substance at least once in the year	~ 5% (4.96% or 2300000 persons for 2012)	~ 10% (approx. 10900000 as of 2017)
Most used substances	Cannabis (79.44%) > Cocaine (2.02%) > Heroin (1.01%), stimulants (1.21) > Hallucinogens (0.4%); poly-abuse 13.51% (see also Graph.15)	Cannabis (63%) > Opiates (12%) > Cocaine (8%) > Stimulants (7%); Hallucinogens (5%); NPS 5%. Not reported poly-drug use*

*What is shown in this field is a reworking of the graph Graph. 2.1.4 on page 74 of the Report. The acronym NPS stands for New Psychoactive Substances. The considerations on p. 68 show that the population is predominantly male with an average age of 35.

Tab. 7 - Consumption in the last year in the Italian adult population in the years 2006-2022.

	2006	2008	2010*	2011**	2012*	2014**	2017**	2022**
Hallucinogens	0,6	0,6	0,21	0,30	0,19	0,30	0,30	0,90
Heroin	1,4	1,7	0,24	0,40	0,14	0,80	0,50	01,40
Stimulants	0,6	0,8	0,29	0,40	0,13	0,50	0,40	1,00
Cocaine	2,3	2,2	0,89	1,30	0,60	1,10	1,20	1,40
Cannabinoids	11,1	14	5,33	8,50	4,01	9,00	10,40	10,80

* See Favasuli et al. (1, p.6) and GPS-DPA 2010 and GPS-DPA 2012 Studies - Anti-Drug Policy Department in [23], p.17

** From CNR-IFC in [2], p. 75-85 with reference to 'Consumption in the last year' only

percentages by 10 to eliminate values below unity.

It is evident that the downward trend depicted in **Graph. 12** in the area enclosed by the rectangle drawn between 2010 and 2012 with some trend lines, is a parenthesis between two periods when trends were higher for all five substances considered. Cannabinoids still occupy first place, followed by cocaine and opiates. After a relatively slight decline in the years 2010-2012,

they 'regain ground' in the following years, so much so that, according to the annual report of 2023([2]) , they represent an upward trend can be expected for all substances.

In **Graph. 13** The above substances were categorised alongside with other substances/behaviours that are conducive to abuse. Leaving aside cocaine/crack, stimulants and opiates, a substantially parallel trend can be seen as to cannabinoids, binge drinking on the one hand and

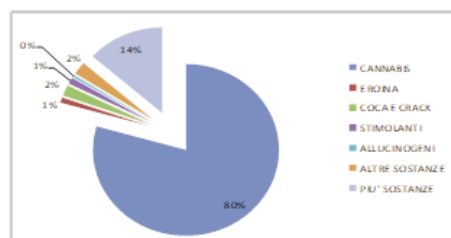
drunkenness on the other, while pathological gambling (PG), after a surge from 2014 to 2017, tend to decrease, although it remains at higher levels than in 2014. Tobacco also appears to be decreasing. Turning to the military context, it is appropriate to begin with a comparison of the general population and the military population over the period 2011-2015, before presenting the findings relevant to our situation.

Graph. 14 shows the percentage compo-

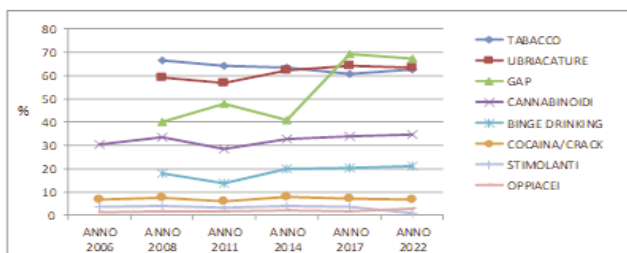


Graph. 12 - Trend of abuse in the Italian population in the years 2006-2022.

Sources: Annual reports to Parliament on the drug phenomenon - years 2014 [23] and 2022 [2].

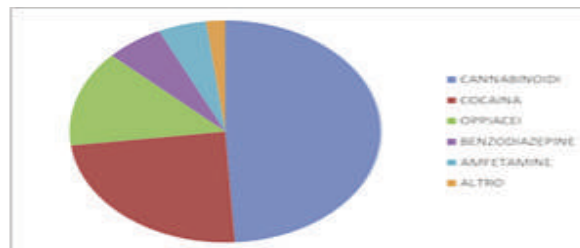


Graph. 14 - Percentage composition of positives in the population (year 2012).



Graph. 13 - Comparison of cannabis and other intake in the 18-64 year-old population.

Source: CNR-IFC, in [2], pp. 75 - 134: Combination of data on 'lifetime consumption' of cannabinoids versus tobacco, alcohol and gambling in the years 2006-2022.



Graph. 15 - Percentages of positivity by substance categories found in screened military personnel - 2011-2015.



sition of drug positives in the Italian population in 2012, as also anticipated in **Tab. 6**, while the distribution of the percentage of positives in the military in the above-mentioned period had the distribution shown in **Graph. 15**.

This made it possible to compare data from this department with the military population (**Graph. 16**).

It is worth noting that cocaine (BDZ deliberately excluded) is more prevalent than cannabinoids. On the other hand, **Graph. 17** shows that, during the review period, the sample evaluated at this laboratory was smaller than the national Armed Forces/Carabinieri sample, with a higher proportion of permanent service personnel. These personnel are older than the population's peak age for this substance (see Graph 11). However, there are no comparisons in that publication for the Police Forces other than the Carabinieri, nor for the Fire Brigade and civilian personnel.

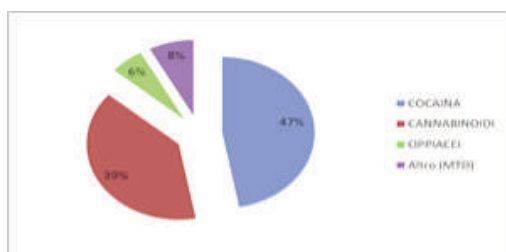
Finally, it is worth comparing the present day (2023) with the findings of a past

study carried out at this DMML concerning the period immediately before the period considered (2007–2010). In relative percentage terms, there was a steady decline in substance use in psychiatric diagnoses, which fell from 6% in 2007 to 4% in 2008 and 2009, and then to 2% in 2010 (lower than current values). In 2023, however, the following emerges:

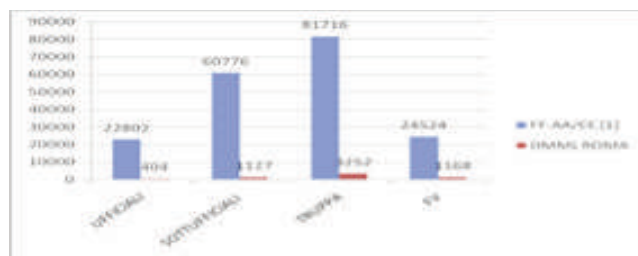
- about 5,300 eligibility files with about 700 psychiatric diagnoses (~13% of the total)
- about 19 diagnoses reporting the use of substances and alcohol (**2.71%**, up from 2010).

It is therefore evident that in this case, too, the trend indicated in this publication (3) constitutes another 'parenthesis' in a wider fluctuation. For the technical reasons mentioned above, we ignore the trend over these twelve years. However, the percentage has risen slightly from 2% to 2.71%, and there is good reason to believe that the phenomenon is underestimated. This is partly due to the decline

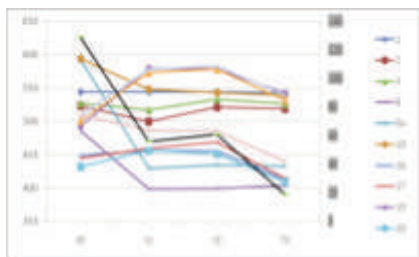
in requests beginning in 2019 and exacerbated by the lockdown in 2020. The second phase of the study involved analysing 25 urine samples to capture any substantial changes in catabolite concentration. This was done in view of the samples being stored in freezing conditions, and the thermal stress they had undergone by the time they underwent Level 2 testing. This included the necessary thawing and refreezing processes up to the present time. Since a triple positive (cocaine, opiates and benzodiazepines) was occasionally found in a urine sample (now disposed of) on the same day as the initial test, in addition to the evaluation by the alternative method and preparation of the sample for the usual Level 2 test, a small 4cc urine sample was stored in two 2cc aliquots to be retested the following day, after storage of the two aliquots at room temperature and in the refrigerator, respectively. Urine samples were thus taken from 22 persons, 20 men and 2 women: for one the urine was collected



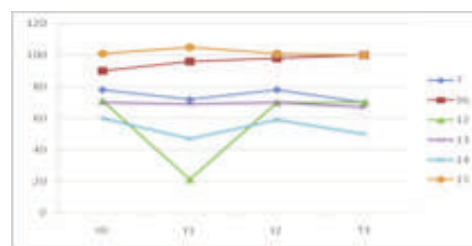
Graph. 16 - Total positive drug tests, years 2011-2015 DMML, Rome.



Graph. 17 - Graph 17 - Number of screened subjects by category. Years 2011-2015. From [1] Tab.V p. 8.



Graph. 18 - Trend in cocaine-like concentrations.



Graph. 19 - Trend in cannabinoid concentrations.



Tab. 8 - Urine samples retested prior to disposal.

Person	Urine samples stored until disposal				Concentrations measured ng/mL					
	N°	Date 1st level	Positivity	Result of 2nd level	t ₀ Initial conc	t ₁	t ₂ a T.a.		t ₃ to T.a	
A	1	25/1/22	Cocaine	Confirmed	544	544	544		543	
	2	7/6/22	Cocaine	Confirmed	523	500	521		519	
	3	7/12/23	Cocaine	Confirmed	527	517	533		526	
B	4*	9/1/23	Opiates	Negative	2800	873	2883		2110	
C	5	25/10/22	Opiates	Not carried out	3650	3560	3308		3300	
	6	13/4/23	Opiates	Confirmed	3752	3291	3388		3392	
D	7	26/5/22	Cannabinoids	Negative	78	72	78		70	
E	8	18/7/23	Cocaine	Confirmed	486	399	400		404	
F	9a	18/7/23	Cocaine	Confirmed	593	430	435		433	
	9b		Cannabinoids	Confirmed	90	96	98		100	
G	10	9/3/23	Cocaine	Confirmed	594	548	543		539	
H	11	22/6/23	BZD	Not sent	819	822	917		914	
I	12	15/11/22	Cannabinoids	Confirmed	71	51	70		70	
K	13	10/11/22	Cannabinoids	Negative	70	69	70		67	
L	14	20/9/21	Cannabinoids	Negative	60	47	59		50	
M	15	16/10/23	Cannabinoids	Confirmed	101	105	101	99	100	99
N	16	16/10/23	Cocaine	Confirmed	449	456	456	468	413	423
O (7)	17	19/10/23	Cocaine	Confirmed	445	460	469	464	415	417
P	18	6/2/24	Cocaine	Confirmed	129	56	61	57	19	20
Q	19	22/2/24	Cocaine	Confirmed	492	580	578	577	542	537
R	20	11/4/24	Cocaine	Confirmed	432	456	451	456	409	416
S	21	16/4/24	Opiates	Negative**	1115	630	546	651	554	581
T (7)	22	23/4/24	Methadone	Not carried out	568	568	569	590	494	412
			BZD		310	269	266	229	265	244
U	23	20/5/24	Cocaine	Confirmed	501	573	578	573	532	528
V***	24	24/6/24	Cocaine	Confirmed	509	578	583	574	539	533
			Opiates	Confirmed	769	697	603	615	618	613
			BZD	Not carried out	113	111	112	125	111	118
Z	25	11/11/24	Cocaine	Confirmed	510	487	486	485	440	443

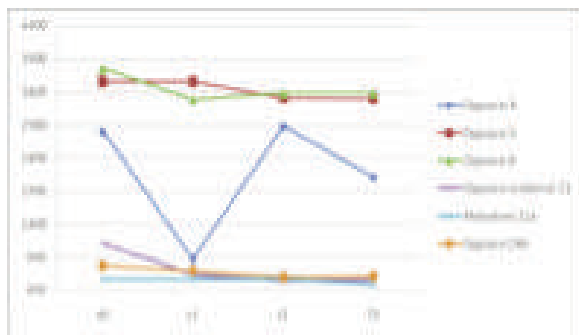
*Sample 4 was also positive for alcoholuria;** Codeine in drug history; ***Same person as in Graph 22

three times, for another 2, for all the others only once.

Tab. 8 shows that cocaine tends to be confirmed on the Level 2 test, while

cannabinoids and opiates are less likely to due to the possibility of false positives. It is evident that the concentration tends to decrease between time t₀ and t₁; espe-

cially for cannabinoids, opiates and BZDs, but then increases at time t₍₂₎ (samples 4, 11 and 12) up to the original concentration (t₀). This underestimation may



Graph. 20 - Trend in opiate concentrations.

be due to the presence of possible non-covalent bonds (e.g. hydrogen bonds, van der Waals forces and hydrophobic interactions) between the metabolite and other molecules in the biological liquid. These bonds are favoured above all by freezing; at cooler temperatures, the molecules are detached by thermal agitation.

(BZD in **Graph 22**). Clearly, the normal fluctuations of the analytical method are also included where the final concentration appears to exceed the initial one (**Graph. 19**, sample 9b). Compared to the other molecules, cocaine (**Graph. 18**), evidently because it is more hydrophilic, tends to decrease in concentration between time t_0 and t_3 , especially in samples 8, 9a and 18, which were subjected to greater thermal stress, an effect that is most evident at a relatively very low concentration (sample 18 shown in the secondary y-axis on the right). Conversely, other samples describe fluctuating trends. In any case, these are small concentration nuances, justifiable in the context of Level 1 determinations. **Graph. 22** shows that after de-freezing little changes between storage in a refrigerator and at a temperature between 20 and 22°C.

Discussion

Clearly, the trend in findings related to

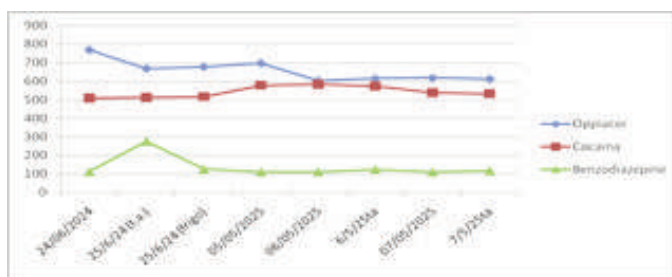
substance use reflects, on the one hand, the requests of those in authority and, on the other hand, the availability of psychological/psychiatric investigations

following the detection of substance use. For this reason, the trend of positive results over the years does not reflect national trends in general, or military trends in particular. This may be due to several factors, including fewer requests for testing, the lockdown and reduced personnel, as well as the inevitable decay of drug concentrations due to delayed detection. It is not known whether the shortage of tests carried out at this location has been offset by an increase in testing at other laboratories. However, the following general 'rule' is evident: the better prepared a health service is — even a forensic one — the more accurately it reflects the trend of a phenomenon in the reference population.

In any case, the preponderance of positivity for cocaine, especially in recent times, is reflected in the increase of the phenomenon at a national level, as



Graph. 21 - Trend of BZD.



Graph. 22 - Trend in concentrations at different temperatures and over time in a sample.

evidenced by the consultation of national data in general (2, 12, 23) and in the military context. Although lower than that for cocaine, the positivity for cannabinoids is still relevant given that cannabinoids and cannabis sativa derivatives are considered 'soft drugs' in the common understanding. This may lead to an underestimation of the problem, which may become insidious and unmanageable, in the same way as others such as alcoholism, pathological gambling (GAP) and smoking, with which it is compatible in terms of frequency (**Graph. 14**).

However, even when the magnitude is low, the risk becomes appreciable when multiplied by frequency, due to the long-term effects of THC and the Gate-Theory, which sees cannabis use as a precursor to heavier drugs. In this study, however, positive tests for cannabinoids were carried out at a later age than positive tests for cocaine. These elements make a



preventive approach even more necessary, especially at a younger age and during the recruitment process. Since January 2025, this has been the case for aspirant enlisted personnel at the Recruitment Centres. In fact, in the first four months of activity, two positive cannabinoid tests were recorded out of approximately 1,000 tests (0.2%), specifically among those aged 15–24.

Conclusions

The drug phenomenon has bio-psychosocial connotations that must always be borne in mind when assessing the health status of a military community as part of the wider population in which it operates. When considering preventive, curative and forensic medicine over time, the latter should be an expression of the results of the former and a verification point. On the other hand, if we consider 4Ps Medicine, the timeline becomes circular, or better spiral-shaped, and Forensic medicine can provide a starting point for future curative, preventive and rehabilitative interventions aimed at improving the situation. At an epidemiological and supra-individual level, it can provide data that lead to the timely implementation of measures to avoid the adverse outcomes examined in this study.

In this regard, it should be noted that in the «P» of Prevention several authors - including M. Jarmouille, 1986; T. Kuehlein, 2010 - incorporate quaternary prevention, i.e. overmedication, in relation to, for example, the long-term effects of cognitive decline associated with BZD abuse (P. Gareri & coll., 2018) in individuals predisposed to Alzheimer's disease.

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Nursing management of psychiatric emergency or urgency: acute amphetamine-induced psychosis. A review of the literature

Gestione infermieristica dell'emergenza-urgenza psichiatrica: la psicosi acuta indotta da anfetamine. Una revisione della letteratura

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Abstract: This study examines the management of acute amphetamine-induced psychosis in psychiatric emergency settings, focusing on the role of nurses. A systematic literature review was conducted, analysing thirteen qualitative and quantitative studies published within the last five years, as well as academic handbooks and regional guidelines. The results highlight variability in care approaches and operational difficulties in managing agitation and mechanical restraint. Nurses play a pivotal role in the early identification of symptoms and de-escalation interventions, yet they encounter significant challenges pertaining to training and working conditions. The study emphasises the need for standardised protocols and targeted training to improve clinical management and the well-being of healthcare personnel.

Riassunto - Questo studio esamina la gestione della psicosi acuta indotta da anfetamine nei contesti di emergenza psichiatrica, con particolare attenzione al ruolo infermieristico. È stata condotta una revisione sistematica della letteratura, analizzando 13 studi qualitativi e quantitativi pubblicati negli ultimi 5 anni, oltre a manuali accademici e linee guida regionali. I risultati evidenziano la variabilità degli approcci assistenziali, le difficoltà operative nella gestione dell'agitazione e il ricorso alla contenzione meccanica. Gli infermieri svolgono un ruolo chiave nel riconoscimento precoce e negli interventi di de-escalation, ma affrontano criticità legate alla formazione e alle condizioni lavorative. Lo studio sottolinea la necessità di protocolli standardizzati e percorsi formativi mirati per migliorare la gestione clinica e il benessere del personale sanitario.

Key words: Acute induced psychosis, substance abuse, nursing management, aggression management, work environment.

Key messages:

- Effectiveness in caring for patients with acute amphetamine-induced psychosis depends on timely clinical assessments and coordinated therapeutic approaches.
- The quality of care depends on the training of nursing staff and appropriate organisational conditions.

Introduction

Amphetamine-induced psychosis is a psychiatric condition characterised by psychotic symptoms such as paranoid delusions and visual and auditory hallu-

cinations that occur during or immediately after amphetamine use. These symptoms differ from those of primary psychotic disorders, which may precede the onset of substance use or occur during periods of prolonged abstinence.

Once initiated, the psychotic symptoms continue for as long as the substance is used. Amphetamine use is widespread globally, with rates of up to 1.3% of the adult population in some areas. Among chronic methamphetamine users (an

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amphetamine derivative), 26%–46% develop psychotic symptoms during their lifetime. Psychosis is more prevalent among regular users and individuals who take high doses. Risk factors include an early age of onset and prolonged abuse. Amphetamine psychosis is mainly associated with drug-induced dopaminergic and glutamatergic dysfunction. Amphetamines stimulate the release of dopamine and inhibit its reabsorption, leading to excessive activity in brain circuits involved in perception and thinking. The duration of use and the amount of the drug taken are strongly correlated with the risk and severity of psychosis. In addition, genetic factors, such as predispositions linked to dopaminergic genes, may contribute to individual vulnerability. Managing acute amphetamine-induced psychosis in psychiatric emergency settings is a complex clinical area requiring specific relational and technical skills (15). The analysed studies highlight significant critical issues in the assessment and treatment of patients, with particular emphasis on the crucial role of nurses. Existing literature emphasises the ethical and operational challenges associated with managing agitation risks, using restraints, and implementing de-escalation interventions (7).

Materials and Methods

The study aims to analyse recent nursing methods in emergency contexts, which are integral to the management of acute aggression. A literature review was conducted based on the following research question: ‘What specific assessments, interventions and techniques should nurses apply when managing psychiatric emergencies related to acute amphetamine-induced psychosis?’ The

Tab. 1 - PICO method formulated from the primary research question.

Population	Intervention	Comparison	Outcomes
Patients with acute amphetamine-induced psychosis in emergency-emergency settings	Specific nursing assessments and techniques	//	Management and stabilisation

Tab. 2 - Overview of the search strategy adopted.

Database	Mesh terms	n articles	selected articles	Articles
MEDLINE [via PubMed].	(amphetamine psychosis) AND (pathophysiology)	15	1	Cohen-Laroque J, et al. <i>Positive and negative symptoms in methamphetamine-induced psychosis compared to schizophrenia: A systematic review and meta-analysis.</i> 2024, <i>Schizophr Res.</i>
	(amphetamine psychosis)	170	1	Dimy Fluyau, Paroma Mitra and Kervens Lorthé <i>Antipsychotics for Amphetamine Psychosis: A Systematic Review.</i> 2019, <i>Frontiers in Psychiatry</i>
	(induced psychosis) AND (differential diagnosis)	28	2	Fiorentini A, Cantù F, Crisanti C, Cereda G, Oldani L, Brambilla P. <i>Substance-Induced Psychoses: An Updated Literature Review.</i> 2021, <i>Frontiers in Psychiatry</i> .
				Cambra Almerge J, Sánchez-Romero S, Arias Horcajadas F. <i>Differences between substance-induced psychotic disorders and non-substance-induced psychotic disorders and diagnostic stability.</i> 2023, <i>Adicciones.</i>
	((emotional impact) AND (mental health of nurses)) AND (psychiatric care)) AND (psychiatric nurse) (psychiatric units) AND (resource limitations)	26	1	Bekelepi N, Martin P. <i>Support interventions for nurses working in acute psychiatric units: A systematic review.</i> 2022, <i>Health SA Gesondheid.</i>
		55	1	Johnson S, Dalton-Locke C, Baker J, Hanton C, Salisbury TT, Fossey M, Newbigging K, Carr SE, Hensel J, Carrà G, Hepp U, Caneo C, Needle JJ, Lloyd-Evans B. <i>Acute psychiatric care: approaches to increasing the range of services and improving access and quality of care.</i> 2022, <i>World Psychiatry.</i>
	((De-escalation Techniques) AND (Aggression Management)) AND (Psychiatric)	16	3	Celofiga A, et al. <i>Effectiveness of De-Escalation in Reducing Aggression and Coercion in Acute Psychiatric Units: A Cluster Randomized Study.</i> 2022, <i>Front Psychiatry.</i>
CINAHL [via Ebsco].				Fernández-Costa D, et al. <i>Alternatives to the Use of Mechanical Restraints in the Management of Agitation or Aggressions of Psychiatric Patients: A Scoping Review.</i> 2020, <i>J Clin Med.</i>
				Price O, et al. <i>De-escalating aggression in acute inpatient mental health settings: a behaviour changes theory-informed, secondary qualitative analysis of staff and patient perspectives.</i> 2024, <i>BMC Psychiatry.</i>
	((triage) AND (emergency psychiatric services)) AND (nursing)	3	2	Rajab Dizavandi F, Froutan R, Moonaghi HK, Ebadi A, Fayyazi Bordbar MR. <i>Mental Health Triage from the Viewpoint of Psychiatric Emergency Department Nurses: a Qualitative Study.</i> 2023, <i>Archives of Academic Emergency Medicine.</i>
				Stigter-Outshoven C, Van de Glind G, Wieberdink LJ, van Zelm R. <i>Competencies Emergency and Mental Health Nurses Need in Triage in Acute Mental Health Care: A Narrative Review.</i> 2024, <i>Journal of Emergency Nursing.</i>
	verbal de-escalation AND psychiatric emergency	65	1	Hodžić V, Johnson SE. <i>Crisis Management in Psychiatry.</i> 2023, <i>Advances in Psychiatry and Behavioral Health.</i>
	psychiatric nursing AND emergency	34	1	Corbetta M, Corso B, Camuccio CA. <i>Rules and ward climate in acute psychiatric setting: Comparison of staff and patient perceptions.</i> 2022, <i>International Journal of Mental Health Nursing.</i>



Medline and Cinahl databases were consulted, as well as the following manuals:

- Lara Weiss Roberts (2019) Textbook of Psychiatry, Seventh Edition, American Psychiatric Association Publishing
- Tony Thrasher (2023) Emergency Psychiatry, Oxford University Press.
- M.D. Boland, Robert Joseph (2021), Synopsis of Psychiatry, 12th edition, Kaplan & Sadock's
- Regione Lazio & Salute Lazio (2022) - *Manuale regionale triage intra-ospedaliero modello Lazio a cinque codici (Regional intra-hospital triage manual Lazio five-code model)*.

The PICO method was applied to define

the literature search (**Tab.1**).

Boolean operators were used to define the literature search, which included the following MeSH terms: *amphetamine, psychosis, induced psychosis, differential diagnosis, mental health of nurses, psychiatric nursing and de-escalation techniques*. All relevant full-text articles published within the last 5 years, including both experimental and non-experimental studies, were included in the search. The articles had to focus on the nursing management of acute amphetamine-induced psychosis in patients of either sex, aged between 18 and 65 years. Studies dealing with primary psychosis or the clinical histories of specific psychiatric disorders, such as bipolar disorder and schizophrenia,

were excluded from the search. Furthermore, studies focusing on drugs not previously mentioned or not directly related to the treatment of induced psychosis were excluded.

Results

The results of the selected articles are shown in **Table 2**. The search strategy resulted in 412 articles being found, but only 13 of these met the search objective. Analysis of the selected articles (see **Table 3**) revealed different techniques for assessing and managing patients with acute-phase-induced psychotic episodes, as well as the critical issues involved. Regarding the three previously introduced psychiatric manuals in the

Tab. 3 - Articles selected for critical literature analysis.

Article	Study design	Sample	Methodology	Results
Cohen-Laroque J, et al. <i>Positive and negative symptoms in methamphetamine-induced psychosis compared to schizophrenia: A systematic review and meta-analysis</i> . 2024, <i>Schizophr Res</i> .	Systematic review and meta-analysis	Clinical studies comparing methamphetamine-induced psychosis and schizophrenia. n74	Comparative analysis of positive and negative symptoms in both conditions	Methamphetamine-induced psychosis has positive symptoms comparable to schizophrenia, but less pronounced negative symptoms and a greater tendency to recover after abstinence. It is useful to help the nurse understand how best to differentiate them and decide how to act.
Dimy Fluyau, Paroma Mitra and Kervens Lorthé <i>Antipsychotics for Amphetamine Psychosis. A Systematic Review</i> . 2019, <i>Frontiers in Psychiatry</i>	Systematic review	Clinical trials of 314 participants on antipsychotic drugs for the treatment of amphetamine psychosis	Comparative analysis of the pharmacological effects of different antipsychotics on positive and negative symptoms of the psychotic episode	The use of the different antipsychotics had the effect of reducing and controlling the psychotic episode without establishing a clinical superiority of one drug over the other
Fiorentini A, Cantù F, Crisanti C, et al. <i>Substance-Induced Psychoses: An Updated Literature Review</i> . 2021, <i>Frontiers in Psychiatry</i> .	Updated Literature Review	54 studies	Examines various types of substance-induced psychosis	Overview of neurobiological mechanisms and treatment options for substance-induced psychosis.
Cambra Almerge J, Sánchez-Romero S, Arias Horcajadas F. <i>Differences between substance-induced psychotic disorders and non-substance-induced psychotic disorders and diagnostic stability</i> . 2023, <i>ADICIONES</i> .	Comparative observational study	Patients with substance-induced psychosis and non-substance-induced psychosis. n 48	Evaluation of diagnostic stability and distinguishing factors	Substance-induced psychoses tend to be less stable diagnostically and respond more rapidly to treatment than primary psychoses.

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Article	Study design	Sample	Methodology	Results
Bekelepi N, Martin P. <i>Support interventions for nurses working in acute psychiatric units: A systematic review.</i> 2022, <i>Health SA Gesondheid</i> .	Systematic review	122	Analysis of support programmes for psychiatric nurses	Support programmes, such as continuing education and psychological support, improve crisis management and the well-being of nurses in acute psychiatric units.
Johnson S, Dalton-Locke C, Baker J, et al. <i>Acute psychiatric care: approaches to increasing the range of services and improving access and quality of care.</i> 2022, <i>World Psychiatry</i> .	Literature review	88	Proposals to improve access and quality of care for acute psychiatric disorders	Identified models for expanding acute psychiatric services, emphasising accessibility, integration with other health services and a personalised approach to care.
Celofiga A, et al. <i>Effectiveness of De-Escalation in Reducing Aggression and Coercion in Acute Psychiatric Units. A Cluster Randomized Study.</i> 2022, <i>Front Psychiatry</i> .	Cluster-randomised study	Patients in acute psychiatric units. 33	De-escalation techniques to reduce aggression and coercive measures	De-escalation techniques have significantly reduced aggression and the use of coercive measures, improving the management of patients in critical situations.
Fernández-Costa D, et al. <i>Alternatives to the Use of Mechanical Restraints in the Management of Agitation or Aggressions of Psychiatric Patients: A Scoping Review.</i> 2020, <i>J Clin Med</i> .	Literature review	44 studies	Examines alternatives to mechanical restraints to manage agitation and aggression	Alternatives to mechanical restraint, such as psychological intervention and environmental modification, are effective in improving the management of psychiatric patients without the use of coercion.
Price O, et al. <i>De-escalating aggression in acute inpatient mental health settings: a behaviour change theory-informed, secondary qualitative analysis of staff and patient perspectives.</i> 2024, <i>BMC Psychiatry</i> .	Secondary qualitative analysis	Patients and staff in acute psychiatric settings. n.14	Evaluation of staff and patient experiences with de-escalation techniques	De-escalation techniques are considered effective, but require continuous training and a structured approach to improve results.
Rajab Dizavandi F, Froutan R, Moonaghi HK, et al. <i>Mental Health Triage from the Viewpoint of Psychiatric Emergency Department Nurses; a Qualitative Study.</i> 2023, <i>Archives of Academic Emergency Medicine</i> .	Qualitative study primary	Psychiatric emergency department nurses. n 10	Analysis of psychiatric triage practices and their perception	Nurses believe that key competencies for effective triage include risk assessment, resource management and the ability to respond to critical situations.
Stigter-Outshoven C, Van de Glind G, Wieberdink LJ, van Zelm R. <i>Competencies Emergency and Mental Health Nurses Need in Triage in Acute Mental Health Care: A Narrative Review.</i> 2024, <i>Journal of Emergency Nursing</i> .	Narrative revision	21 studies	Examines the skills required of psychiatric emergency nurses	Core competencies include risk assessment and patient management in critical situations.
Hodzic V, Johnson SE. <i>Crisis Management in Psychiatry.</i> 2023, <i>Advances in Psychiatry and Behavioral Health</i> .	Literature review	33 studies	Discussion of psychiatric crisis management methods	Proposals to improve psychiatric crisis management through systematic and structured approaches.
Corbetta M, Corso B, Camuccio CA. <i>Rules and ward climate in acute psychiatric setting: Comparison of staff and patient perceptions.</i> 2022, <i>International Journal of Mental Health Nursing</i> .	Comparative observational study	Staff and patients in an acute psychiatric ward. n 24	Analysis of the perception of the climate and rules within the department	Differences in perceptions between staff and patients regarding the rules and climate of the ward.

Manuale regionale triage intra-ospedaliero modello Lazio a cinque codici

(Regional Intra-hospital Triage Manual Five-Code Lazio Model), edited by

Regione Lazio & Salute Lazio (2022), some indications on the management of



STATO DI AGITAZIONE PSICOMOTORIA - ALTERAZIONE DELLO STATO MENTALE					
CODICE TRIAGE	1	2	3	4	5
Parametri Vitali	Da codice 1	Da codice 2	Da codice 3	Da codice 4	
Caratteristiche del Sintomo/Segno Principale	Grave disturbo del comportamento con minaccia immediata di violenza pericolosa per sé stesso e per gli altri. Estrema agitazione con aggressività fisica e/o verbale. TSO. Tentato suicidio. Atti autolesivi associati a idee suicidarie manifeste. Manifestazioni suicidarie. Alto rischio di fuga.	Estrema agitazione, irrequietezza. Alterazioni del pensiero. Allucinazioni, comportamento, bizzarro, non contenibile. Etilismo acuto con comportamento non controllabile ma senza aggressività. Disorientamento spazio-temporale. Confusione mentale ma con capacità di cooperare.	Agitazione contenibile. Disturbo del comportamento ma paziente controllabile. Alterazioni del tono dell'umore in senso euforico/stato di agitazione o in senso depressivo senza ideazione suicidaria. Etilismo cronico senza disturbi comportamentali.	Irritabile senza aggressività. Riferito Attacco di panico. Paziente noto per crisi sociale. Problemi sociali di alloggio, o di relazione. Richiesta di farmaci.	
Sintomi/Segni Associati		Cefalea /Febbre/Abuso di sostanze, ipoglicemia			
PROCEDURE DI TRIAGE	1	2	3	4	5
Attività (Secondo protocollo locale)	Sorveglianza visiva continua con rapporto 1:1. Richiedere l'intervento del personale di sicurezza. Fornire un ambiente sicuro per i pazienti, accompagnatori e operatori.	Osservazione regolare a un massimo di intervalli di 15 minuti. Non lasciare il paziente in sala d'attesa senza supporto di una persona. Richiedere l'intervento del personale della sicurezza se necessario. Fornire un ambiente sicuro per i pazienti, gli accompagnatori e gli operatori.	Osservazione regolare a un massimo di intervalli di 30 minuti. Non lasciare il paziente in sala d'attesa senza supporto di una persona. Richiedere l'intervento del personale della sicurezza se necessario. Fornire un ambiente sicuro per i pazienti, accompagnatori e operatori.	Controllo di routine in sala d'attesa ad un massimo di intervalli di 1 ora.	
Attivazione Consulenza (Secondo protocollo locale)	Allertare immediatamente personale medico e consulente psichiatra.	Allertare personale medico e consulente psichiatra in caso di attesa superiore a 60 minuti. Definire protocolli condivisi di presa in carico precoce con gli psichiatri.			
Rivalutazione		Osservazione diretta o video- mediata con monitoraggio costante delle condizioni.	Ripetizione di parte o tutte le fasi di valutazione su decisione del triagista, a richiesta del paziente, una volta trascorso il tempo di attesa massimo raccomandato.		
Altro	Definire percorsi locali per i pazienti che richiedono un colloquio con lo psichiatra, con lo scopo di ridurre al minimo l'attesa e agevolare la presa in carico.				

Fig. 1 - Table provided by the Lazio Region in “Manuale regionale triage intra-ospedaliero modello Lazio a cinque codici”.

psychiatric emergencies emerged. These emergencies were classified and merged in a very generic manner with the treatment of psychomotor agitation and altered mental status. However, a detailed and specific approach to the assessment and management of acute psychosis is lacking here, which highlights the general absence of clear, structured national guidelines on this subject.

Discussion

Managing acute amphetamine- and methamphetamine-induced psychosis in a nursing context is a complex challenge that requires clinical expertise, aggression management skills, pharmacological knowledge and ethical sensitivity. As this phenomenon is becoming more prevalent, nurses are playing a crucial role in the assessment, management and treat-

ment of patients in psychiatric emergencies. Triage is essential for managing psychiatric emergencies promptly. The five-code model enables effective classification based on clinical criteria and vital parameters, using a methodology that includes:

- Immediate assessment to identify signs of clinical instability.
- Allocation of a priority code based on pre-defined protocols and specific tools for psychiatric emergencies.
- Continuous reassessment of the patient to monitor any changes in clinical condition.

This requires clinical ‘insight’, supported by standardised diagnostic tools and continuing education. Nurses must be able to quickly detect danger signs, such as extreme agitation or potentially aggressive behaviour. The Emergency

Safety Implementation Measures provide a table (**Fig. 1**) to give a more precise indication of the signs and symptoms that must be present for a patient to be assigned a specific colour code.

It is crucial for nurses to be able to swiftly recognise patients exhibiting acute symptoms of amphetamine or methamphetamine intoxication and differentiate them from individuals experiencing primary psychosis. However, the overlap of symptoms between substance-induced and primary psychotic disorders can make this distinction challenging. Psychoses induced by substances, such as those caused by amphetamine and methamphetamine use, tend to be less stable in diagnosis than primary psychoses. This manifests as intense but transient psychotic symptoms that respond more quickly to drug treatment and abstinence from the substance (2).



This implies that nurses must be particularly vigilant when collecting medical histories, considering substance use as a potential trigger, and continuously reassessing patients to adapt therapeutic interventions (3). It is crucial to recognise that patients with substance-induced psychosis may subsequently develop primary psychosis or latent vulnerability to more enduring psychotic disorders. This emphasises the importance of careful follow-up, even after the acute phase, to prevent underestimating the problem and ensure more precise diagnostic framing over time (3). Checking the patient's risk of aggression is also crucial in the triage and assessment phase. Several analysed studies emphasise the importance of using standardised tools and a structured methodology to categorise the level of risk. These tools include observing the patient's body language, tone of voice, and willingness to cooperate. Collecting anamnestic information on possible triggers helps create a comprehensive clinical picture, which is essential for preventing new incidents of violence. A structured approach to triage enables the anticipation of risky behaviour and the adoption of more effective management strategies (4). Combining these competencies enables nurses to ensure a timely diagnosis and personalised, patient-centred care. Through interdisciplinary collaboration and adherence to guidelines, nursing triage can be a vital means of improving clinical outcomes and reducing the risks associated with managing psychiatric patients in emergency situations (4, 5). It should be noted that triage is not merely a technical act; it also requires advanced communication skills in order to swiftly establish a therapeutic relationship with the patient, reduce agitation, and ensure appropriate

intervention. The ability to balance clinical assessment with an empathic approach is key to ensuring patient safety and well-being (5). However, the increasing complexity of psychiatric emergencies requires healthcare personnel to constantly update their skills. Training should include simulated cases and courses on risk assessment and managing communication with agitated patients, as well as insights into the diagnostic differences between primary and substance-induced psychosis. Only through an integrated, evidence-based approach can the effectiveness of psychiatric triage and the quality of care provided be further improved (3, 4). De-escalation is a vital technique for managing aggression, reducing the need for coercive measures, and fostering a more positive therapeutic environment. It is based on a communicative and relational approach that aims to calm the patient and encourage active cooperation. Interventions include the use of clear and calm language, maintaining a non-threatening posture, and identifying the patient's needs. This approach has been shown to significantly reduce both aggression and the use of physical restraints, as demonstrated by the randomised study analysed. However, its effectiveness hinges on the continuous training of healthcare personnel, who must be able to adapt the approach to different situations. This requires well-defined protocols and regular simulations to improve staff skills and operational readiness (6, 7). A central aspect of de-escalation is how patients perceive the techniques used. Patients tend to react better to interventions that respect their personal space and are perceived as non-threatening. An empathic approach that considers the patient's subjective experiences can

prevent further escalation and improve collaboration. Therefore, adopting flexible strategies that include active listening and involving patients in decision-making is essential for successful de-escalation (6). Furthermore, some de-escalation techniques have been shown to be more effective than others. Elements such as a reassuring tone of voice, reducing environmental stimuli, maintaining an appropriate distance, and using clear, direct language have been shown to significantly reduce aggressive episodes. Systematic implementation of these strategies through specific training programmes can therefore increase the overall effectiveness of interventions in acute psychiatric wards (7). Historically, physical restraint has been used in psychiatric settings to manage highly agitated or aggressive patients. However, this practice carries significant risks, including physical and psychological harm to the patient, as well as a deterioration of the therapeutic relationship. Modern guidelines therefore promote alternatives, such as psychological intervention and environmental modification, which may include reducing external stimuli and creating a safe space. These interventions have been shown to be effective in managing agitation without the need for coercion. Although restraint is sometimes necessary in extreme situations, it must be used as a last resort in accordance with strict ethical and clinical protocols. Detailed documentation and continuous monitoring of the patient are essential to ensure the appropriate and justified use of restraint (8). Recent research has identified several practical alternatives to mechanical restraint that can be implemented in psychiatric wards to reduce the use of coercive measures. These include strategies such as sensory rooms, guided relaxation techniques,



targeted psychological interventions, and agitation prevention protocols. Sensory rooms, in particular, offer a safe and controlled environment in which patients can calm down without forced intervention from staff. Systematically adopting these alternatives can help create a therapeutic environment that is less coercive and more centred on the patient's dignity (8). Second-generation antipsychotics, such as olanzapine and risperidone, are the primary choice of treatment for acute psychotic symptoms. These drugs act mainly as antagonists of dopaminergic D2 receptors and partly on serotonergic 5-HT_{2A} receptors, helping to modulate the excessive mesolimbic dopaminergic activity caused by amphetamines. Initial administration may be by the intramuscular (IM) route in emergency situations to ensure rapid efficacy, followed by a switch to oral administration for maintenance (9, 10).

For example, IM olanzapine has been shown to effectively control psychotic symptoms within 15–30 minutes. Subsequently, switching to oral therapy is recommended to allow long-term control and improve adherence to treatment. Regular monitoring of vital parameters, cardiovascular function, and sedation levels is crucial to prevent serious side effects (10, 11).

Antipsychotics can prolong the QTc interval, thereby increasing the risk of potentially fatal ventricular arrhythmias such as torsade de pointes. This risk is particularly high with drugs such as haloperidol, droperidol, ziprasidone and iloperidone. For patients at high cardiovascular risk, safer options may include antipsychotics with less impact on the QTc interval, such as aripiprazole and lurasidone (9, 10). Quetiapine is often chosen for patients displaying high levels

of anxiety and agitation due to its sedative effects. This has been observed in clinical guidelines for the treatment of psychotic agitation (10, 11). Benzodiazepines such as lorazepam or diazepam can be used to control extreme agitation. These drugs act as GABA-A receptor agonists, helping to rapidly reduce agitation and anxiety. They are particularly useful for calming patients without excessively suppressing cognitive function, although they must be administered with caution and their use monitored to avoid side effects such as excessive sedation (11, 12).

It is important to avoid taking drugs that could increase dopaminergic or adrenergic activity, as these could exacerbate psychotic symptoms. For example:

- Amphetamines and their derivatives would be contraindicated as a treatment for substance use disorder in the acute phase due to their stimulating effect on the central nervous system.
- Tricyclic antidepressants and other drugs that increase norepinephrine or serotonin non-selectively may worsen agitation and increase the risk of hypertensive crisis.
- Non-selective beta-blockers such as propranolol are not recommended in cases of acute adrenergic hyperactivation, as they can reduce peripheral vasodilation and increase central arterial pressure (10, 12, 13).
- This is because amphetamines increase the release of, and block the reabsorption of, dopamine and norepinephrine at the synaptic level. This causes excessive stimulation of the brain circuits involved in perception and thinking. Antipsychotics counteract these effects, particularly in mesolimbic path-

ways, thereby alleviating delusions and hallucinations. Benzodiazepines act on GABA-A receptors to potentiate synaptic inhibition and promote a calming effect (12, 13). The healthcare environment in which acute psychiatric emergencies are managed plays a crucial role in the quality of care and the well-being of patients and staff. Well-structured organisation accompanied by continuous staff training can significantly improve access to services, crisis management, and the ward climate (14, 15). The atmosphere of a psychiatric ward directly influences the effectiveness of treatment and the patient experience. Significant discrepancies often exist between patients' and staff members' perceptions of the rules and the ward climate. Patients may view the rules as rigid and punitive, whereas staff tend to see them as vital for maintaining safety and order. This misalignment can damage the therapeutic relationship and increase the risk of conflict (16). Based on the information available, it can be concluded that fostering dialogue, mutual understanding, and adapting rules to individual needs can improve the overall climate, promoting a calmer state of mind for patients. A common criticism of psychiatric emergency settings is the shortage of staff. Inadequate nurse-to-patient ratios can lead to work overload, compromising the quality of care and increasing the risk of burnout among healthcare workers. Logistical and organisational difficulties represent a further obstacle to optimal care (17). In fact, professional training alone is insufficient:



nurses also need psychological support to cope with the stress of long shifts and managing highly emotional situations (17).

The various analysed articles emphasised the importance and necessity of broadening the range of knowledge, focusing mainly on the following points:

- Standardisation of protocols: Uniform implementation of national and regional guidelines.
- Continuing education: Refresher courses on triage, pharmacology, and de-escalation techniques.
- Psychological support for operators: Specific programmes to reduce stress for staff.
- Increasing human resources to ensure an adequate staff-to-patient ratio to improve the effectiveness of interventions.
- Facilitated access to health services, including dedicated pathways for psychiatric emergencies and stronger links to primary care services.

Conclusions

This literature review revealed that nursing the management of acute amphetamine-induced psychosis is a complex challenge that requires a multi-dimensional, integrated approach. The literature review clearly shows that there is a need to develop standardised protocols to guide clinical practice, from initial triage assessment through to pharmacological and behavioural management. Although de-escalation techniques have been shown to be effective in reducing aggression and the use of restraints, their implementation requires ongoing training and adequate organisational resources. Second-generation antipsychotic pharmacotherapy is the

mainstay of treatment, but must be customised to the individual characteristics of each patient. It is particularly important to consider the working conditions of nurses, who require psychological and organisational support to effectively manage these emergencies. It is fundamental to bridge the gap between staff and patient perceptions of the rules and climate of psychiatric wards, and this can be achieved by promoting a therapeutic environment that fosters collaboration. Future studies should focus on implementing specific training programmes and evaluating organisational models that optimise available resources, thereby improving the quality of care and reducing the use of coercive practices.

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CASE REPORT



Lionfish poisoning: a rare clinical case

Avvelenamento da pesce leone: un raro caso clinico

Margherita Moretti * Jole Serra °

Abstract: Poisoning by Scorpaenidae, including lionfish, is rare and typically occurs in tropical countries, although cases of injury caused by Scorpaenidae have been reported in the literature, even in non-tropical areas. We present a clinical case that occurred in the emergency room of Beirut Military Hospital and was treated by Italian healthcare teams. The clinical manifestations and clinical-therapeutic management are reported alongside references to existing scientific literature.

Riassunto: L'avvelenamento da Scorpaenidae, tra cui il pesce leone, è un evento raro e tipico dei paesi tropicali sebbene in letteratura siano descritti molteplici casi di lesioni causate da Scorpaenidae anche in aree non tropicali. Si riporta un caso clinico avvenuto nel pronto soccorso dell'Ospedale Militare di Beirut trattato dai team sanitari italiani in cui saranno riportati le manifestazioni cliniche e la gestione clinico terapeutica con riferimento letteratura scientifica esistente.

Key words: Scorpaenidae, fish envenomation, Lion fish, clinical treatment.

Key messages:

- Adequate information for healthcare professionals on the initial management of cases of poisoning by marine species ensures favourable clinical outcomes.
- In cases of Scorpaenidae poisoning, soaking the affected area in hot water deactivates the heat-sensitive components of the toxin, making it a safer and more effective method than other approaches.

Introduction

The Scorpaenidae family is a large group of fish characterised by their ability to cause poisoning through a variety of spines. This family is responsible for the second most frequent case of fish poisoning after skates and rays. They are widespread in tropical, subtropical and temperate regions, and some species have also been found in polar regions. It is not possible to provide an accurate estimate of the number of cases of poisoning, but it is not uncommon.

The Scorpaenidae family consists of

three groups, which are distinguished based on the structure of their poisonous organs and toxicity levels. These three groups are:

- Pterois, which are equipped with long, thin spines, small venom glands and a less powerful sting (e.g. lionfish and zebrafish) (**Fig. 1**);
- Scorpaena: shorter and thinner spines; larger venom glands; and a more powerful sting (e.g. scorpionfish; *Notesthes robusta*) (**Fig. 1**).
- Synanceia: equipped with strong, powerful spines; highly developed venom glands; and a potentially fatal

sting (e.g. stonefish) (**Fig. 1**).

Injuries and poisonings have been reported in open water, for example through accidental exposure during fishing or diving activities, and at home, for example through careless handling by aquarium owners. Members of the Scorpaenidae family possess around 18 spines, which are distributed between the dorsal, pelvic and anal regions. Each spine is associated with a pair of venom glands and is wrapped in a fluid integumentary sheath. During poisoning, the sheath descends down the spine,

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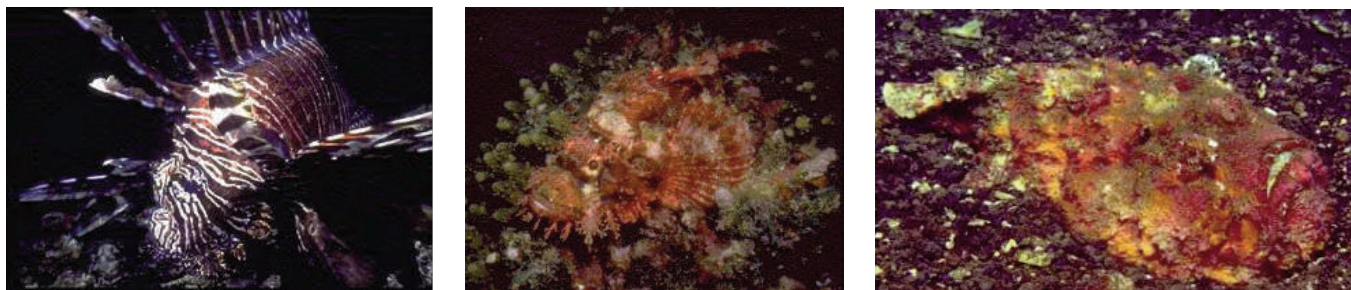


Fig. 1 - Pterois (lionfish), Scorpaena (scorpionfish) and Synanceia (stonefish).

compressing the venom glands located at the base and causing the venom to move towards the anterolateral depressions of the spines, which then penetrate the wound (1). Lionfish venom comprises a thermolabile neurotoxin that causes oedema, plasma extravasation, and cutaneous thrombotic lesions (2). A comparative study of Caribbean lionfish species showed that, *in vitro*, the venom causes haemolysis, weak cytotoxicity, proteolytic and hyaluronidase activities; *in vivo*, however, it is neither haemorrhagic nor myotoxic, but causes oedema, plasma extravasation and thrombotic-like skin lesions. Some minor differences have been observed in the venom secretions of adult and juvenile species (3). Excruciating pain and neuromuscular alteration are the immediate consequences of being stung by members of the *Synanceia* genus. The pain can spread to the whole limb and the local lymph nodes, peaking in intensity after 60–90 minutes and lasting over 12 hours if left untreated. Mild pain may persist for days or weeks. Less severe symptoms, though still very painful, follow poisoning by the genera *Scorpaena* and *Pterois*. Typically, poisoning results from one or more stings, each surrounded by a bluish halo of cyanotic tissue. Oedema, erythema and subsequent hyperaemia may also extend to the entire limb. Tissue necrosis is rare in the absence of secondary infection (unlike other cases of fish poisoning).

Vesicle formation, especially in the hands, can easily lead to skin tissue flaking, cellulitis and hypoesthesia. Systemic symptoms may include nausea, muscle weakness, dyspnoea and hypotension (4, 5). The severity of the poisoning depends on several factors, including the species responsible, the number of stings and the victim's age and general health.

- **Pterois:** In a series of 101 cases in the United States, 92% of patients presented with local pain, 60% with oedema, and 13% with systemic symptoms. There were no fatalities. Wounds were categorised according to severity, with 95% being grade I (erythema), 4% being grade II (vesicles), and 1% being grade III (tissue necrosis). Hot water immersion therapy was used to treat pain in 97% of patients; the administration of the antidote was not necessary in any case. One patient required intravenous antibiotic therapy and one hypotensive patient responded well to intravenous fluid therapy. Thirteen per cent of patients experienced minor systemic symptoms.

Based on this and other US reports, most lionfish stings result in uncomplicated wounds that cause intense local pain, but respond well to warm water immersion therapy. Although rare cases of death have been reported in open water, the available data are very general and

therefore unreliable.

- **Scorpaena:** the severity of injuries and systemic symptoms is greater than in cases of *Pterois* poisoning. The fatality rate of poisoning cases is controversial. One case (Mozambique, 1957) is considered a direct consequence of intravenous venom penetration, or most likely an anaphylactic reaction, due to the absence of identifiable elements at the sting site. Other reports describe death occurring days or months after poisoning, suggesting a possible correlation with secondary complications (e.g. wound infection, tetanus) (1).

Once the domain of fishermen and seafarers, the sea is now a place of discovery for many snorkelling enthusiasts. The Mediterranean Sea is home to a variety of species, some of which are poisonous and potentially dangerous. However, the Mediterranean's biodiversity is constantly increasing thanks to the progressive topicalization of its waters, which is being driven by a global increase in temperatures. This has resulted in species from tropical and subtropical areas settling in our sea, which was previously foreign to them. Encounters with these species can be dangerous, so it is useful to learn to recognise them.

- **Echinoderms**, for example, are characterised by slow, non-aggressive movements and include sea urchins, starfish and sea cucumbers (**Fig. 2**).



Fig. 2 - Echinoderms (from left): sea urchins, starfish and sea cucumbers.

Injuries and cases of poisoning are mainly the result of careless handling or accidental exposure, which is exacerbated by the poor visibility in fast-flowing water. Of the various species of sea urchin, the most venomous are the flower urchin (*Toxopneustes pileolus*) and the *Tripneustes* species. These species have specific structures called pedicellariae that are equipped with a triple mandibular apparatus surmounted by venom glands. These glands are capable of penetrating the skin and are difficult to remove due to their distinctly adherent valvular structure. Contact can result in intense pain, paresthesia, hypotension, respiratory distress and muscular paralysis, which can last up to six hours. One case involved a female diver who lost consciousness and drowned following accidental contact with a flower urchin. The most toxic species of sea star is the crown-of-thorns starfish (*Acanthaster planci*), which has long, sharp spines topped by a covering associated with glandular structures that produce a variety of toxins responsible for local and systemic effects. Poisoning begins with the spines penetrating the skin, which is usually followed by immediate excruciating pain. Divers have often reported difficulty ascending to the surface, as well as disorientation and loss of control, due to the intense pain. Multiple punctures or injuries to joints are associated with pain and impaired

mobility for several weeks. Systemic symptoms include prolonged nausea and vomiting, headaches, arthralgia, paresthesia and muscle paralysis. Sea cucumbers are also responsible for food poisoning. They have a surface coating containing toxins (the main one of which is holoturin) and a mass of whitish or pinkish tubules known as the organ of Cuvier. This organ is located within the anal region and is everted by the animal when it is attacked or disturbed. Direct contact with these components, or even fragments released nearby, can induce contact dermatitis and severe ocular inflammation, and, in severe cases, blindness (6).

- Stingrays are cartilaginous fish found on the seabed. They have a flattened body, one or more strong spines on the tail, and ventrolateral sacs containing venom (**Fig. 3**). They are not aggressive towards humans, but injuries following contact with these animals are very common, especially when the victim accidentally steps on the fish, triggering a defence mechanism. The tail is thrown at the victim, usually striking the foot or lower leg and causing a deep wound with jagged edges. The animal's punctorial apparatus injects a protein toxin into the wound, causing intense pain immediately. Stingray venom is highly complex chemically and

differs between the various species known to date. Neuro-inflammatory mediators such as hyaluronidase, cystatin, calglandulin, neurokinins, calcium and histamines contribute to the excruciating pain associated with stings. Systemic symptoms are rare and include nausea, vomiting, diarrhoea, muscle cramps, abdominal pain and hypotension (8).

- Octopuses are generally harmless and only become aggressive when provoked. Their bites pose little risk to survival, except for the bite of the blue-ringed octopus, which inhabits the waters of the Pacific Ocean (**Fig. 3**). The venom secreted by the salivary glands of the blue-ringed octopus contains numerous components, one of which is the highly toxic tetrodotoxin. It blocks voltage-dependent sodium channels, thereby blocking peripheral nerve conduction and causing paralysis and death from respiratory failure. Central nervous system effects include nausea, vomiting, miosis, diabetes insipidus, and depression of cortical activity. However, the prognosis is generally excellent; in cases of severe poisoning, oral and peripheral paresthesia, blurred vision, muscle paralysis and respiratory failure can appear rapidly (7).
- Portuguese Man 'o War: this oceanic species is found in the tropical



Fig. 3 - Ray and octopus.

waters of the Atlantic, Pacific and Indian Oceans, although it has also recently been spotted in the Mediterranean Sea. Thanks to a transparent gas-filled pouch, it partially remains at the surface, beneath which are tentacles that can reach a length of up to 50 metres (**Fig. 4**). These tentacles contain more than ten different types of venom capable of quickly paralysing and killing small fish, and they retain their venomous power even when

detached from the main body. Stings cause a burning sensation and local contact dermatitis in humans, the effects of which may last for several days. In rare cases, anaphylactic shock, fever, cardiac arrhythmia and respiratory failure may occur.

Purpose

In light of the ongoing topicalization of the seas, this case report outlines innovative perspectives on the clinical treat-

ment of rare but urgent medical conditions.

Materials and methods

As expected in cases of poisoning, the Italian medical staff at the Beirut Military Hospital used a clinical approach involving the management of the wound and, if necessary, the extraction of the foreign body. This was followed by the affected body region being immersed in hot water (about 45 °C) and immediate analgesic treatment.

Clinical case presentation

On 13 July 2023, the Emergency Department at Beirut Military Hospital accepted a male patient who reported being bitten by a lionfish on the back of his left hand. He also complained of severe pain in his left arm, which radiated to the corresponding hemithorax. The patient was in a state of psychomotor agitation, but was alert, oriented and cooperative. There were no skin lacerations except for a



Fig. 4 - Portuguese Man 'o War.



small, slightly raised, reddened and dark punctiform lesion at the puncture site, and the hand and entire arm were oedematous.

The patient was able to accurately report the incident: he recalled being in diving training at the time of the traumatic event and reported being at a depth of 25 metres. While performing the planned ascent manoeuvres, he felt a sting on his left hand, where he was wearing his protective glove. He recognised the lionfish immediately and began to feel a sharp pain.

Monitored vital parameters showed an arterial pressure of 135/95 mmHg, a heart rate of 112 bpm, a respiratory rate of 18 acts/min, and an SpO₂ of 96% in room air. On objective examination, diffuse oedema and erythema of the left upper limb were observed, starting from the left hand. The puncture site was indicated on the back of the hand, where no foreign body was visible; only a slightly raised, reddened, dark punctiform lesion was noted.

Results

Due to the extremely painful clinical manifestations and oedema that started in the left hand and were described as progressive, an intravenous infusion of 200 mg of hydrocortisone and 10 mg of tramadol in 100 ml of 0.9% saline was administered. At the same time, the left hand and as much of the distal part of the arm as possible were placed in a container of warm water at approximately 40 °C. The poison inoculation site was dressed by nursing staff with hydrogen peroxide and Betadine, after ruling out the presence of foreign bodies. After approximately 20 minutes, the oedema had not progressed, vital parameters remained stable (with the excep-

tion of blood pressure, which had increased to 150/100 mmHg) and the patient's reported pain had not abated. Therefore, a further intravenous infusion of tramadol (10 mg) in 100 ml of 0.9% saline was administered.

After a further 20 minutes, the patient's reported pain gradually subsided and their vital signs stabilised. The patient was monitored for six hours after admission and administered human tetanus antibody immunoglobulin (250 IU/1 ml) intramuscularly. As the patient reported living a considerable distance from the hospital and being unable to return to Beirut for follow-up visits, he was discharged with home treatment consisting of amoxicillin/clavulanic acid 875/125 mg twice daily for seven days and paracetamol 1000 mg tablets as required, as a precautionary measure.

Approximately ten days after the incident, the diver visited the Beirut Military Hospital Emergency Department to say goodbye to the medical staff. The injury was no longer visible, and the patient reported that he was experiencing complete remission of painful and oedematous symptoms, as well as psychological and physical well-being, about three days after the poisoning.

Discussion

According to the literature, the aim of therapy in cases of Scorpaenidae poisoning is to provide local and systemic analgesia, treat wounds at risk of infection, provide supportive therapy, and treat systemic symptoms if necessary in cases of significant poisoning. Wound treatment involves gently removing the visible spines and sheath to prevent further penetration or rupture and to inactivate the thermolabile components of the venom, which might

otherwise cause a severe systemic reaction. Surgical removal of embedded spines is indicated when they are located near joints, nerves or vessels.

Visual inspection for foreign body retention can be supplemented with radiographs for radioluminous foreign bodies or ultrasound for radio-opaque foreign bodies. Surgical debridement, incision and drainage, or fasciotomy, are not indicated unless the wound contains foreign bodies, becomes necrotic or develops compartment syndrome (9). The recommended initial treatment for Scorpaenidae poisoning is immersion in warm water, as with poisonings from echinoderms, rays, and other marine species. According to the literature, immediately immersing the affected extremity in warm water (up to 45 °C) for 30–90 minutes (or until the painful symptoms subside) inactivates the thermolabile components of the venom, making it a safer and more effective treatment than other methods (e.g. cold water, vinegar, papaya compresses or ice) (10). Additional local analgesia may be necessary, taking care not to cause burn injuries to the patient. Oral or intravenous opioids are indicated for pain that is not controlled by hot water immersion. Benzodiazepines are indicated for anxiety, muscle spasms, or for patients with wounds that are difficult to immerse or anaesthetise. All forms of restraint, such as watches and bracelets, must be removed from the affected extremities, which should be kept unloaded to facilitate lymphatic and venous drainage. Painful lymphoedema following stonefish poisoning may require compression treatment with long gloves or elastic stockings (9). Prophylactic antibiotics are generally not indicated, except for people with deep puncture wounds and immunocompromised



individuals. Once infection has been established, timely therapy must be instituted to cover potential marine pathogens. Infections caused by Gram-negative bacteria and mycobacteria require combined antibiotic therapy. The typical Gram-positive infections are those caused by *Streptococcus iniae*, characterised by impetigo and cellulitis, and those caused by *Erysipelothrix rhusiopathiae*, which manifest as erysipeloid. These infections can be treated with single antibiotics, particularly penicillins or macrolides (if there is a penicillin allergy), until the results of the culture examination and antibiogram are available. In cases of suspected *Mycobacterium marinum* infection, confirmation by culture examination is necessary, as is initiation of clarithromycin and ethambutol combination antibiotic therapy (11).

Necrotising marine infections may be monomicrobial, caused by bacteria such as *Vibrio vulnificus*, *Aeromonas hydrophila* or *Edwardsiella tarda*, or polymicrobial. In both cases, if necrotising lesions are present, the infection can progress rapidly to necrotising fasciitis and myonecrosis, particularly in immunocompromised patients, those on steroid therapy, and those with diabetes mellitus, HIV/AIDS, liver or renal failure, or cancer. These patients should initially be treated with broad-spectrum antimicrobials, especially in cases of penetrating trauma, until the outcome of culture examinations from drains or biopsies is known. Subjects with cirrhosis, hepatitis, uremia, haemosiderosis, or other conditions involving iron retention are at a higher risk of invasive *Vibrio* infections, which are associated with a higher mortality rate. They should be treated empirically with combinations of third-generation

cephalosporins (ceftazidime), fluoroquinolones and tetracyclines or aminoglycosides and trimethoprim-sulfamethoxazole (in paediatric cases where tetracyclines and quinolones are contraindicated) (11). Tetanus prophylaxis is recommended for all marine species injuries in patients with an uncertain history of tetanus vaccination (9.1).

Corticosteroid therapy based on hydrocortisone or methylprednisolone may be used to prevent or treat serum sickness, either alone or in combination with a venom antidote. Stonefish antivenom is rarely indicated for lionfish poisoning, unless the symptoms respond to warm water immersion and additional treatment with analgesics and regional anaesthetics.

Stonefish antivenom, currently available in Australia, is produced by Commonwealth Serum Laboratories (CSL). It consists of 2,000 IU per 1.5–3 ml vial and is administered either intramuscularly or intravenously, after dilution and skin testing to assess the risk of an anaphylactic reaction to equine sera (12).

Conclusions

With almost a thousand new 'alien' species, the Mediterranean is the marine region with the highest number of 'invasions' worldwide. The main causes of this are climate change, rising sea temperatures, and human activities such as uncontrolled fishing, pollution, shipping traffic, and ship dumping. New tropical species enter the Mediterranean from two main geographical areas: the Suez Canal, through which organisms from the Red Sea enter, and the Strait of Gibraltar, through which species from the Atlantic coast of Africa enter. To this flow must be added species that are introduced unin-

tionally through ship bilge water or hull seepage, which is often discharged into the sea without any precautions (12). Given the increasingly frequent presence of *Scorpaenidae* species in non-tropical waters, particularly in the Mediterranean, it is important for medical and nursing staff to be familiar with poisonous marine species, as well as the current recommended medical and pharmacological treatments. This is particularly useful in military first aid contexts, as well as in isolated areas where specialist personnel and sufficient diagnostic capacity are lacking. Healthcare personnel should have adequate information on how to manage cases of marine species poisoning, particularly regarding initial treatment involving immersion in warm water and the administration of parenteral analgesics. It is also important to remember that, in cases of marine injuries, tetanus prophylaxis is necessary rather than human tetanus immunoglobulin, and that prophylactic antibiotic administration is needed in cases of deeply penetrating, lacerated or necrotic wounds to prevent major bacterial overinfection in situ (9).

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CASE REPORT



Operation 'Levante': pro radial sural nerve transplant on a 38-year-old civilian woman

Operazione Levante: trapianto nervoso del nervo surale pro nervo radiale su donna civile di 38 anni

Valerio Stroppa*

Abstract: Cases of nerve damage to the peripheral nerves of the upper limbs can be treated via transplant using sensory nerves taken from other sites. In the course of the humanitarian mission designated 'Operation Levante' at the Egyptian port of El Alarish, the surgical team aboard the Italian Navy's Vulcano Ship performed a complex procedure involving orthopaedic microsurgery, specifically a nerve transplant from the sural nerve to the radial nerve. This case report demonstrates that, even within the confines of an operating theatre and despite the presence of significant criticality, advanced specialist surgery can be performed and wounded patients can be treated with microsurgical techniques. It is noteworthy that such techniques are currently only performed in ultra-specialised centres in Italy.

Riassunto: In caso di lesioni nervose dei nervi periferici degli arti superiori è possibile provare ad effettuare un trapianto utilizzando nervi sensitivi prelevati da altre sedi. Durante la Missione Umanitaria "Operazione Levante" presso il porto egiziano di El Alarish, l'equipe chirurgica presente sulla Nave Vulcano della Marina Militare ha effettuato un intervento di microchirurgia ortopedica effettuando un trapianto di nervo da nervo surale pro nervo radiale. Questo case report dimostra che anche in Teatro Operativo, nonostante notevoli criticità, è possibile effettuare una chirurgia specialistica avanzata, trattando un ferito con tecniche microchirurgiche che in Patria vengono effettuate solo in centri ultraspecialistici.

Key words: hand surgery, orthopaedics, sural nerve, operating theatre.

Key messages:

- an inter-agency healthcare approach in terms of means, personnel and specialised and ultra-specialised clinical capacities allows surgical interventions of excellence and high surgical complexity in heterogeneous operational contexts.
- General surgery instruments can be adapted for ultra-specialised surgery.

Introduction

Peripheral nerve fibres are notably delicate structures, which renders them susceptible to damage from various forms of compression (1). The communication abnormalities that result from this process are manifestations of the

damage. Nerve defects may have multiple origins, either iatrogenic (medical or surgical) or traumatic (2, 3). A significant proportion of peripheral nerve fibre injuries are associated with suboptimal functional outcomes, inadequate nerve recovery and loss of sensory and motor function. These are followed

by partial recovery, muscle atrophy, chronic pain and profound weakness (4). It is evident that the regenerative process is a time-consuming process, particularly in the absence of external intervention (5, 6). Furthermore, there are other factors that impair nerve regeneration after injury, such as the loss of large

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amounts of nerve tissue and prolonged denervation of proximal nerves, which increase the likelihood of irreversible atrophy of innervated organs (5). The treatment approach primarily involves microsurgery, encompassing direct repair, end-to-end suturing without tension, and the gold standard technique of utilising autologous nerve grafts to repair larger lesions (3, 7, 8).

The utilisation of the latter mitigates the risk of immunological rejection and engenders a native tissue microenvironment that elicits a positive therapeutic effect. The utilisation of the sural nerve as an autologous nerve graft in peripheral nerve surgery is a well-documented practice in the relevant literature. The reasons for its prevalence are several-fold. Firstly, the harvesting process is both rapid and uncomplicated. Secondly, the available nerve length is sufficient for most purposes. Thirdly, the nerve course is largely linear with minimal branching. Fourthly, the sizing is appropriate for the task. Finally, there is a large number of fascicular groups (9, 10).

The surgical technique involves the removal of the nerve graft through a long skin incision from the distal to the proximal side of the leg. The utilisation of this incision facilitates the execution of the operation with minimal exposure and negligible risk of damage to the nerve graft (10).

In the aftermath of the 7 October 2023 outbreak of hostilities between Israel and Hamas, Defence has been called upon to contribute to efforts to manage a situation that portends potential escalation and necessitates an integrated approach. In this regard, the Italian Government deployed a Humanitarian Mission called «Operation Levant» at the Egyptian port of El Alarish, deploying a Role 2 hospital, with a joint military and

civilian team afloat Nave Vulcano, a vessel of the Italian Navy. During the mission, a total of 80 patients were treated. Four of these patients underwent highly specialised surgery, despite the ship being equipped for Role 2 tasks.

Purpose

This case report illustrates the management of a highly specialised surgical clinical problem with instruments and a general surgery team in a complex operational context.

Clinical case description

The 38-year-old female patient sustained blunt trauma approximately 30 days prior, resulting in multiple injuries to the upper and lower limbs. A physical examination of the patient revealed the presence of two scar outcomes in the volar and dorsal regions of the distal third of the left arm. These scars were attributed to a penetrating foreign body injury. The patient exhibited a total sensory and motor deficit of the innervation region of the median nerve, accompanied by the distinctive 'monkey hand' posture. Two cicatricial areas were identified in the volar and dorsal regions of the distal third of the right arm and the distal third of the left arm. These areas were attributed to penetrating foreign body injury, resulting in a total sensory and motor deficit of the ulnar and radial median nerve innervation territory. The patient was not undergoing any therapeutic interventions and did not have any pre-existing medical conditions.

Materials and Methods

The patient underwent two surgical procedures within a short time period.

The decision to perform the two surgeries at such close intervals was predicated on the premise that it would increase the probability of success, given the relatively recent nature of the traumatic event. In such cases, the temporal aspect of traumatic events with severe sequelae is a critical factor in determining a favourable prognosis. The surgical technique employed was designated as 'open'. In the absence of microsurgical instrumentation, general surgical instrumentation was utilised, with the configuration of said instrumentation adapted to the selected surgical technique in accordance with the principles of force majeure. The team comprised medical and nursing personnel, including an orthopaedic surgeon specialising in hand surgery, a thoracic surgeon, an anaesthetist, and two nurses, one of whom was an instrumentalist and a theatre nurse. The operation was successfully completed after approximately four hours, without encountering any significant complications.

Results

In the initial procedure, the patient was positioned in a supine decubitus position, and an incision was made in the distal third of the ulnar region of the left arm. The foreign body injury was identified, and subsequent investigation revealed the presence of scar tissue compressing the median nerve (**Fig. 1**). The surgical intervention involved the debridement of scar tissue and the neurolysis of the median nerve. The ischaemic fascia was not utilised in this instance.

In the second operation, performed two days later, the patient was positioned in supine decubitus. Subsequently, two inci-

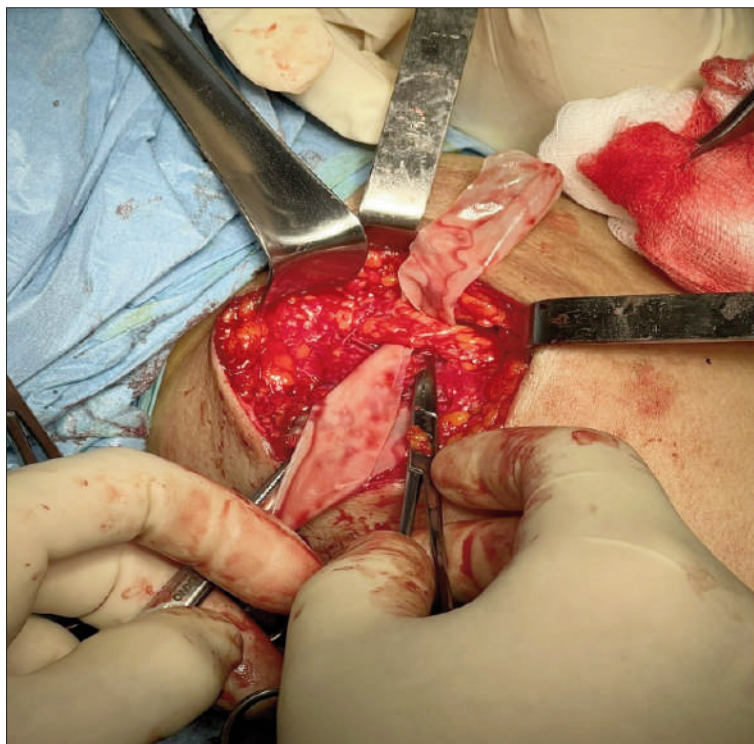


Fig. 1 - Left median nerve explored.



Fig. 3 - Injured radial nerve divided into branche

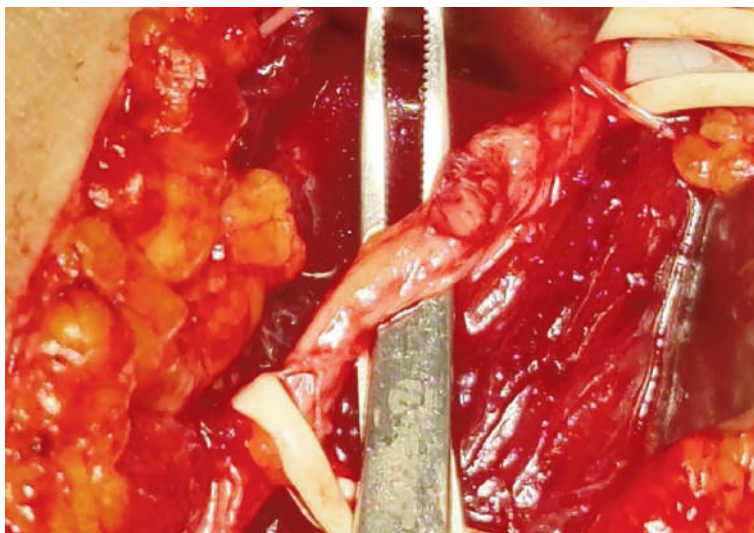


Fig. 2 - Injured radial nerve.

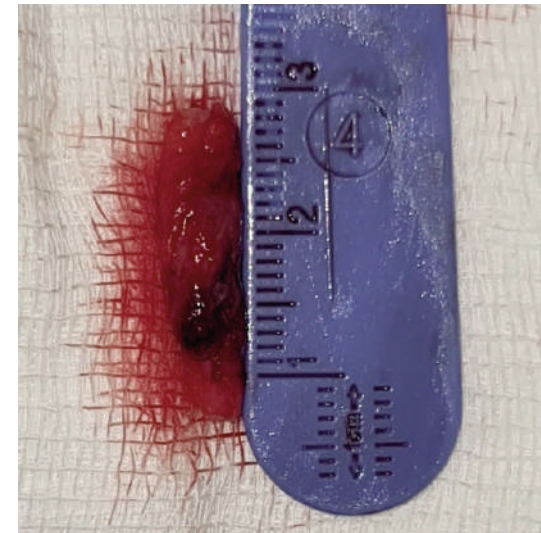


Fig. 4 - Severed radial nerve.

sions were made on the right arm: one median and one lateral. The scar of the foreign body was traced until the median and ulnar nerves were found to be compressed by scar tissue, and the radial nerve was completely injured. Following the neurolysis of the median and ulnar

nerves, the radial nerve stumps were regularised, and a 4-centimetre gap was calculated (**Figs. 2, 3, 4**).

The second surgical step was then taken, involving the removal of the sural nerve. A longitudinal incision was made in the lateral median region of the leg. The sural

nerve was isolated (**Fig. 5**), and 5 cm of the nerve was removed, with stump regularisation (**Fig. 6**).

The third surgical stage was performed with the transplant neurorrhaphy on the radial nerve performed with 5-zero nylon thread (**Fig. 7**).

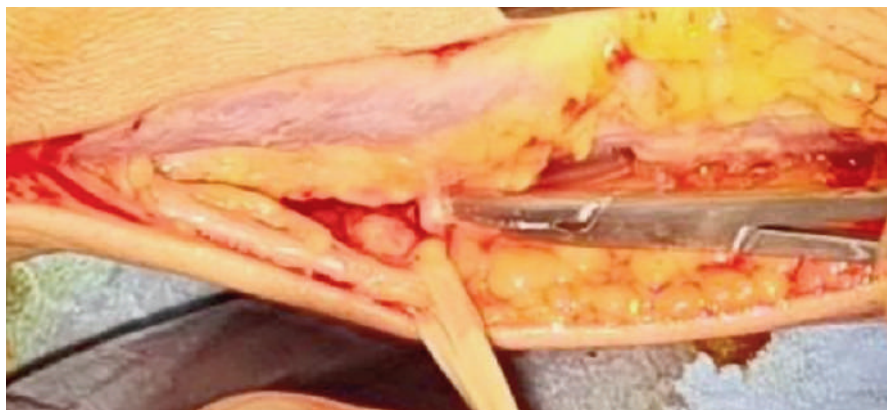


Fig. 5 - Sural nerve withdrawal.



Fig. 6 - Sural nerve transplant.

The arm was protected with a plaster cast for 20 days after surgery. An ischaemic bandage was not used.

On the first post-operative day, the patient immediately recovered sensitivity and mobility of the areas innervated by the median nerve of the left arm and ulnar nerves of the right arm. At 60 days, the patient began to recover mobility and sensitivity of the innervated territories of the radial nerve of the right arm. The follow-up was followed by direct contact with the patient who was transferred to a hospital and rehabilitation centre in Qatar.

The critical issues that emerged were related to the lack of specialised orthopaedic microsurgery devices including micro pliers, micro needle holders, Acland Micro sutures, Sigma Aldrich Micro dissection, and Guthrie skin retractor. This was due to the logistics of the health unit, which was not set up for high speciality surgery, as this was unpredictable.

Discussion

The Role 2 setup helps deal with urgent cases for surgical and medical stabilisation of patients and subsequent evacuation to higher levels of care where they

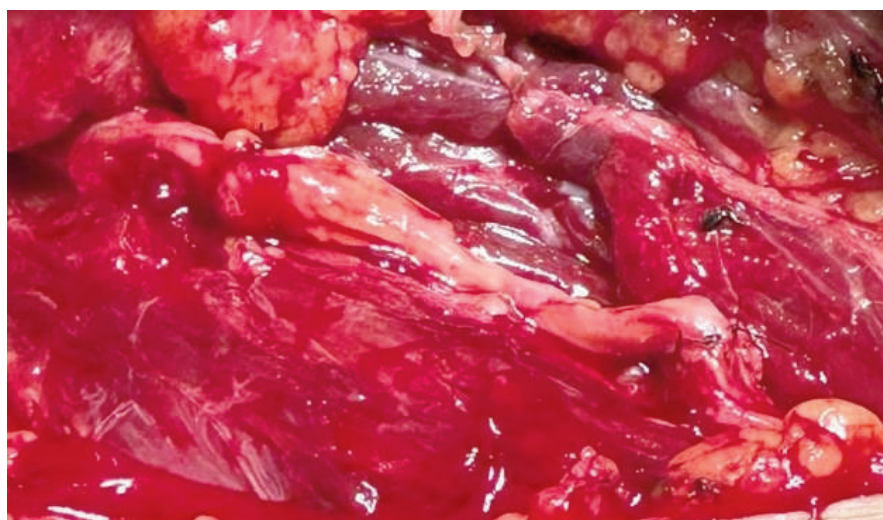


Fig. 7 - Neurorrhaphy of the sural pro radial nerve.

can receive ultra-specialised surgical, medical and rehabilitation treatments. The surgical instrumentation present is therefore adequate for this purpose but limited for a higher level of surgery; despite this, devices for traditional general surgery, such as Farabeuf retractors or Mayo Hegar needle holders, have been adapted to the surgical technique. The objective of this case report was to demonstrate that cases which come to the attention of doctors in a Role 2 setting do not invariably constitute an emergency. In our case, the patient had already been stabilised and the lesions were approximately 30 days old. There-

fore, the preparation and experience of the medical and nursing staff was a fundamental factor in the treatment strategies and patient care. They compensated for the limited materials and means available, thus managing to cope with delicate and ultra-specialised surgical procedures, guaranteeing high standards and important results even under emergency conditions.

Conclusions

The clinical experience carried out on the Vulcano Ship has shown how a joint medical approach is necessary and



successful in terms of means, personnel, and specialised and ultra-specialised clinical capabilities. This approach has enabled the performance of complex surgical operations, such as nerve transplants, which are typically conducted in highly specialised hospital centres in Italy, even in critical and emergency situations.

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CASE REPORT



Emerging evidence in diabetic foot wound care: a paradigmatic study

Evidenze emergenti in vulnologia del piede diabetico: uno studio paradigmatico

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Alberto Serra^{oo}

Abstract: Skin ulcers are a priority clinical issue for healthcare professionals worldwide, representing a shared patient safety concern. In Europe, an estimated 1.5-2 million people experience a chronic wound. Some 64% of wounds are managed at home. Of these, an estimated 24% has lasted 6 months or more, and almost 16% have remained unhealed for a year or more. It is estimated that 5% of lower limb ulcers are of diabetic origin, a condition that affects more than 3.5 million people in Italy. The most significant complication associated with diabetic foot injury is the risk of amputation. Indeed, the literature shows that about 80% of such injuries do in fact heal if properly managed by qualified personnel. These case reports have highlighted and consolidated the emerging evidence in the field of Wound Care and above all the importance of the multidisciplinary team in the planning and treatment of complex wounds, such as diabetic wounds. Further studies on the management of complex wounds in the area of the diabetic foot would be desirable in the future, with the intention of not only improving clinical practice, but above all the outcomes defined which will be decisive for the future quality of life of patients.

Riassunto: Le ulcere cutanee rappresentano una tematica clinica di prioritaria importanza per gli operatori sanitari di tutto il mondo, rappresentando un condiviso problema di sicurezza per pazienti. In Europa, si stima che circa 1,5-2 milioni di persone manifestano una ferita cronica. Il 64% delle ferite sono gestite a domicilio; tra questi, si stima che il 24% abbia vissuto con la ferita per 6 mesi o più, e quasi il 16% è rimasto non guarito per un anno o più. Si stima che 5% delle ulcere dell'arto inferiore siano di origine diabetica, una patologia che in Italia colpisce oltre 3,5 milioni di persone. La complicità più rilevante legata alla lesione da piede diabetico è il rischio di amputazione, del resto in letteratura emerge che circa l'80% di tali lesioni guarisce se opportunamente gestite da personale qualificato. Questo case report ha consentito di evidenziare e consolidare quali siano le evidenze emergenti in ambito del Wound Care e soprattutto dell'importanza dell'equipe multidisciplinare nella pianificazione e trattamento delle ferite complesse, quali quelle diabetiche. Del resto nel futuro Sarebbero auspicabili ulteriori studi in merito alla gestione di ferite complesse in ambito del piede diabetico, con l'intento non solo di migliorare la pratica clinica, ma soprattutto gli outcomes definiti che risulteranno determinanti per la futura qualità di vita dei pazienti.

Key words: Wound care, Diabetic foot, Advanced dressings.

Key messages:

- The role of the multidisciplinary team in the management of a complex diabetic foot case is crucial in improving clinical outcomes.
- The use of rating scales is essential in assessing the healing process of a wound and its appropriate clinical treatment.

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Introduction

In recent years, skin ulcers have become a significant health concern, particularly in light of the ageing population and the increasing prevalence of chronic degenerative diseases (1). Skin ulcers are a clinical priority for healthcare professionals worldwide and represent a shared patient safety concern. Despite numerous national and international awareness and health education campaigns focusing on prevention and management, their incidence in hospital and community settings remains high (2). In Europe, it is estimated that 1.5–2 million people have a chronic wound. Around 64% of these wounds are managed at home, with an estimated 24% lasting six months or more and almost 16% remaining unhealed for a year or more. In their 2019 study, Ligresti et al. drew up a classification of skin ulcers based on their frequency and aetiology (3). Venous ulcers have the highest incidence, accounting for 70% of lower limb ulcers. Arterial ulcers are next in order of prevalence, accounting for 15% of cases, followed by mixed ulcers with an incidence of 7–10%. It is estimated that approximately 5% of lower limb ulcers are of diabetic origin, while 3% are secondary to other pathologies and/or conditions such as vasculitis, neoplasms, haematological problems and post-traumatic events (4). In Italy, according to the National Statistics Institute (ISTAT), it is estimated that 5.9% of the population, i.e. over 3.5 million people, have diabetes, and this figure has been slowly increasing in recent years. The most commonly encountered clinical complication in patients with diabetes is diabetic foot syndrome, which the International Working Group on the Diabetic Foot (IWGDF, 2019) defines as ‘an infec-

tion, ulceration, or tissue destruction in the foot of a person with currently or previously diagnosed diabetes mellitus, usually accompanied by neuropathy and/or peripheral arterial disease (PAD) in the lower limbs’ (5).

A diabetic ulcer is a chronic lesion that affects the skin tissues, from the surface to the deeper layers. Depending on its severity, it can lead to infections and fistulas, which can result in necrosis and amputation of the affected area. Given that amputation is the most significant complication associated with diabetic foot injuries, literature indicates that 80% of these injuries heal with proper management by qualified personnel (6). Consequently, the involvement of a multidisciplinary team of medical specialists and nurses in wound care is becoming increasingly important in the management of patients with diabetic foot conditions.

Recent studies have conclusively shown that a moist environment is necessary for the healing of diabetic foot wounds and other types of wounds because it promotes the healing process. The decision on the type of dressing to be used is often key for vulnologists and should be based on data gathered from clinical observation, the degree of potential infection or established infection, and other complications. Indeed, hydrocolloids have been shown to be more appropriate for wounds that do not secrete large amounts of exudate than gauze, which causes patients pain during dressing changes. Hydrocolloids are also less costly as they do not need to be removed daily as gauze does (8). In contrast, in cases of very heavy exudate, traditional gauze appears to be more effective and less expensive, and the pain experienced by patients during dressing changes does not differ

between types (9).

Some types of advanced dressings are more expensive than others, especially compared to gauze. However, the modest increase in cost caused by using a polyurethane film dressing is offset by reduced costs and fewer wound complications associated with gauze and tape (10). This case report therefore aims to document the instrumental role of the multidisciplinary team in improving clinical outcomes in the management of a difficult diabetic foot case.

Purpose

This case report outlines the role of the multidisciplinary team in managing a complex diabetic foot case by implementing emerging best practices in wound care.

Materials and methods

This study was conducted from February to November 2023 at the Orthopaedics and Traumatology Unit of the Celio General Military Hospital in Rome. The clinical case was managed by a multidisciplinary team comprising orthopaedic surgeons, plastic surgeons and nurses specialising in wound care. The patient consented to the study by signing an informed consent form.

The following rating scales were used: the Bates-Jensen Wound Assessment Tool (BWAT), which investigates clinical wound progression; the SF-12, which investigates the patient’s quality of life; and the NRS for pain. The three scales were administered by the team nurses and then analysed by a physician and a nurse expert in medical statistics. Specifically, seven surveys (T0 to T3) were carried out for the BWAT scale and the NRS was administered at each protocol

change. The range of scores from 35 to ≥ 60 identifies wound degeneration; from 30 to ≥ 13 , the beginning of the tissue repair process; and from ≤ 13 to ≥ 1 , healing. For pain, the scores range from 0 (no pain) to 10 (very painful), and the SF-12 considers quality of life to be sufficiently acceptable at a score of ≥ 50 . These instruments were used to investigate characteristics concerning both the wound and the patient, such as wound site, BWAT score, time spent on care, dressing products used, patient age, admission pathology, pain, and quality of life. Data were analysed using SPSS v21 software.

Clinical case presentation

Patient A.S., aged 78, retired military personnel. He was admitted to the UOC of Orthopaedics and Traumatology at the Policlinico Militare in Rome on 22 February 2023 due to complications arising from diabetic neuropathy in his right foot. He underwent a first surgery to amputate his left forefoot in 2022 and amputation of his right foot in 2023.

Remote pathological history: three weekly dialysis sessions for chronic renal insufficiency (CRI) secondary to diabetic nephropathy; ischemic-hypertensive heart disease due to previous acute myocardial infarction (AMI), treated with percutaneous transluminal coronary angioplasty (PTCA) and stent; chronic obstructive pulmonary disease (COPD); episodes of atrial fibrillation; and arteriovenous fistula (AVF) carrier. He underwent left forefoot amputation surgery in 2022 and right foot amputation surgery in 2023, resulting in severe walking impairment.

Pharmacological therapy: Sevelamer carbonate: 1 tablet, three times a day; pantoprazole: 1 tablet a day;

cardioaspirin; bisoprolol: 1.5 mg; acenocoumarol: 4 mg; atorvastatin: 10 mg; linagliptin: 5 mg; allopurinol: 300 mg, one tablet on the day of dialysis; insulin glargine: 4 units in the evening.

Recent medical history: admission for hyperpyrexia (39°C), vomiting and severe weakness. Blood chemistry tests revealed the following results: glycaemia 190; azotemia 91.3; creatininemia 8.20; sodiemia 135; potassemia 5.4; CPK 286; protein C 11.08; CBC 2.94; Hb 10; HCT 31.4; PLT 128; INR 2.92; PTT 56; AT III 82. A chest X-ray showed no evidence of inflammatory foci in the active phase. On 22 February (identified as T0), the end of the stump was covered with a dry, necrotic eschar. Ultrasonic debridement was performed, exposing the metatarsal heads of the first and third toes, which were surrounded by diffuse fibrin and devitalised tissue. The perilesional skin appeared slightly reddened, and the margins were jagged. (*Fig. 1*).

Medication protocol

- Cleansing and irrigation with PHMB (polyhexanide) solution.
- Antisepsis with hypochlorous acid (HOCL) solution.

- Application of a spray that forms a transparent, protective barrier film to protect the perilesional area.
- Application of a black honeycomb polyurethane foam dressing over the entire wound area.
- Placement of NPWT (vacuum therapy), blocking it with an adhesive film to isolate and promote vacuum to the lesion area (*Fig. 2*).
- Closure is achieved by making a soft bandage with a self-adhesive dressing.

The BWAT scale score was 57. The NRS score was 8. The SF-12 score was PCS-12 (Physical Score): 22.80085 and MCS-12 (Mental Score): 24.43928.

Antibiotic therapy was started for a wound swab culture positive for *Pseudomonas aeruginosa* and *Staphylococcus aureus*.

The photo taken on 27 March shows necrotic areas mixed with granule-like areas (*Fig. 3*). The photo taken on 22 April shows a large amount of mixed slough and fibrin. Shortening of the stump was then opted for, with the margins being brought into contact with each other using stitches to facilitate closure (*Figs 4, 5*).

On 5 May, stump reduction surgery was

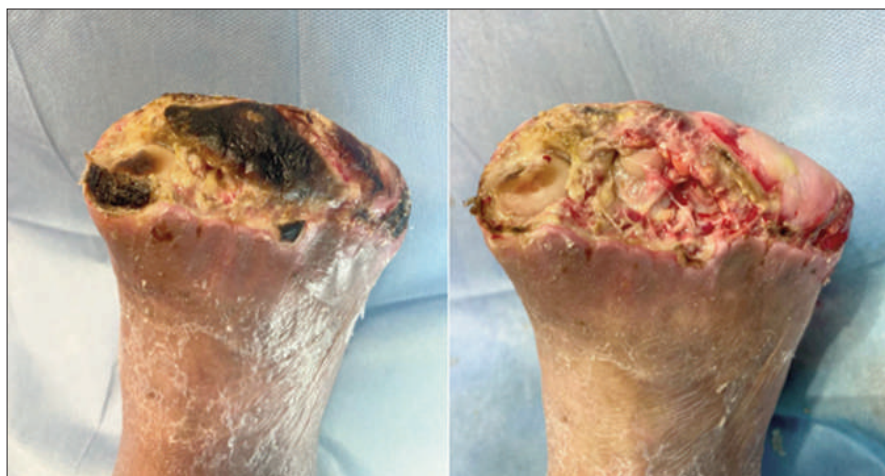


Fig. 1 - T0 (22 February – Before and after ultrasonic debridement).



Fig. 2 - T0 (March – After ultrasonic debridement, NPWT repositioning at pressure - 125 mmHg).



Fig. 3 - T0 (March – After ultrasonic debridement, NPWT repositioning at pressure -125 mmHg).

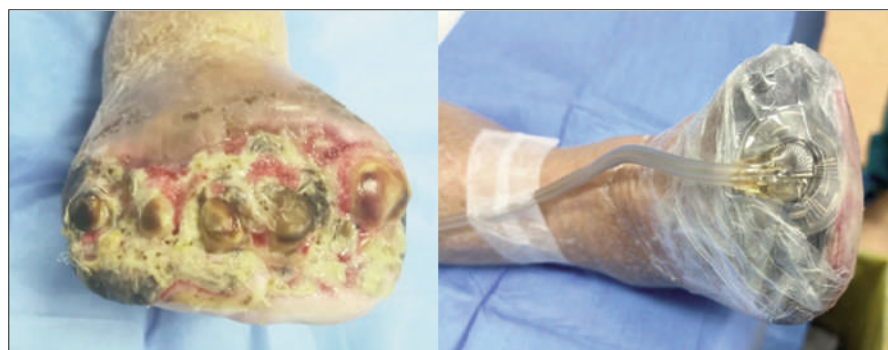


Fig. 4 - T1 (22 April: NPWT repositioning and preparation for surgery to shorten the stump).



Fig. 5 - T1 (5 May: Surgery to shorten the stump, NPWT repositioning at a pressure of -100 mmHg).

scheduled, as the lesion was not closing and the healing process had stopped. Post-operatively, NPWT was applied (**Fig. 5**).

Medication protocol - Time 1

- Cleansing and irrigation with PHMB (polyhexanide) solution;
- antisepsis with HOCL (hypochlorous acid) solution;
- application to protect the perilesional area of a spray that forms a transparent and protective barrier film;
- application of a silicone dressing with holes, designed to adapt to the moist wound, capable of reducing pain and easy to remove;
- subsequent application of a black honeycomb polyurethane foam dressing over the entire wound area;
- placement of the NPWT, blocking it with an adhesive film to create and isolate the lesion area and thus promote 'vacuum';
- closure by making a soft bandage with a self-adhering bandage;
- continued antibiotic therapy for pseudomonas and staphylococcus aureus.

The BWAT scale score was 41 and the NRS score was 7 pre-surgery, and 25 and 4 post-surgery, respectively.

A swab of the lesion for germs, accompanied by an antibiogram, was also carried out on 1 June (Time 2). No staphylococcus or pseudomonas were present. Antibiotic therapy was suspended. The BWAT scale score was 38. The NRS score was 7.

Medication protocol - Time 2

- Cleansing and irrigation with PHMB (polyhexanide) solution;
- antisepsis with HOCL (hypochlorous acid) solution;
- placement of a green, close-meshed, bacterial-capture gauze treated with a fatty acid derivative (DACC) inside the fistulas created internally and laterally at the stump closure (**Fig. 6**);
- application to protect the perilesional area of a spray that forms a transparent and protective barrier film;
- foam-based (polyurethane) secondary dressing;
- NPWT repositioning;
- closure with adhesive film and soft bandage.

Since 28 July, a fistula has appeared on the central part of the closed stump. We proceeded to:

- 'squeeze' and remove a free filament of tendon (**Fig. 7**);
- the fistula and other unclosed stump areas were flushed with HOCL using a cannula;
- green, close-meshed gauze treated with a fatty acid derivative (DACC) was applied;
- it is closed by placing secondary absorbent dressing and then a self-adherent bandage was used for final closure.

At the re-evaluation at T3 on 18 August,



Fig. 6 - Fistulisation of the wound laterally after surgery.



Fig. 7 - T2 (28 July - Cleaning of the bottom of the lesion and washing of the fistulas with a syringe).

the fistulas appeared closed, with only the outer lateral part of the stump still unclosed (**Fig. 8**).

Medication protocol time 3

- Antisepsis with HOCL-based solution of the fistula at the dorso-plantar level;

- surgical debridement of the bottom with a scalpel is performed;
- Placement of secondary absorbent dressing with bacterial-capturing gauze interface;
- closure by making a soft bandage with a self-adhering bandage.
- Result of the protocol at 20 days maintained 2 months (**Fig. 9**).



Fig. 8 - T3 (18 August - Antisepsis of the dorsoplantar fistula).



Fig. 9 - T3 (Evolution of the lesion: reduction in the size of the dorsoplantar fistula).



Fig. 10 - Start of follow-up.

The BWAT scale score was 27. The NRS score was 6.

After one and a half months (September/October 2023), almost complete closure of the lesion could be observed; only a small lateral area of disepithelialisation remained (**Fig.10**). From this moment on, the remodelling phase begun.

The BWAT scale score is 13. The NRS score is 3.

The SF-12 score is: CS-12 (Physical Score): **84.24**; MCS-12 (Mental Score): **74.43**

Analysing the multiple surgical and wound care treatments implemented from T0 to T4 showed that they reduced pain, improved the lesion and quality of life. In particular, stump reduction surgery at T2 improved the lesion abruptly, promoted reparative processes, and improved quality of life; however, a complication due to fistulisation worsened the lesion and quality of life after 20 days (**Fig. 11**).

The wound care protocols applied had an effect on the improvement of the lesion and pain. Specifically, it should be noted

that NPWT was used from protocols 0 to 3, which significantly improved the lesion and supported advanced medication. This certainly justified the progressive improvement in scores, in addition to the implementation of contextually adaptable pain therapy (**Fig. 12**).

Since Protocol 3, during which the stump reduction surgery took place, there has been an improvement in pain and injury; unfortunately, the complication of fistulisation has delayed healing. Overall, quality of life is quite satisfactory. The results of the SF-12 scale, which measures physical and mental health, show that the two dimensions do not progress in the same way. At T3, the cause of the fistulisation led to a sudden worsening of physical and mental quality of life, with the latter being worse than the former (**Fig. 13**).

Discussions

Diabetic foot disease remains one of the most serious complications of diabetes mellitus. This case demonstrates that, despite the complexity of the pathology in clinical terms, all clinical activities are based on existing scientific literature. In this regard, surgical wounds and wounds caused by primary diseases, such as diabetes, require a moist environment to heal. Decisions on the type of dressing to use should be based on data collected through observation, taking into account the degree of infection and other complications (8). The implementation of assessment scales by the specialist nurse in wound care, such as the BWAT, would provide valuable data for the objective assessment and monitoring of wound healing processes (8).

Advanced dressings are used in dressing protocols after analysis of the data collected on the case under study. For

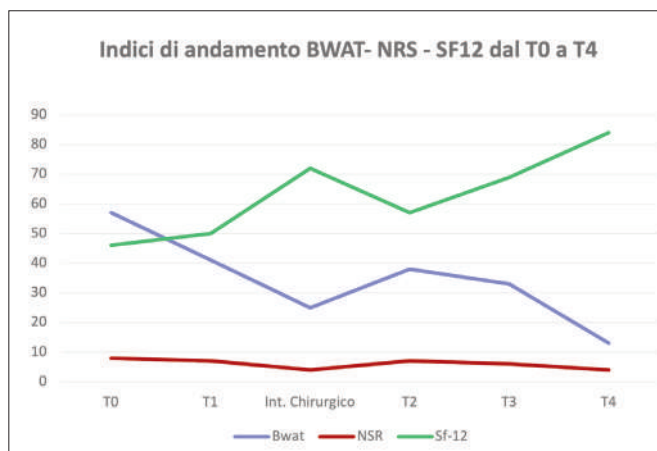


Fig. 11 - BWAT – NRS SF 12 trend from T0 to T4.

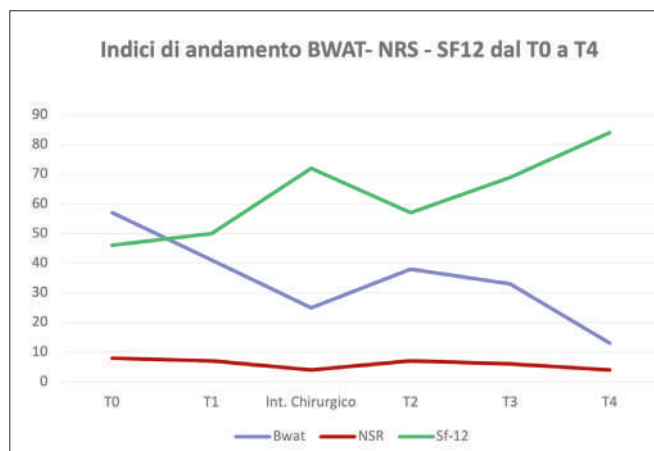


Fig. 12 - BWAT and NRS scores at each change of dressing protocol.

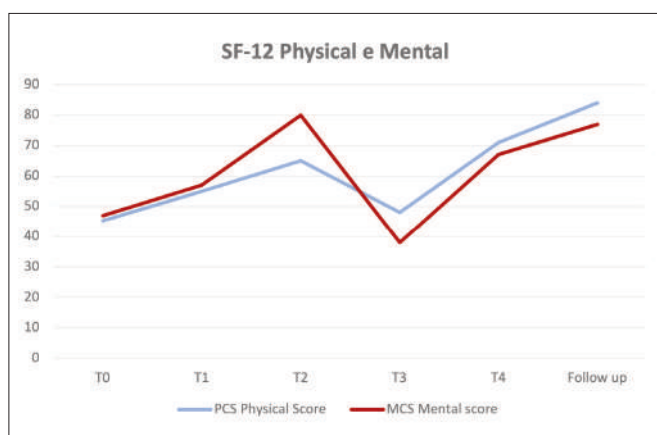


Fig. 13 - SF-12 scores from T0 to T4.

example, hydrocolloids were more appropriate for the wound in the above clinical case than gauze, as gauze caused patients pain during dressing changes. Hydrocolloids are also less expensive for this type of wound because, unlike traditional gauze, they do not need to be removed daily (9, 10).

NPWT is of fundamental importance in rapidly promoting healing processes. The literature on this subject is very thorough. Combining NPWT with supportive surgical techniques appears to be an effective way of treating a variety of complex wounds, including diabetic foot ulcers. Furthermore, it

presence can lead to non-adherence to therapy and a shorter recovery time. Certain complications, such as post-surgery fistulisation, can lead not only to the lesion worsening, but also have a negative impact on the patient's quality of life, with the psychological sphere potentially being more affected than the physical one.

Conclusions

This work highlighted and consolidated the emerging evidence in the field of wound care, particularly emphasising the importance of multidisciplinary

seems that implementing NPWT would reduce hospital bed days and costs related to the condition (11, 12).

Furthermore, pain assessment is an important consideration since, as in the presented clinical case, it affects the patient's quality of life. Its

teams in planning and treating complex wounds. The clinical case study was a valuable tool for demonstrating how these processes adhere to a rigorous scientific approach based on EBM and EBN. Further studies on the management of complex wounds in the context of the diabetic foot would be desirable in future, with the aim of improving clinical practice and, above all, achieving defined outcomes that will be decisive for patients' future quality of life.

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PERSPECTIVE



S100B and Health: from the brain to plants via milk

S100B e Salute: dal cervello alle piante passando dal latte

Vincenzo Romano Spica * Fabrizio Michetti **

Abstract - The S100B protein was initially discovered in the brain during the 1960s. For several decades, research has been conducted on both humans and other vertebrates, with a focus on various organs and tissues. The characterisation of this phenomenon has also been undertaken in different biological fluids and cellular mechanisms. The contribution to medicine has been substantial, encompassing between 4,000 and 40,000 scientific contributions on PubMed, based on the level of query specificity. More recently, through in silico studies performed by bioinformatics methodologies, complemented by subsequent validation in vitro by immunodetection, the molecular configuration of S100B has been delineated in selected edible plants and fruits. It is a general law that nature employs the homologous gene information in species that are so distant in phylogeny. This observation, however, is opening up new scenarios for research and medicine. The hypothesis that S100B might play a role in nutrition was first postulated upon the observation that breastfeeding is a source of S100B, which is present in breast milk. The rationale behind nature's decision to incorporate this molecule into the infant's initial dietary intake remains a subject of scientific investigation. The main question is why this principle should be shared by all mammals and their offspring. Initially, S100B was theorised to be a neurotrophic factor; however, recent studies have revealed a novel perspective that identifies the target of S100B's physiological action in the microbiota. At least two pathways are currently under scrutiny: firstly, an endogenous pathway that is facilitated by enteric glial cells, and secondly, an exogenous pathway that is introduced by nutritional intake from birth, in the beginning through breastfeeding and subsequently lifelong, through the consumption of varied and balanced diets. S100B exploitation appears a promising tool for strengthening health and restoring imbalances, even under stressful conditions. The mechanisms would not be those involving probiotics, prebiotics, or nutrients, but rather a new approach based on a potential harmonization of the microbiota. The emphasis is on the biodiversity of the microflora, which is increasingly recognised as a key factor at a local level or exerting effects on other organs through gut-brain axis. Advancements in genetics and bioinformatics are unveiling novel technological horizons.

Riassunto - La proteina S100B fu inizialmente scoperta nel cervello durante gli anni '60. Per decenni è stata studiata nell'uomo e altri vertebrati, in diversi organi e tessuti, fino a caratterizzarla in vari fluidi biologici e meccanismi cellulari. Il contributo alla medicina è stato amplissimo e intenso, comprendendo su PubMed tra i 4000 e 40000 contributi scientifici, a seconda del livello di specificità posto nell'interrogare questo database di riferimento per la letteratura biomedica. Oggi, attraverso studi in silico basati su metodi di bioinformatica confermati poi in vitro con metodi immunologici, la struttura molecolare di S100B è stata dimostrata persino in alcune piante e frutti commestibili. Non deve stupire che la natura utilizzi la medesima informazione genica in specie e contesti così lontani nella filogenesi, ma, questa osservazione sta aprendo nuovi scenari per la ricerca e la medicina. Il sospetto che S100B potesse avere un ruolo nell'alimentazione emerge già osservando che l'allattamento al seno era una fonte di questa proteina, presente nel latte materno. Perché la natura avrebbe dovuto mettere energia per introdurre nel primo alimento del neonato questa molecola? Perché questo principio è universale per tutti i mammiferi e i loro cuccioli? Inizialmente si pensò fosse un fattore neurotrofico, ma oggi si sta aprendo una prospettiva rivoluzionaria, che identifica il bersaglio dell'azione fisiologica di S100B nel microbiota. Almeno due vie sono in studio, una endogena attraverso le cellule enterogliali ed una esogena attraverso l'alimentazione dalla nascita con l'allattamento e poi nel corso della vita con diete variate ed equilibrate. S100B appare un promettente strumento per rinforzare la salute e ripristinare squilibri, anche in condizioni di stress per l'organismo. I meccanismi non sarebbero quelli di probiotici, prebiotici, o nutrienti, bensì quelli di un potenziale armonizzatore del microbiota. Il focus è in quella biodiversità della microflora, che sempre più spiega effetti "in loco" o a distanza su altri organi attraverso complesse interazioni, come l'asse intestino-cervello, o fattori trofici ancora da investigare. I progressi della genetica, bioinformatica e scienze "omiche" stanno aprendo nuovi orizzonti conoscitivi e tecnologici, che investono anche questa piccola proteina S100B, nota da tempo, ma dalle rinnovate e promettenti prospettive.

Key words: S100B, Microbiota, Diet, Breastfeeding, Gut-Brain Axis, Elisa, NGS, Bioinformatics, Epidemiology

Key messages:

- S100B levels in gut lumen are associated to eubiosis, exerting a role in microbiota regulation with potential applications in therapy, prevention and health promotion.
- Nutritional, Pharmaceutical or Phytotherapy-based approaches may open new perspectives for developing novel strategies to apply S100B in diet under regular or stressing conditions.

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A protein discovered in the brain and studied in different tissues

S100B is a small (10 kDa) protein, capable of forming dimers and tetramers, and binding calcium (1). Originally discovered in brain extracts in the 1960s (**Fig. 1**), it was later characterised in other tissues. One of its defining characteristics is its solubility in a 100% saturated solution of ammonium sulphate (2), hence the name. It is expressed by several cells, including glial astrocytes in the central nervous system, and also in various organs and biological fluids. This protein is well conserved phylogenetically, being found in various animal species in forms that are homologous to those found in humans, indicating a relevant biological role. Moreover, similar molecules belonging to the S100 protein family include EF-hand domains and helix-loop-helix (HLH) structures. The genes that encode these proteins are located in the q21 region of the long arm of chromosome 1, except for the S100B protein, which is located in a different region of the human genome, on chromosome 21q22. Transcription of this gene into mRNA and translation into amino acids has been observed in various organs and tissues, including the kidney, adrenal gland, cartilage, immune system, eye, adipose tissue, skin melanocytes, Leydig cells in male gametes and the mammary gland, as well as in trophoblasts and stromal cells in the chorial villi of the placenta (3). From the earliest studies on the brain, growing evidences support a fundamental role for S100B in the functioning of the organism (**Fig. 2**). From the initial focus aimed at elucidating its physiological and trophic function, the following decades

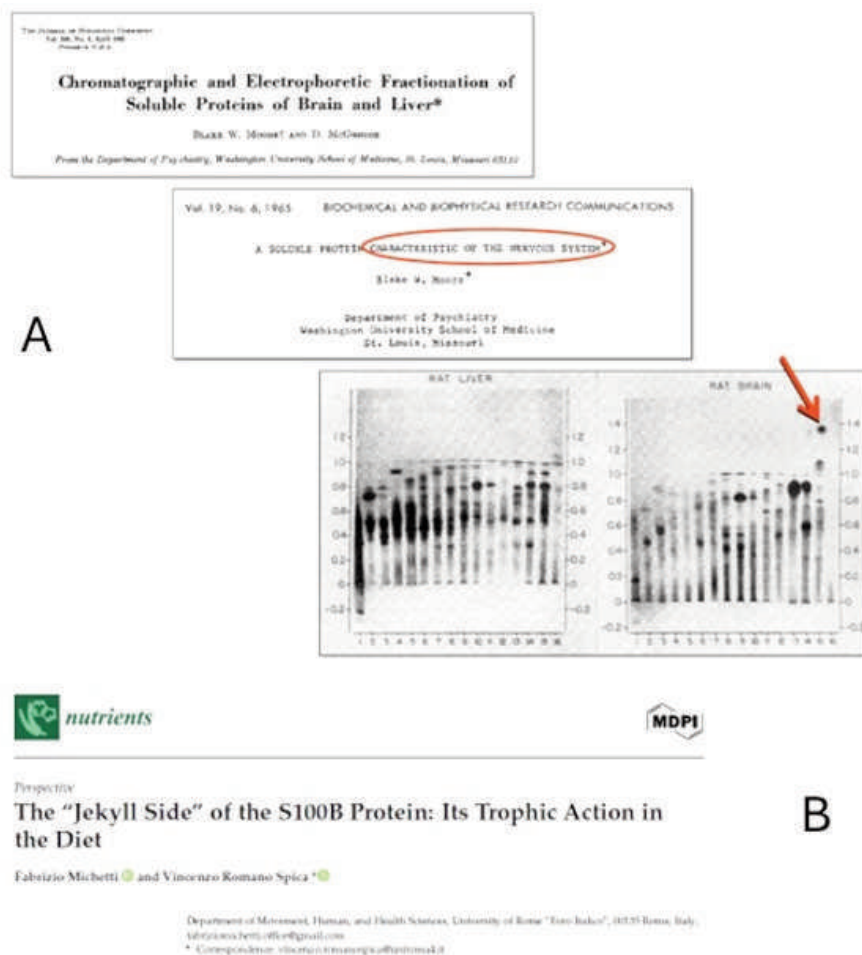


Fig. 1 - Early work (A) reporting the discovery and characterisation of a brain protein originally named S100. The name was derived from the observation of its solubility in a 100% solution of ammonium sulphate at neutral pH. Subsequently, other molecules of the same family were identified, distinguished by letters and/or numbers, for a complex of more than 20 members. However, S100 -also referred to as S100B: beta- possesses a number of autonomous characteristics, such as being located on chromosome 21q22, as opposed to the 1q21 locus where the genes encoding the other members of this protein family are located. It has the ability to interact and bind with other molecules and can form homodimers, heterodimers and tetramers. Its presence in the brain, and in particular its expression in the glia, led to it being assayed in blood even in hospital practice as a valid prognostic marker released in head trauma. However, its expression has also been demonstrated in various other tissues and biological fluids. Recently (B), a trophic and physiological action has been reconsidered and new perspectives have also been considered through the intake of the protein through particular foods present in the diet, re-evaluating the 'Dr. Jekyll' side as opposed to the 'Mr Hyde' side related to the study of protein modifications in pathological phenomena. Recent findings have opened up new perspectives for a physiological role of S100B in protecting and promoting health through modulation of the microbiota.

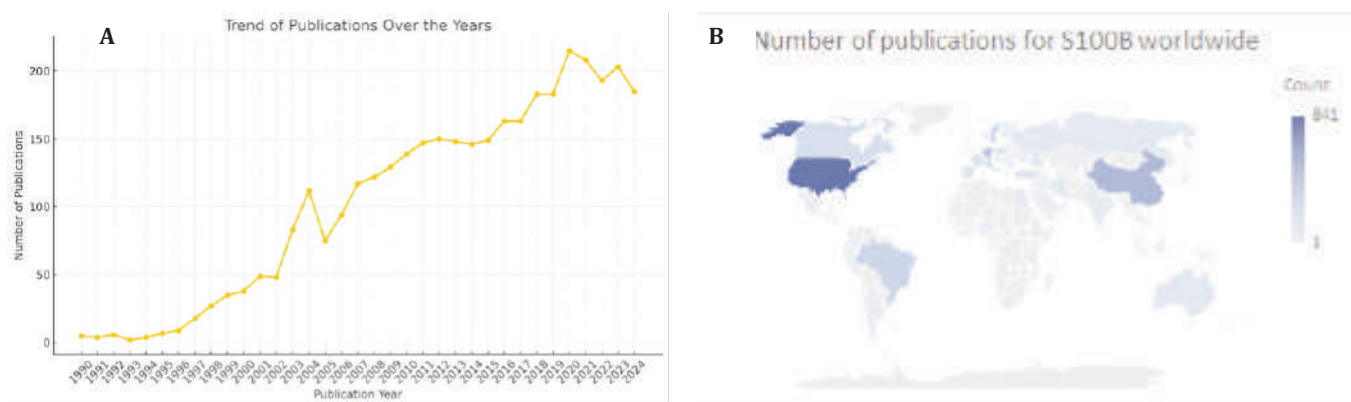


Fig. 2 - A) Analysis of yearly publications trend. The web science database includes 3559 records on S100B protein and about 39,000 for «S100». The line indicates the publication trend from 1990 until 2024, showing the number of papers which are published each year. This trend starts increasing in 1990 and till then 2024 its impact is increasing. It shows an upward trend which dominantly indicates the increment in the research trends concerning the S100B protein in different scientific areas.

B) Analysis of countries. A country map was generated to find the leading countries in the research fields of S100B protein. Among the records which were analysed, the publications originated from 89 countries. The top 10 countries in terms of publication count include USA, China, Germany, Italy, Brazil, England, Sweden, Canada, Japan, France. The USA emerged as the foremost contributor. The second and third position carried by China and Germany.

witnessed a shift away from the 'normal' condition to studying, instead, its response in various 'pathological' conditions (4, 5).

Alterations in serum or tissue levels have been reported in a variety of diseases, ranging from neurological disorders to obesity and diabetes, and including certain cancers, such as melanoma. S100B has even been identified as a promising prognostic marker in cases of severe acute respiratory syndrome (SARS-CoV-2) infection (6). It is only very recently that scientific research has redirected the focus of this investigation towards the trophic role that was at the origin of its discovery. This has resulted in the highlighting of the dual nature of the protein, with one aspect being beneficial to health and the other being associated with pathological phenomena, somewhat akin to the duality of the characters Dr. Jekyll and Mr. Hyde (7). In the field of medicine, it is well-established that a given molecule can exert both positive and negative effects.

A salient example of this phenomenon is the utilisation in pharmacology of plant poisons as therapeutic agents, such as atropine or colchicine. Additionally, also proto-oncogenes and suppressor genes, have been identified as fundamental DNA sequences essential for life, regulating cell cycle. This notion has been substantiated by seminal research contributions, notably the 1989 Nobel Prizes in Physiology and Medicine, bestowed upon Harold Varmus and Michael Bishop for their discoveries concerning the origin of 'cancer' oncovirus genes from 'normal' cellular genes. For S100B, several scientists have reached the conclusion that low (nanomolar) concentrations could be considered physiological by exerting a trophic effect ('Jekyll side'), whereas high (micromolar) concentrations could exert a toxic/proinflammatory role ('Hyde side'). It is evident that modified levels may not be causative of the disease; rather, they are the consequence of alterations induced by pathogenic agents

or mechanisms. In both hypotheses, however, various intracellular biochemical pathways have been identified, while extracellular S100B is believed to interact with surrounding cell types mainly through the receptor for advanced glycation end products (RAGE), a ubiquitous transmembrane receptor similar to immunoglobulins that binds to a wide range of extracellular ligands and intracellular effectors (7, 8). At present, the 'Hyde side' of S100B is the primary focus of the scientific community, particularly in relation to its use as a biomarker for various diseases. In contrast, the physiological role of this protein, i.e. its main biological and trophic function (the 'Jekyll side'), remains to be fully unravelled.

From humans to animals even in plants

The discovery that the molecular structure of S100B is present in plants (9) brought about a revolution in

knowledge about this protein. While it was already known that the genetic sequence of this small protein was highly conserved across phylogenies, it had never been systematically studied in plants before. However, it was already known that S100B was present in animals and in particular in mammals. The human amino acid sequence is, highly similar to those of cattle, donkeys and sheep, as well as cats, leopards, camels, elephants, cetaceans, guinea pigs and rats. Surprisingly, nature has also made homologous genes available to produce S100B in species that are more distantly related to humans, such as earthworms, planarians and silkworms. Immunoreactivity for S100B has also been observed in cockroaches (10).

Finally, researchers came to discover S100B in plants while conducting a clinical-pharmaceutical study on the action of S100B inhibitors in

neurodegenerative diseases and inflammatory bowel diseases, particularly Crohn's disease (5, 11). To exclude S100B contamination in the mice's feed during *in vivo* experiments, it was monitored by immunodetection. This led to the hypothesis that S100B molecular domains could also be found in plants. *In silico* bioinformatics pipelines were developed and applied to investigate the available genomes of the entire *Viridiplantae* clade, which comprises over 500,000 species. Supercomputers revealed that the theoretical molecular structure of S100B was present in a small percentage of plants (less than 0.02%), including edible species. This was later confirmed immunologically by showing the presence of antigens compatible with the molecular architecture of S100B *in vitro*, both in animals and plants (**Fig. 3**). Further studies in botany, genetics, and plant physiology are needed to

understand the significance of proteins containing the S100B domain being expressed in different plant tissues, including leaves and fruits. Some of these edible species are rare, but others are very common worldwide, such as apples and spinach.

From breastfeeding to diet in adults

S100B has been found to be present in biological fluids, including milk secreted by the mammary apocrine gland (12). This characteristic is common to all mammals, meaning the S100B protein is present in the initial food consumed by every human and other baby mammal.

It is widely believed that S100B may be one of the beneficial factors that determine the advantages of breastfeeding, and it may also play a natural role in the development of newborns through neurotrophic action (13, 14). However, recent evidence

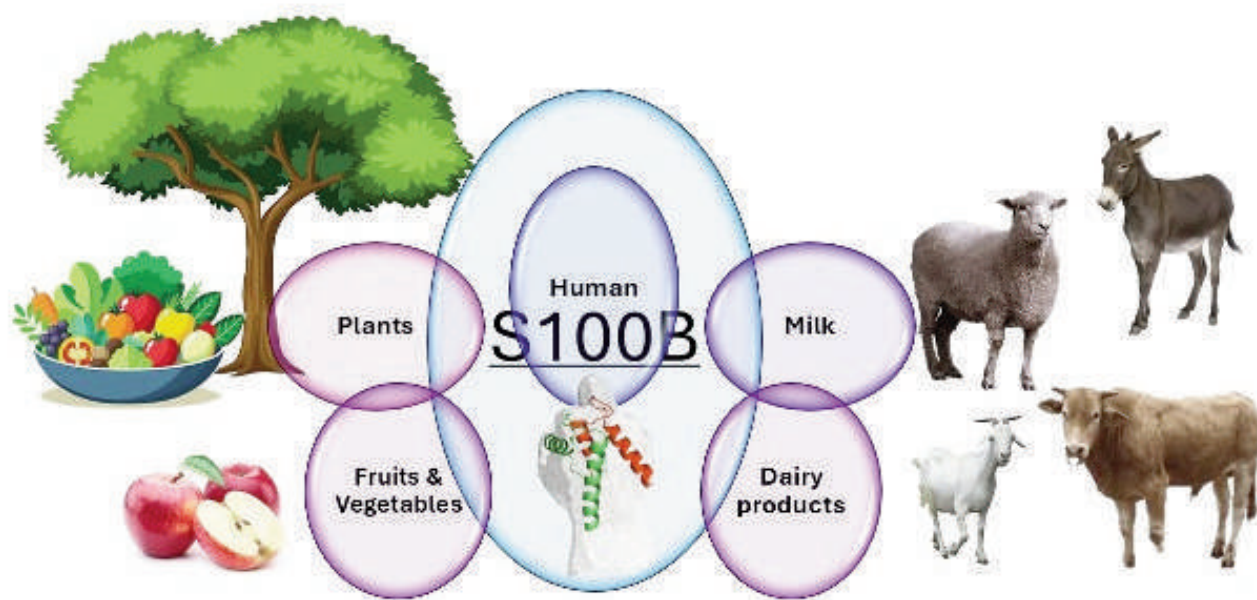


Fig. 2 - The S100B protein was originally discovered in the brain, but has recently been shown to be present in the diet as well, through various foods, including milk and some dairy products, certain fruits and vegetables. The action initially provided through breastfeeding could therefore be maintained even after weaning in various types of diets, including the Mediterranean diet, which is rich in vegetables, fruit and dairy products.



suggests that S100B also plays a role within the intestinal lumen by interacting with the microbiota. This occurs indirectly, without the protein crossing the intestinal barrier and being absorbed into the circulation. Various experimental, *in silico* and *in vivo* observations suggest that S100B influences the microbiota, which may then act on other systems or apparatuses. For example, it may modulate the functional axes of the microbiota-organs, including the gut-brain axis (15, 16). The gut microbiota is now considered a true organ, despite being composed of genetically distinct non-eukaryotic cells, but rather a prokaryotic community of bacteria and other microorganisms, including fungi, protozoa, and viruses. The intestinal bacterial microflora is extremely complex, comprising 600–1,000 different species and more than 10^{13} – 10^{14} prokaryotic cells in total, contributing about 1–2 kg to the weight of each individual. Using an *ad hoc* developed algorithm, the researchers generated the ‘microbiota proteome’: all the proteins that can be expressed based on knowledge of the genomes present in a given microflora (15). This approach confirmed the potential interaction between S100B and various bacterial ligands and revealed how their distribution changed between healthy subjects and those with Crohn’s disease. Furthermore, *in vivo* experiments on mice revealed that biodiversity indices, particularly the Shannon index, followed S100B levels in the intestinal lumen (16). Higher S100B values in the colon were found to correlate with an increase in the Shannon index, which may serve as an indicator of eubiosis. The whole of these results suggests that the presence of S100B in mother’s milk may support

infant development and perform direct neurotrophic actions on the nervous system, as well as indirect actions through harmonising the microbiota and mediating via the gut-brain axis. Building on this speculation, the hypothesis that breast-feeding, through S100B, plays a crucial role in initiating the correct formation of the microbiota and defining the imprinting of the microflora for an established biodiversity that will accompany the individual throughout life is worth exploring. Therefore, vaginal delivery, involving exposure to the first lactobacilli and microflora through the birth canal and subsequent interaction with environmental microflora, would constitute the basis on which breastfeeding and nutritional factors, including S100B, can contribute to establishing a healthy intestinal ecosystem in newborn babies from the very beginning of life.

Similarly, observations from plant studies showed that dietary intake of S100B could continue in the adult diet. Certain types of fruit and vegetables, such as apples, spinach and brassica vegetables, are rich in S100B and are traditionally part of the diet provided in early childhood. Other sources of S100B include certain dairy products such as yoghurt, ricotta and some cheeses. These foods, along with others, are common in various diets around the world and may contribute to harmonising the microbiota even in adulthood (17). Recent epidemiological studies and preliminary data show that it is possible to estimate and compare the amount of S100B in various diets. From this perspective, S100B becomes an innovative nutraceutical factor and a revolutionary additional indicator that can be used to design healthy, customised diets. Eubiosis is an

increasingly relevant topic in medicine that is no longer limited to managing constipation or intestinal inflammatory diseases such as Crohn’s/IBD. It also extends to preventing chronic degenerative diseases through the action of metabolic pathways (18).

In conclusion, S100B could play a role in directing the colonisation and formation of the microbiota in a sterile gut, such as that of an infant. The infant’s meconium is surprisingly devoid of the microbes that will inhabit the adult intestinal lumen and will account for around a fifth of the weight of the faecal material. Once the microbiota has been established in the first months of life, however, S100B may continue to play its role in two ways: (i) an exogenous route involving a balanced diet containing certain vegetables and/or dairy products; and (ii) an endogenous route involving the production of the protein by glial cells in the enteric nervous system (ENS), which wraps around the intestinal tract in an impressive geometric network. In this context, the ENS would not just only manage peristalsis, but may control the ‘human-microbiota’ bidirectionally, regulating the biodiversity of the microflora (19, 20). From this perspective, S100B opens up new avenues for research and innovative applications in medicine and health.

Innovation and applications in different sectors

As a nutritional factor and harmoniser of the microbiota, S100B could therefore find fascinating applications in various fields. Experiments are already underway to develop targeted solutions and identify nutritional, pharmacological, or phytotherapeutic intervention strategies that could benefit



from these recent findings. The availability of plant sources of S100B could lead to new ways of balancing diets and implementing phytotherapy-based interventions. Additionally, the ability to more accurately estimate the amount of S100B in food will enable this new parameter to be incorporated into the preparation and customisation of eubiosis-aimed dietary programs. S100B-based products could be extremely useful in scenarios where a balanced diet cannot be guaranteed, such as in sports, extreme situations or travels where the balance of the microbiota needs to be protected from stress or debilitating conditions. Although the mechanisms of action have not yet been fully elucidated, there is evidence to support its effects and its promising applications in different fields and scenarios. For instance, preliminary experimental data suggests that an harmonising action on microflora could be transferred also to other fields in order to govern fermentation processes in several processes for the production of foods, pharmaceuticals or other specific technological areas. Modulating microbiota equilibrium may play a relevant role in managing microflora in other ecological niches, such as oral, vaginal, skin or even environmental microflora.

Conclusions

Not only is the S100B protein present in astrocytes of the brain and other tissues, but its molecular structure is also found in certain foods, including milk and other dairy products, as well as several edible plant species. There is evidence to suggest that the gut microbiota has a harmonising function, with cascading implications for eubiosis and potential

trophic-protective actions on various organs. From birth, newborns take up this molecule through breast-feeding and subsequently through a balanced diet. The dosage of S100B in the diet or through targeted supplementation could provide new insights into scientific and technological research, disease treatment or prevention, and health promotion from childhood to elderly.

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Application of the Haddon Matrix to Civil-Military Interaction in Disaster Relief Operations

Applicazione della Matrice di Haddon ad Operazioni di disaster relief con interazione civile-militare

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Abstract - Civil-Military Interaction can give a relevant contribution to humanitarian-led Disaster Relief. These operations can be analyzed by means of Military After Action Reports allowing for a continuous improvement process in terms of planning toward a more comprehensive preparedness posture in disaster response. The COVID pandemic highlighted the relevance of the topic within the field of Public Health. Globally, Armed Forces readily supported their civilian counterparts, both in national and international contexts. Collection of reliable data has always been a challenge in disaster contexts. In addition, Military data is often aggregated and subject to secrecy. By means of its “dissect and conquer” approach towards complex, unconventional problems, the Haddon Matrix is a useful analysis tool in evaluating the synergic effect of Civil-Military Interaction within the Disaster Cycle. An evaluation of efficacy can be added in the third dimension of the Matrix introducing indicators derived from Health Economics. Relevant differences can be found analyzing Civil-Military Interaction support in the context of Disaster Relief operations following a natural catastrophe or within a primary Public Health emergency. The Haddon Matrix can dissect, analyze and subsequently improve the support given by the Military in case of lack, insufficiency or destruction of health services following a disaster. Such analysis guides focused preparation efforts towards cost effective choices in terms of both appropriately trained personnel and required equipment.

Riassunto - L'interazione Civile-Militare può dare un contributo rilevante alle operazioni di Disaster Relief umanitarie. Queste Operazioni possono essere analizzate con Rapporti strutturati post-evento che consentano un continuo processo di miglioramento in termini di pianificazione verso uno stato di preparazione più ampio in ambito di risposta ai disastri. La pandemia da COVID-19 ha sottolineato la rilevanza dell'argomento in ambito di Salute Pubblica. In tutto il mondo le Forze Armate hanno supportato la controparte civile, in contesto nazionale ma anche internazionale. La raccolta di dati affidabili è sempre stata una sfida in contesto di disastro. Inoltre, i dati militari sono spesso aggregati e soggetti a segretezza. Grazie al suo approccio “dissect and conquer” verso problemi complessi e non convenzionali, la Matrice di Haddon appare come uno strumento di analisi utile nella valutazione dell'effetto sinergico derivato dall'Interazione Civile-Militare nell'ambito del Ciclo dei Disastri. Una valutazione di efficacia può essere aggiunta alla terza dimensione della Matrice mediante applicazione di indicatori mutuati dall'Economia Sanitaria. Differenze rilevanti possono essere evidenziate analizzando la risposta di Disaster Relief con Interazione Civile-Militare a disastri naturali e ad emergenze primariamente di Sanità Pubblica. La Matrice di Haddon può dissezionare, analizzare e quindi migliorare il supporto che i Militari riescono a dare in caso di mancanza, insufficienza o distruzione di servizi sanitari a seguito dell'impatto di un evento disastroso. Questa analisi può guidare sforzi di preparazione rivolti verso scelte che siano efficaci in termini di personale addestrato adeguatamente ed equipaggiamento appropriato.

Key Words: Civil-Military Interaction, Disaster Medicine, Haddon Matrix, Natural Disaster, Public Health emergency.

Key Messages:

- Disasters are complex and unconventional events: their impact and the subsequent response operations cannot be analysed effectively by means of traditional Epidemiology.
- The Haddon Matrix can be used by Armed Forces participating in Disaster Relief operations with CMI as a structured After-Action Report tool aiming for a more effective preparedness posture.

Introduction

“Disaster” and “catastrophe” are often used as synonyms. The first derives from

the French “*désastre*”, in turn coming from the Latin prefix *dis-* (“in lack of” or “bad”) and *-aster* (“star”): literally “under a bad star”, recalling a natural calamity striking

unexpectedly under a malevolent celestial influence. “Catastrophe” comes from the late Latin *catastrōpha*, which in turn derives from the Greek καταστροφή,

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“upheaval”, referring to the unexpected and painful outcome of an unfortunate event. Defining the concept of “disaster” is not an easy task. The event must be first “quantified” in scale and contextualized in time and space, the latter not merely in a geographical sense, but also in a specific sociocultural *milieu*. The noun “disaster” is a sponge word: it takes a different meaning based on the context in which it is used: disasters “*can be more easily recognized than defined*” (1). A high magnitude earthquake causing hundreds of victims is undoubtedly a disaster. However, a car crash causing less than ten injuries can be considered a disastrous event if it takes place in a rural area served only by a small first aid facility. Therefore, regardless of the scale considered, any event capable of overwhelming or destroying both the response capacity and the social structure of the affected area, is often acknowledged as a “disaster” (2, 3). Such complex; unconventional events do not fit into traditional epidemiological studies. The subsequent multisectoral response is also a complex operation, based upon the highly regulated interplay among national and often foreign military and non-military actors, as well as multiple organizations (4, 5, 6). Disaster Relief operations with CMI support need flexible and appropriate After-Action Reports for analysis. We are currently witnessing a paradigm shift: from regulatory frameworks designed merely for natural or man-made events, towards the development of more flexible guidelines and principles applicable to a broad range of contexts, including complex Public Health emergencies. The recent COVID pandemic highlighted the relevance of CMI operations within the field of Public Health: globally, Armed Forces readily supported their civilian counterparts, both in national and international contexts (7). These combined efforts were protracted in

time, challenging sustainability. More typically, the Military offers highly specialized supporting capacities within a neatly defined window in terms of space and time (8, 9). The Military are often employed by governments as actors of the response to a disaster: while this is expected in national contexts, the deployment of Foreign Military Assets (FMA) can give birth to conceptual frictions (10). A potential controversy stems from the fact the Military cannot abide by all the Humanitarian Principles: they are the ultimate expression of a government and therefore can seldom be considered neutral nor independent. The security of humanitarian actors and their possibility of access to the affected areas depend upon a clear distinction of roles played by military and non-military actors within the area of operations. Given this potential conceptual controversy due to the employment of FMA, the UN recommends their involvement only as a “*last resort*”: CMI should be involved only when the civilian response is overwhelmed, or when demand is too high for available civilian/humanitarian assets (11, 12). However, recent Disaster Relief operations might suggest that military assets can be readily employed if they are the best option for a rapid and effective response in the peculiar context in which the disaster stroke. The UN and NATO are constantly working towards more structured guidelines for CMI: this “synergy” between military and non-military actors can give a relevant contribution to humanitarian-led Disaster Relief worldwide (13, 14).

The Haddon Matrix

The Haddon Matrix is a theoretical model developed in the 1970s by Dr. William Haddon Jr with the aim of finding solution-oriented preventive strategies and reducing morbidity/mortality related to

road accidents (15). Recently, several works proposed the application of such analytical tool to a broad range of Public Health interventions connected to Disaster Medicine. With its “*divide and conquer approach*”, the Matrix allows to open and literally break down a complex and unconventional problem into its smaller components. The grid gives a big picture of the multiple constitutive elements: such analysis favors a gradual and thorough understanding of the underlying etiological mechanisms. This process identifies phase-targeted interventions and preventive strategies addressing single components of a more complex issue (16). A logical consequence of this analysis is an appropriate and structured resource allocation in preparation for future events.

The Matrix is composed of four columns and three rows (**Tab. 1**). The four columns are named after the so-called “determinant factors”:

1. **Host:** subject/s at risk, potential victim/s showing susceptibility to the studied injury mechanism.
2. **Agent:** “impacting force”, either animate as a biological vector, or inanimate as a form of energy (thermal, radiant, chemical or electrical energy, but also the magnitude of an earthquake).
3. **Physical environment:** the actual environment where the disastrous event takes place, whose constitutive elements do participate to the mechanism of injury.
4. **Socio Cultural environment/ Organizational culture:** the set of norms, practices, guidelines of the community stricken by the impact of the disastrous event, the socio political *milieu* around the mechanism of injury. This involves also an organizational perspective and a legal stand-



Tab. 1 - Overview of the Haddon Matrix with CMI in the fourth column.

INFLUENCING FACTORS				
TEMPORAL PHASES (continuum)	POTENTIAL HOST	AGENT/VECTOR	PHYSICAL ENVIRONMENT	SOCIAL ENVIRONMENT/ ORGANIZATIONAL CULTURE
PRE-EVENT (T-1) Readiness phase	Risk assessment: 3 major potential risks in the following 6 months Identification of the principal medical problem due to the characteristics of the most probable scenarios Analysis of risk perception Risk communication Primary prevention interventions: vaccination prophylaxis, focused training based on principal medical problem continuous study and research simulation training based upon probable scenarios Community education: building capacity of timely response to early warning systems	Properties of impacting agent: biological (animate vector) chemical physical (es. magnitude of an earthquake) radiological inanimate agent: form of energy (es. thermal, radiant, chemical, electrical) mass destruction weapons potential of engineering of agents to produce unexpected intentional effects Knowledge of different types of agents Existence of functioning early warning systems	Existing infrastructure (Hospitals), their number and location in the potentially affected area Vulnerability analysis (supply and creation/augmentation of logistic chains for water/food/medicines other resources) Coexisting factors of sociocultural vulnerability: presence of conflict in the same area At risk populations in areas that are difficult to access Proximity to high-risk areas (hydrogeological, seismic...) Operability of communication systems Telemedicine State of transport infrastructure Presence of and relative distance from airports/heliports Distance from the sea	Diffusion of culture of preparedness Risk assessment: 3 major potential risks in the following 6 months Analysis of risk perception Preparedness posture Operational surveillance Effective management of supply chains Readiness of supply chains Allocation of resources according to budget Interagency training involving all the actors of the potential Response Operation (large scale simulations and training involving CMI): from single Armed Forces to international level Continuous study and research Simulation training based upon probable scenarios Preparation planning based on lessons learned Structured analysis of previous operations Choice of appropriate material (type, quantity) and preparation of logistic chains Preparation of personnel (study, research, training) Knowledge of measures to contain the spread of secondary infectious diseases Individual and collective protective measures Identification of key resources and eventual gaps in organization Liaison for eventual international and interagency response Already tested Incident Command System (chain of command, knowledge of roles) Comunicazioni: testare i sistemi (accordi anticipati con le Forze Armate per comunicazioni in emergenza) Interagency planning of emergency response (establishment of intermediate objectives, timing and entity of response) Inclusion of CMI in planning considerations
EVENT (T0) Crisis	Crisis communication Public Health interventions on affected community (secondary prevention) based upon principal medical problem Crisis triage decontamination post-exposure prophylaxis isolation/quarantine Management of trauma and Crush Syndrome	Disease or trauma caused by agent Identification of principal medical problem: planning and resources defined accordingly Number of victims/casualties Technical capacity to identify the causative agent	Preparedness posture of infrastructure Rapidly accessible economic resources, supplies Clinical, surgical, diagnostic, hospitalization Surge capacity Increase in hospitalization capacity (eventual use of hospitalization capacity of military naval units or field hospitals in adjunct)	Response to impact: implementation and adherence of emergency response plans (previously established and tested) Interagency First response according to previous planning (national/international level, civil response, necessity of military support) Activation of Incident Command System Emergency communications (with eventual military support) Management of communication towards media and journalists



INFLUENCING FACTORS				
TEMPORAL PHASES (continuum)	POTENTIAL HOST	AGENT/VECTOR	PHYSICAL ENVIRONMENT	SOCIAL ENVIRONMENT/ ORGANIZATIONAL CULTURE
EVENT (T0) Crisis	Evacuation from affected area Resettlement of displaced population Food and water: supply and hygiene Essential goods Support to displaced population/to pulation in isolation or quarantine Personal protective equipment (PPE) Psychological support	Response to the impact: contrast interventions Acute impact on health of affected population (ex. trauma, spread of infection) Acute impact on mental health of affected population and of personnel Management of immediate consequences (ex. Crush Syndrome)	Telemedicine Resettlement of displaced population/support of population in isolation or quarantine Emergency access to transportation Possibility of evacuation	Surge capacity: role of CMI Possible level of CMI: cooperation, coordination, coexistence (depending on the situation of peacetime or coexisting conflict in the area of operations) Surge of support capacity Evacuation Food and water: supply and hygiene Essential goods Rapid implementation of secondary prevention interventions to prevent secondary Public Health emergencies (sanitary conditions) Prevention of possible spill-over Possibility of access to and egress from affected area Restore access to affected areas/communication systems/transport infrastructure if damaged/destroyed Restore access to hospital infrastructure/field hospitals Possibility of egress and evacuation by land, air, sea Early Transition: from CMI response to local civil response
POST-EVENT (T+1) Management of sequelae	Risk communication Analysis of risk perception Mitigation of impact Recovery/reconstruction/reorganization Management of sequelae (both physical and psychological) Psychological support to survivors and personnel Post-event surveillance for early detection of secondary Public Health emergencies	Long-lasting impact of agent Management of sequelae (both physical and psychological) Reaction of the agent towards mitigation/elimination/reconstruction efforts Eventual persistence of the agent in the affected area	Application of lesson learned and After Action Report as a guide during reconstruction in order to lessen vulnerability of infrastructure	Risk communication After Action Report Analysis and application of lesson learned: improvement of surge capacity and overall organization (from single hospital level, up to the level of governmental organizations or Armed Forces) Continuous Follow-up Management of eventual persistence of the agent in the affected area Management of sequelae Post-event surveillance for early detection of secondary Public Health emergencies Reconstruction Mitigation Prevention Economic impact on affected community Focus on building local capacity for early transition and better resilience

point, such as, for instance, the existence of restrictions against harmful behaviors in a given context (16). The three rows of the grid reflect the temporal sequence of events. Sometimes

the impact of the disastrous event is punctual, clearly defined in time. In case of a slow-onset disaster, an index starting event can be arbitrarily defined, or a sequence of events can be established.

The rows are filled following the continuum of the various phases of the traumatic mechanism, each requiring specific Public Health interventions:

1. Pre-event (“pre-crash”): the phase



preceding the impact during which primary preventive strategies can prevent or reduce harmful effects derived by the impact/contact between the agent and a susceptible host. This phase also includes readiness, preparedness posture towards a potential impact, risk evaluation and risk communication.

2. **Event (“crash”)**: moment - or period - of actual impact of the agent. The interaction of a given form of energy or of a biological vector with susceptible structures of the host initiates the so-called “crisis” phase. This period includes crisis communication, evaluation of damage, triage and emergency medical treatment of victims, counselling and psychological support, Public Health actions such as, in the case of an infectious disease outbreak, post-exposure prophylaxis, isolation, quarantine.
3. **Post-event (post-crash”)**: management of the consequences, either immediate or long-term. This phase comprises an acute response phase, immediately following the impact. Once the process of damage has started all the efforts should be focused on the chances of rescue. There is also a later phase of recovery/reconstruction, management of long term physical and psychological sequelae, mitigation of the effects of the impact. A systematic analysis should be performed by means of a structured After Action/Event Report. The evaluation of lessons learned allows for subsequent renewed preparation for future events (16).

A third dimension can be added to the Matrix: the depth can allow the insertion of outcome measures of effectiveness derived from Health Economics (17). A

seemingly insurmountable component of the broader issue might result in more manageability when considered in a different phase. Filling the cells of the Matrix equals finding a list of possible strategies towards a broad range of Public Health threats, such as the evaluation of preparedness of hospital infrastructures against earthquakes (18), the organization of mass gatherings (19), possible countermeasures against asymmetrical warfare and terrorism (20), the COVID pandemic and the preparedness posture of a given community (21).

Application of the Haddon Matrix to Military After Action Reports for Disaster Relief operations with CMI

To the best of our knowledge, the Haddon Matrix has never been used by Armed Forces as a structured After-Action Report analyzing the contribution of CMI to Disaster Relief operations. CMI can be included in the fourth column, under the heading “Organizational Culture”. We propose two hypothetical applications of the Haddon Matrix as After-Action Report: the first is a model focused on the response to an elevated magnitude earthquake (**Tab. 2**), while the second concerns the response implemented towards an infectious disease outbreak (**Tab. 3**). Given its flexibility, the Matrix can be seen as a multidimensional analytical tool allowing a multisectoral brainstorming process and continuous improvement towards a more effective and focused preparedness posture. The whole set of discrete items filling the cells outlines a continuum from preparation to implementation of the response after the impact, recovery/reconstruction and mitigation (22). This structured analysis defines which capabilities should be prioritized in preparation

against future events, in terms of both cost effectiveness and appropriateness. Armed Forces should focus their preparation efforts on skills that might be used for support in multiple scenarios, from natural/man-made disasters to terrorist attacks or infectious disease outbreaks with pandemic potential (23). This analysis allows the individuation of eventual gaps: Military capacities and skills are often called in to fill these gaps. Specific military assets are surge capacity with enormous logistical reserves, highly trained personnel rapidly deployable, aeromedical evacuation with biocontainment flights for highly infectious patients, an already functioning hierarchical structure with clear chain of Command, versatile and highly capable communication systems, readily deployable field hospitals, military ships with reconfigurable assets. Finally, the items filling the cells can be used as Intermediate Objectives as Process Indicators during or after Disaster Relief operations with CMI in response to similar, future events (24).

Discussion

The Matrix appears as a useful analytical tool for Armed Forces taking part in CMI operations for Disaster Relief. Applying such a theoretical instrument results in more focused organization of logistic chains, appropriate choice of assets apt for the specific type of event, identification of useful training and study/research activities. Organizational gaps identified thanks to the Matrix can be filled by ad hoc exercises and simulations involving all the actors involved at national but also international level. The synergy between military and civilian support actions gives a combined effect that is greater than the sum of the single contributions (25).



Tab. 2 - Example of the Haddon Matrix with CMI in the fourth column: Disaster Relief after a major earthquake.

INFLUENCING FACTORS				
TEMPORAL PHASES (continuum)	POTENTIAL VICTIM	AGENT/VECTOR	PHYSICAL ENVIRONMENT	SOCIAL ENVIRONMENT/ ORGANIZATIONAL CULTURE
PRE-EVENT (T-1) Readiness phase	Risk assessment: 3 major potential risks in the following 6 months Identification of the principal medical problem due to the characteristics of the most probable scenarios Analysis of risk perception Risk communication Primary prevention interventions: <i>focused training based on principal medical problem (Traumatic injuries, Crush Syndrome)</i> <i>continuous study and research,</i> <i>simulation training</i> Community education: building capacity of timely response to early warning systems	Properties of impacting agent: magnitude of an earthquake Knowledge of the type of impacting energy Anticipation of expected consequences Existence of functioning <i>early warning systems</i>	Existing infrastructure (Hospitals), their number and location in the potentially affected area Vulnerability analysis (supply and creation/augmentation of logistic chains for water/food/medicines other resources) Coexisting factors of <i>s o c i o c u l t u r a l</i> vulnerability: presence of conflict in the same area At risk populations in areas that are difficult to access Proximity to high-risk areas (hydrogeological, seismic...) Operability of communication systems Telemedicine State of transport infrastructure Presence of and relative distance from airports/heliports Distance from the sea	Diffusion of culture of preparedness Risk assessment: 3 major potential risks in the following 6 months Analysis of risk perception Preparedness posture Operational surveillance Effective management of supply chains Readiness of supply chains Allocation of resources according to budget Interagency training <i>involving all the actors of the potential Response Operation</i> (large scale simulations and training involving CMI): from single Armed Forces to international level <i>Continuous study and research</i> <i>Simulation training based upon probable scenarios</i> Preparation planning based on lessons learned Structured analysis of previous operations Choice of appropriate material (type, quantity) and preparation of logistic chains Preparation of personnel (study, research, training) Knowledge of measures to contain the spread of secondary infectious diseases Individual and collective protective measures Identification of key resources and eventual gaps in organization <i>Liaison</i> for eventual international and interagency response Already tested <i>Incident Command System</i> (chain of command, knowledge of roles) Comunicazioni: testare i sistemi (accordi anticipati con le Forze Armate per comunicazioni in emergenza) Interagency planning of emergency response (establishment of intermediate objectives, timing and entity of response) Inclusion of CMI in planning considerations
EVENT (T0) Crisis	Crisis communication Public Health interventions on affected community (secondary prevention) based upon principal medical problem: trauma <i>Crisis triage</i> <i>Management of trauma and Crush Syndrome</i> <i>Evacuation from affected area</i> <i>Resettlement of displaced population</i>	Traumatic injury caused by agent Identification of principal medical problem: planning and resources defined accordingly Number of victims/casualties	Preparedness posture of infrastructure Rapidly accessible economic resources, supplies <i>Clinical, surgical, diagnostic, hospitalization</i> <i>Surge capacity</i>	Response to impact: implementation and adherence of emergency response plans (previously established and tested) <i>Interagency First response</i> according to previous planning (national/international level, civil response, necessity of military support) Activation of <i>Incident Command System</i> Emergency communications (with eventual military support) Management of communication towards media and journalists



INFLUENCING FACTORS				
TEMPORAL PHASES (continuum)	POTENTIAL VICTIM	AGENT/VECTOR	PHYSICAL ENVIRONMENT	SOCIAL ENVIRONMENT/ ORGANIZATIONAL CULTURE
EVENT (T0) Crisis	Food and water: supply and hygiene Essential goods Support to displaced population PPEs Psychological support	Technical capacity to identify the causative agent Response to the impact: contrast interventions Acute impact on health of affected population (ex. trauma, spread of secondary infections) Acute impact on mental health of affected population and of personnel Management of acute consequences (ex. Crush Syndrome)	Increase in hospitalization capacity (eventual use of hospitalization capacity of military naval units or field hospitals in adjunct) Telemedicine <i>Resettlement of and support to displaced population</i> Emergency access to transportation Possibility of evacuation	<i>Surge capacity</i> : role of CMI Possible level of CMI: cooperation, coordination, coexistence (depending on the situation of peacetime or coexisting conflict in the area of operations) Surge of support capacity Evacuation Food and water: supply and hygiene Essential goods Rapid implementation of secondary prevention interventions to prevent secondary Public Health emergencies (sanitary conditions) Possibility of access to and egress from affected area Restore access to affected areas/communication systems/transport infrastructure if damaged/destroyed Restore access to hospital infrastructure/field hospitals Possibility of egress and evacuation by land, air, sea Early Transition: from CMI response to local civil response
POST-EVENT (T+1) Management of sequelae	Risk communication Analysis of risk perception Mitigation of impact Recovery/reconstruction/reorganization Management of sequelae (both physical and psychological) Psychological support to survivors and personnel Post-event surveillance for early detection of secondary Public Health emergencies	Long-lasting impact of agent Multiple, repetitive seismic activities Management of sequelae (both physical and psychological)	Application of <i>lesson learned</i> and <i>After Action Report</i> as a guide during reconstruction in order to lessen vulnerability of infrastructure	Risk communication <i>After Action Report</i> Analysis and application of <i>lesson learned</i> : improvement of <i>surge capacity</i> and overall organization (from single hospital level, up to the level of governmental organizations or Armed Forces) <i>Continuous Follow-up</i> Management of long term consequences and eventual multiple, repetitive seismic activities Post-event surveillance for early detection of secondary Public Health emergencies Reconstruction Mitigation Prevention Economic impact on affected community Focus on building local capacity for early transition and better resilience

From a medical standpoint, there is a crucial necessity: training and equipment must be tailored to the main medical problem that the actors will probably encounter, based upon the result of risk analysis highlighting the most probable

event in the studied area. The value of the Matrix as a theoretical model resides in its applicability to a broad range of Public Health threats, whose complexity will likely escalate due to, among other reasons, increasing scale and frequency

of catastrophic events triggered by climate change. Armed Forces need systematic performance analysis tools, not just unstructured lessons learned or cumbersome, qualitative frameworks focused merely on the civilian standpoint



Tab. 3 - Example of the Haddon Matrix with CMI in the fourth column: Disaster Relief during a global pandemic.

INFLUENCING FACTORS				
TEMPORAL PHASES (continuum)	POTENTIAL VICTIM	AGENT/VECTOR	PHYSICAL ENVIRONMENT	SOCIAL ENVIRONMENT/ ORGANIZATIONAL CULTURE
PRE-EVENT (T-1) Readiness phase	Risk assessment: 3 major potential risks in the following 6 months Identification of the principal medical problem due to the characteristics of the most probable scenarios Analysis of risk perception Risk communication Primary prevention interventions: <i>vaccination prophylaxis, focused training based on principal medical problem: spread of infectious disease continuous study and research simulation training</i> Community education: building capacity of timely response to <i>early warning systems</i>	Properties of impacting agent: biological (animate vector) outbreak of zoonosis? potential of engineering of agents to produce unexpected intentional effects? Knowledge of different types of agents Existence of functioning <i>early warning systems</i>	Existing infrastructure (Hospitals), their number and location in the potentially affected area Vulnerability analysis (supply and creation/augmentation of logistic chains for water/food/medicines other resources) Coexisting factors of sociocultural vulnerability: presence of conflict in the same area At risk populations in areas that are difficult to access Proximity to high-risk areas (hydrogeological, seismic...) Operability of communication systems Telemedicine State of transport infrastructure Presence of and relative distance from airports/heliports Distance from the sea Eventual restrictions to international travel Supply of PPEs, autonomous chains of production Checklists and algorithms to counter the spread of the infection	Diffusion of culture of preparedness Risk assessment: 3 major potential risks in the following 6 months Analysis of risk perception Preparedness posture Operational surveillance Effective management of supply chains Readiness of supply chains Allocation of resources according to budget Interagency training <i>involving all the actors of the potential Response Operation</i> (large scale simulations and training involving CMI): from single Armed Forces to international level <i>Continuous study and research</i> <i>Simulation training based upon probable scenarios</i> Preparation planning based on lessons learned Structured analysis of previous operations Choice of appropriate material (type, quantity) and preparation of logistic chains Preparation of personnel (study, research, training) Knowledge of measures to contain the spread of secondary infectious diseases Individual and collective protective measures Identification of key resources and eventual gaps in organization <i>Liaison</i> for eventual international and interagency response Already tested <i>Incident Command System</i> (chain of command, knowledge of roles) Comunicazioni: testare i sistemi (accordi anticipati con le Forze Armate per comunicazioni in emergenza) Interagency planning of emergency response (establishment of intermediate objectives, timing and entity of response) Inclusion of CMI in planning considerations
EVENT (T0) Crisis	Crisis communication Public Health interventions on affected community (secondary prevention) based upon principal medical problem	Modes of transmission of infection Identification of principal medical problem: spread of infectious disease - planning and resources defined accordingly	Implementation of Incident Command System to control infection spread Preparedness posture of infrastructure Rapidly accessible economic resources and supplies	Response to impact: implementation and adherence of emergency response plans (previously established and tested) <i>Interagency First response</i> according to previous planning (national/international level, civil response, necessity of military support) Activation of <i>Incident Command System</i> Emergency communications (with eventual military support) Management of communication towards media and journalists



INFLUENCING FACTORS				
TEMPORAL PHASES (continuum)	POTENTIAL VICTIM	AGENT/VECTOR	PHYSICAL ENVIRONMENT	SOCIAL ENVIRONMENT/ ORGANIZATIONAL CULTURE
EVENT (T0) Crisis	<i>Crisis triage</i> <i>decontamination</i> <i>post-exposure prophylaxis</i> <i>isolation/quarantine</i> <i>of trauma and Crush Syndrome</i> <i>Medical Evacuation</i> <i>towards higher level facilities</i> <i>Resettlement of displaced population</i> Food and water: supply and hygiene Essential goods Support to population in isolation or quarantine PPEs Psychological support	Number of victims/infected patients Technical capacity to identify the causative agent (swabs, lab tests) Response to the impact: contrast interventions Acute impact on health of affected population Acute impact on mental health of affected population and of personnel Management of immediate consequences: complications (as organ failures)	<i>Clinical, surgical, diagnostic, hospitalization</i> <i>Surge capacity</i> Eventual use of hospitalization capacity of military naval units or field hospitals in adjunct Telemedicine <i>Resettlement of and support to displaced population</i> Emergency access to transportation Possibility of evacuation	<i>Surge capacity</i> : role of CMI Possible level of CMI: cooperation, coordination, coexistence (depending on the situation of peacetime or coexisting conflict in the area of operations) <i>Surge of support capacity</i> Evacuation Food and water: supply and hygiene Essential goods Rapid implementation interventions to prevent secondary Public Health emergencies (sanitary conditions) Possibility of access to and egress from affected area/ Restrictions to travel Restore access to affected areas Restore communication systems/transport infrastructure if damaged/destroyed Restore access to hospital infrastructure/field hospitals Possibility of egress and evacuation by land, air, sea Early Transition: from CMI response to local civil response
POST-EVENT (T+1) Management of sequelae	Risk communication Analysis of risk perception Mitigation of impact Recovery/reconstruction / reorganization Management of sequelae (both physical and psychological) Psychological support to survivors and personnel Post-event surveillance for early detection of secondary Public Health emergencies	Long-lasting impact of agent Management of sequelae (both physical and psychological) Reaction of the agent towards mitigation/elimination/ reconstruction efforts Eventual persistence of the agent in the affected area: endemic infection	Application of <i>lesson learned</i> and <i>After Action Report</i> as a guide during reconstruction in order to lessen vulnerability of infrastructure Replenishment of supplies (PPEs, medical equipment, vaccines, drugs)	Risk communication <i>After Action Report</i> Analysis and application of <i>lesson learned</i> : improvement of <i>surge capacity</i> and overall organization (from single hospital level, up to the level of governmental organizations or Armed Forces) Continuous <i>Follow-up</i> Management of eventual persistence of the agent in the affected area: endemic infection Management of sequelae Post-event surveillance for early detection of secondary Public Health emergencies Reconstruction Mitigation Prevention Economic impact on affected community Focus on building local capacity for early transition and better resilience

(26). The novel application of the Haddon Matrix to CMI in support of Disaster Relief operations highlights the importance of systematic analyses. Armed Forces and single organizations strive for self-improvement in terms of readiness, preparedness posture, appropriate and

sustainable management of resources. The use of the Military must be appropriate, cost-effective, sustainable. This analytical approach supports the decision-making process by evaluating the appropriateness and cost-effectiveness of choices made, aiming at making better

choices in the future. Consequently, Armed Forces can find transversal solutions responding to multiple problems, avoiding useless duplication of efforts (23, 24). Another element of novelty is the application of this theoretical model not just to the CMI response to a natural



disaster - an event characterized by a high degree of definition in terms of space and time - but also to global Public Health emergencies. The COVID pandemic required a multisectoral and protracted intervention which challenged - and often surpassed - sustainability. Disaster Relief operations are choral responses between a myriad actors in diverse possible scenarios, either in peacetime or during conflict. The Military are often crucial actors in the acute phase of the response to disasters. Armed Forces have highly specific and readily deployable assets: they can give a positive contribution to the response. Frameworks and platforms for interaction were initially developed with the intention to facilitate coordination among military and non-military contributors. Such tools and frameworks need to evolve, given the dynamic relations among ecosystems (25). The potential conceptual friction derived from the employment of FMA can be mitigated by anticipatory preparation of coordination instruments such as liaison mechanisms. Interaction is also facilitated by training on a broad, multinational scale. Planning a response based upon guiding principles and flexible institutions, with a clear distinction between military and non-military actors, requires a thorough understanding of humanitarian principles and highlights the central role of CMI.

Conclusion

The frequent coexistence of a disastrous event and a preexisting conflict in the same area of operation do generate rapidly evolving challenges to CMI (26). Responses are progressively moving away from a rigid doctrinal interpretation of the "last resort" UN principle. Since the start of the crisis all the available resources should try to put in place the

"best option" for the specific scenario. Military assets in the context of a CMI operation in support of Disaster Relief might be the best option: in this case the Military should act as first responders aiming at a rapid control and resolution of the crisis.

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MEDICINA VETERINARIA



Study of infectious pathogens and endoparasites in two populations of Montecristo goat (*capra aegagrus hircus*) in the free state and in permanent captivation

Studio di agenti patogeni infettivi e di endoparassiti in due popolazioni di capra di Montecristo (*capra aegagrus hircus*) allo stato libero e in captivazione permanente

Carlo Alberto Minniti * Patrizia Ponzio °

Summary - The Montecristo Goat (*Capra aegagrus hircus*) is the only remaining wild example living in Italy and one of the few in the Mediterranean basin. A group of 10 specimens relocated in 2020 to a structure in the Marsiliana State Nature Reserve (GR), managed by the Carabinieri, was subjected to blood and fecal sampling, on which a blood-biochemical profile was performed, as well as the search for any infectious and parasitic pathogens; similar steps were taken with another group hosted at the Bioparco in Rome and consisting of 10 specimens descending from animals relocated in 2011 as part of the LIFE+ MONTECRISTO 2010 project, aimed at the recovery of threatened species and priority habitats on two islands of the Tuscan Archipelago National Park, Pianosa and Montecristo. The data from the different samplings were compared and statistically analyzed ($p < 0.05$), in order to highlight whether different environmental and management conditions could influence the parameters considered. This work is aimed at optimizing the management of goats within ex situ structures and ensuring that the hosted subjects are managed in full compliance with animal welfare.

Riassunto - La Capra di Montecristo (*Capra aegagrus hircus*) rappresenta l'unico esempio selvatico residuale vivente in Italia e uno dei pochi nel bacino del Mediterraneo. Un gruppo di 10 esemplari traslocati nel 2020 in una struttura nella Riserva Naturale Statale di Marsiliana (GR), gestita dall'Arma dei Carabinieri, è stato sottoposto a campionamenti ematici e fecali, sui quali sono stati eseguiti un profilo emato-biochimico, nonché la ricerca di eventuali agenti patogeni infettivi e parassitari; analogamente, si è proceduto nei confronti di altro gruppo ospitato presso il Bioparco di Roma e costituito da 10 esemplari discendenti da animali traslocati nel 2011 nell'ambito del progetto LIFE+ MONTECRISTO 2010, finalizzato al recupero di specie minacciate e degli habitat prioritari su due isole del parco Nazionale dell'Arcipelago Toscano, Pianosa e Montecristo. I dati dei diversi campionamenti sono stati messi a confronto e analizzati statisticamente ($p < 0,05$), in modo da evidenziare se diverse condizioni ambientali e gestionali potevano influenzare i parametri considerati.

Tale lavoro è finalizzato ad ottimizzare al meglio la gestione delle capre all'interno di strutture ex situ e garantire ai soggetti ospitati un management nel pieno rispetto del benessere animale.

Keywords: Montecristo Goat, ex situ translocation, blood-biochemical profile, infectious agents, parasitic agents.

Key Messages:

- animal welfare management in Montecristo Goats translocated ex situ is essential for veterinarians and breeders.
- The goat population present on the Island of Montecristo, due to its peculiarities, can be strongly influenced by management, nutritional, environmental and health factors, capable of determining periodic fluctuations in the numerical consistency of the group.

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Introduction

In contexts where predators are absent, the quality and quantity of food resources, along with climatic factors, can greatly influence the size of herbivore populations (bottom-up regulation). At the same time, however, mechanisms of feedback within the vegetation/herbivore system can also play a role in demographic regulation: by altering the productivity and/or quality of the trophic resource, animals directly influence the carrying capacity of their environment (1, 2).

In the Mediterranean closed island environments, such as populated exclusively by herbivores, the most relevant climatic factor is likely drought, which negatively impacts vegetation, along with certain plant pathologies that can abruptly and unpredictably affect the availability and quality of the trophic resource, and to a lesser extent, winter harshness.

Montecristo, with its population of wild goats, exemplifies this characteristic. However, these relationships have not yet been explored and could help better understand the demographic variations that the population has shown over the years.

Within the After-LIFE Conservation Plan 2020-2025 for the LIFE+ Natura RESTO CON LIFE project «Island conservation in Tuscany, restoring habitat not only for birds» (LIFE13 NAT/IT/000471), specifically included is the LIFE+ MONTECRISTO 2010 project (NAT/IT/353), aimed at recovering threatened species and priority habitats, as well as environmental rehabilitation interventions on two islands in the Tuscan Archipelago National Park, Pianosa and Montecristo, by removing alien species such as the Black rat (*Rattus rattus*) and Tree of Heaven (*Ailanthus altissima*).

Furthermore, through careful floral and faunal monitoring, an action has been planned to reduce the risk of extinction and consequently protect the population of wild goats (*Capra aegagrus hircus*) present on the island of Montecristo.

Considering the history of the island itself and the goat population, characterized by its unique peculiarity, conservation, with the perspective of ensuring long-term permanence, represents the optimal solution for the safeguarding of the wild goat and the protection of the island ecosystem.

This action has resulted in the implementation of an ex situ conservation program, involving the collection of a certain number of individuals, their transfer, and subsequent relocation to different sites.

The ultimate goal of the projects developed over the years within the context of Montecristo Island is to ensure the conservation of vegetation, with particular attention to habitat and population control of the goats, through targeted actions applicable to the environmental context (3).

Although the conservation of goats on Montecristo is closely connected to that of the plant components, it should not be forgotten that, being a multivariate system, there are many factors at play even for the plant component, independent of the presence of goats but influencing their demography.

Specifically, studying the aspects that characterize biodiversity, population structure, feeding, reproduction, as well as the diseases that can most affect these animals, helps better outline feasible strategies ensuring optimal conditions for the animals and the entire island ecosystem.

The objectives of this study were:

- to evaluate, through blood chem-

istry analyses, the general health conditions and possible factors influencing any alterations in two groups of animals, one present on Montecristo Island and subsequently translocated to an ex situ conservation facility in Marsiliana, Massa Marittima (Grosseto), and the other hosted at the Bioparco di Roma;

- to identify specific infectious pathogens and endoparasites, endemic to the island, in subsequent samplings, focusing on possible contamination during continental captivity of ungulates;
- to determine the growth rate of the translocated population, considering potential influencing factors such as diet type and exposure to aforementioned infectious pathogens.

Materials and Methods

The goats examined belong to two groups:

- one originating from 10 animals (5 females and 5 males aged between 1 and 4 years) originally living on Montecristo Island, transferred to the Marsiliana facility in December 2020;
- the other of 10 males aged between 1 and 12 years housed at the Bioparco di Roma, born over the years from an initial nucleus of 5 animals translocated from the island in 2011.

All study subjects were subjected to blood and faecal sampling at different times:

- the Montecristo group, before the transfer (MTC0), then in February 2023 (MTC1) and July 2023 (MTC2);



- the Bioparco group in December 2022 (BPR).
- Biological samples were stored at refrigeration temperature and processed at the Istituto Zooprofilattico Sperimentale del Lazio e della Toscana for routine analyses specific to the species under study. On the island, individuals were first captured using a specific enclosure with a closing system or «trap.» Then, they underwent:
- clinical examination to assess health conditions and suitability for transport;
- identification by applying a dual individual identification system (subcutaneous microchip and plastic ear tag).
- All operational phases (capture, identification, health assessment, sampling, transfer, and relocation of animals) were carried out by personnel from the Carabinieri Biodiversity Unit in Follonica, with technical support and supervision from the Veterinary Service of the Department for Health and Veterinary Organization of the Carabinieri Corps General Command.

Haemato-biochemical Parameters of MTC0, MTC1, and MTC2.

Tables 1 and 2 list the performed tests, units of measurement, and reference values for the goat species according to the laboratory's protocols. Data regarding blood chemistry parameters from the BPR sampling are not reported, as the analyses were performed using a different protocol at a different laboratory, and the results are not comparable to those of the MTC0, MTC1, and MTC2 sampling groups.

Tab. 1 - Haematological parameters analysed at the laboratory of the Istituto Zooprofilattico Sperimentale del Lazio e della Toscana and corresponding reference values for the caprine species.

Parameters - Unit of measurement	Reference ranges
Leukocytes (WBC) $10^3/\mu\text{l}$	8,4-19,6
- Neutrophils (NEU) $10^3/\mu\text{l}$	3-8,5
- Lymphocytes (LIN) $10^3/\mu\text{l}$	5-11
- Monocytes (MON) $10^3/\mu\text{l}$	0,2- 0,9
- Eosinophils (EOS) $10^3/\mu\text{l}$	0-0,8
- Basophils (BAS) $10^3/\mu\text{l}$	0-0,4
- NEU %	25,3-51,8
- LIN %	38,8-66,1
- MON %	0,9-8,1
- EOS %	0-10,3
- BAS %	0-2,4
Erythrocytes (RBC) $10^6/\mu\text{l}$	13,1-20,1
Haemoglobin (HGB) g/dl	7,4-12,3
Haematocrit (HCT) %	23,5-38,3
Mean Corpuscular Volume (MCV) fL	13,6-23,9
Mean Corp. Haemo. (MCH) pg	6,3-10,3
Mean Corp. Haem. C. (MCHC) g/dl	31,9-37,8
Red Cell Distr. Width (RDW) %	23,5-36,6
Mean Platelet Volume (MPV) fL	4,6-10,2
Platelets (PLT) $10^3/\mu\text{l}$	197,1-876

Tab. 2 - Biochemical parameters analysed at the laboratory of the Istituto Zooprofilattico Sperimentale del Lazio e della Toscana and corresponding reference values for the caprine species.

Parameters - Unit of measurement	Reference ranges
Alanine aminotransferase (ALT) U/L	24-83
Aspartate aminotransferase (AST) U/L	167-513
Nitrogen mg/dl	33-47
β -idrossibutirrato (B-HBA) mg/dl	5-14
Cholesterol mg/dl	96-165
Creatinine mg/dl	1-1.8
Total proteins g/dl	6.4-7
A/G	5.5-8.7
Albumin g/dl	2.4-4.1
Alpha 1 Globulin g/dl	0.4-0.9
Alpha 2 Globulin g/dl	0.3-1.9
Beta Globulin g/dl	0.2-1.1
Gamma Globulin g/dl	0.5-3.1
Triglycerides mg/dl	21-36



Bacterial and viral agents MTC₀, MTC₁, MTC₂, and BPR

The bacterial and viral agents investigated in all the samples included in the study, to which the goat species is susceptible, have been (alongside each, the laboratory techniques employed), respectively:

- *Brucella abortus*, *B. melitensis* (ELISA, FDC, RBPT); *Chlamydomphila abortus* (ELISA); *Coxiella Burnetii* (ELISA); *Myc. avium* sub. *Paratuberculosis* (AC Screening); *Salmonella abortus ovis* (SA lenta); *Leptospira* spp. (PCR RT); *Leptospira bratislava*, *L. canicola*, *L. copenhageni*, *L. copenhageni*, *L. grippothyphosa*, *L. hardjo*, *L. icterohaemorrhagiae*, *L. pomona*, *L. saxkoebing*, *L. saxkoebing*, *L. tarassovi* (MAT); *Anaplasma Phagocytophilum* (IFI IGG, PCR RT);
- Caprine Arthritis Encephalitis Virus – CAEV, *Retroviridae Lentivirus* (ELISA); Blue Tongue Virus – BTV, *Reoviridae Orbivirus* (ELISA, PCR RT); Border Disease Virus – BDV, *Flaviviridae Pestivirus* (ELISA, PCR RT); Caprine alphaherpesvirus 1 – CpHV.1, *Herpesviridae Varicellovirus* (SN, PCR RT); Schmollenberg Virus – SBV, *Bunyaviridae Orthobunyavirus* (ELISA, PCR RT).

Acronyms of laboratory techniques: ELISA = Enzyme-Linked ImmunoSorbent Assay antibodies; FDC = Complement Fixation; RBPT = Rose Bengal Plate Test or Rapid Serum Agglutination Test with Rose Bengal Antigen (SAR-Ag:RB); AC Screening = Antibody screening; SA = Slow Serum Agglutination; MAT = Dark Field Microagglutination; IFI IGG = Indirect Immunofluorescence Assay for IgG; PCR RT = Polymerase Chain Reaction Real Time; SN = Serum Neutralization; PCR = Polymerase Chain Reaction; MIC =

Microscopic exam.

Other Infections Agents MTC₀, MTC₁, MTC₂, and BPR

The following pathogens, to which the *Capra aegagrus hircus* species is susceptible, were tested in the blood samples collected in all studied samplings (alongside each, the laboratory techniques used are indicated): *Piroplasmida* (PCR); *Neospora Caninum*, *Toxoplasma gondii* (ELISA); Blood parasites (MIC); Caprine PRNP gene codon 222 (PCR RT).

Faecal Pathogens MTC₀, MTC₁, MTC₂, and BPR

The following pathogens were sought in faecal samples collected (alongside each, the laboratory techniques used are indicated): Enteroparasites, *Trichuris* sp., *Nematodirus* sp., Gastrointestinal Strongyles, *Eimeria* sp. (FLOTAC); Bronchopulmonary Strongyles LPG (BAERMANN); *Escherichia coli*, *Salmonella* spp., *Yersinia* spp., non-*Enterobacteriaceae*, Enteropathogenic *E. coli* or EPEC, Carbapenemase-producing *E. coli*, Enterohemorrhagic *E. coli* or EHEC, ESBL/AMPC-producing *E. coli* (Cultural Examination); Intimin (PCR). Additionally, both faecal and blood samples underwent intestinal microbiome/resistome typing (Bioinformatics Analysis of High-Throughput Massive Sequence Sequencing; Determination of Sequence Quality Parameters HTS; Preparation of Genomic Libraries).

The study also considered feeding and weather conditions as potentially influencing parameters.

Feeding

The subjects on Montecristo Island, until the time of transfer, were fed with available wild vegetation in the area. Upon

their relocation to the conservation area in Marsiliana, they were fed with available wild vegetation supplemented with ad libitum polyphytic hay.

The subjects housed at the Bioparco in Rome were fed with ad libitum polyphytic hay.

Whether Conditions

During the study period, weather data (minimum and maximum temperature; precipitation; average wind intensity; minimum, average, and maximum humidity) were recorded at the various locations hosting the animals (Montecristo, Marsiliana, and Rome) to assess their potential influence on the haematological and biochemical parameters analysed.

Statistical Analysis

The haemato-biochemical data from the MTC₀, MTC₁, and MTC₂ samplings were compared and statistically analysed to highlight any management or environmental factors that could influence them. Specifically, we evaluated whether environmental conditions (insular/continental), weather conditions (summer/winter), and feeding practices (wild vegetation only vs. wild vegetation supplemented ad libitum) could be influencing factors for the parameters considered.

Comparisons were made on paired data, where each goat's results for each haemato-biochemical parameter were compared under two different circumstances. To assess the significance of the difference between mean values, we used statistical tests designed for dependent samples.

Given the limited data availability and uncertainty about the distribution of haematological values, we did not consider the Student's t-test for paired data suitable for this study (4, 5, 6).



Instead, we opted for the use of randomization or permutation tests for dependent samples, typically attributed to Fisher.

The significance threshold was set at $p < 0.05$ (6), and a specific database was created for statistical definition of the different parameters considered in the two compared samplings:

- MTC_1 vs MTC_0
- MTC_2 vs MTC_1 .

Finally, for each haemato-biochemical parameter, the Mean Value (μ) was calculated from the data of each subject examined in the two considered samplings.

For the statistical evaluation, only parameters for which all subject values were known in the individual compared samplings were considered:

- Haematological Values:
 - Leukocytes ($10^3/\mu\text{l}$);
 - Erythrocytes ($10^6/\mu\text{l}$);
 - Haemoglobin (g/dl);
 - Haematocrit (%);
 - Platelet Volume (fL).
- Biochemical Values:
 - ALT (U/l);
 - AST (U/l);
 - Nitrogen (mg/dl);
 - Cholesterol (mg/dl);
 - Creatinine (mg/dl);
 - Total Proteins (g/dl);
 - Triglycerides (mg/dl);
 - Albumin (g/dl).

To ensure homogeneous and comparable data, the $\pm$ DELTA (Δ) value was indicated between the averages of each correlation.

To achieve the final statistical processing and determine the relative significance of the compared sampling data, the $\pm$ DELTA% value was calculated to avoid disparities related to different units of measurement and magnitude orders of individual parameters. Additionally, significant comparisons at 5% were indi-

cated with the * symbol and reported on histogram graphs for representation.

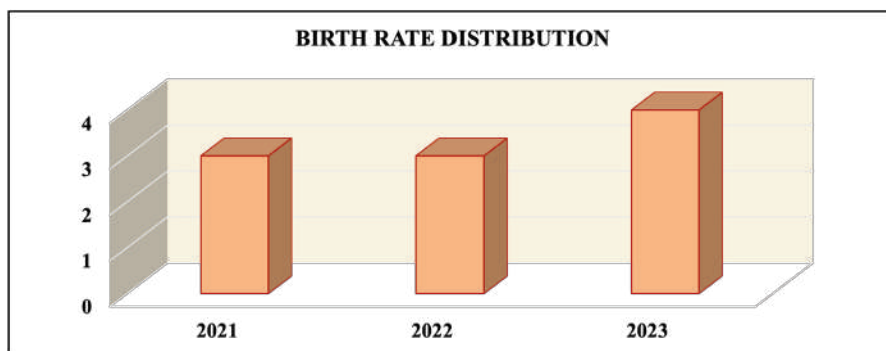
Results

At the Marsiliana facility during the monitoring period, the ibex population experienced an increase of 10 new individuals born, while 2 individuals were reported deceased. The Percentage Natality Rate

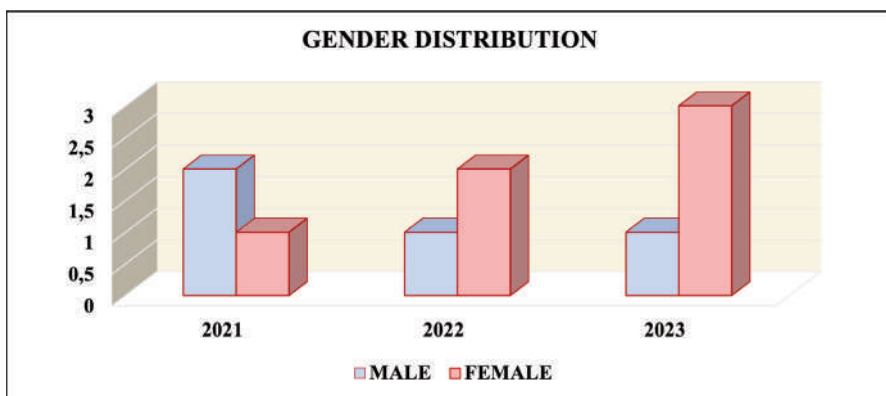
(TN%) was found to be 55% (10 births out of 18 subjects), with a sex ratio of 0.7.

Graph. 1 and 2 depict the distribution of births over the years and the corresponding gender distribution.

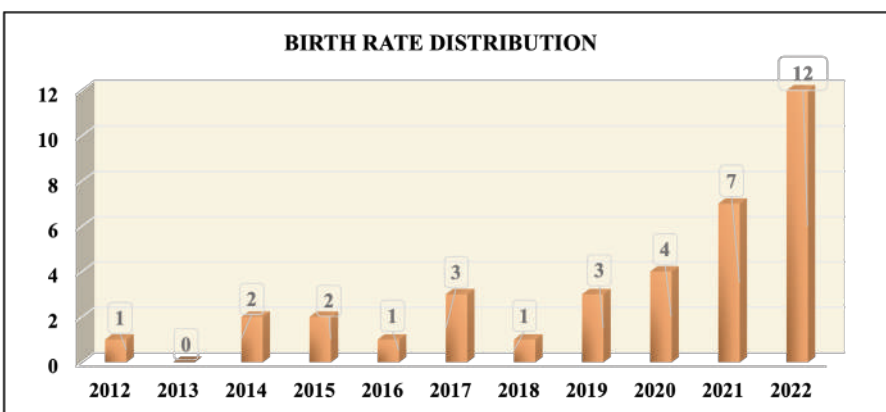
At the Bioparco di Roma, at the end of the monitoring period, the population consisted of 10 male animals. **Graph. 3 and 4** provide a detailed description of the number of subjects born at the facility



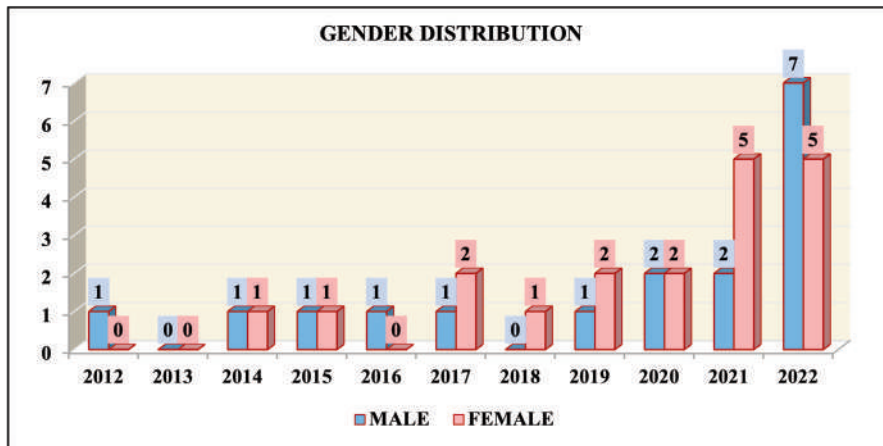
Graph. 1 - Birth Distribution of the Marsiliana Group (MTC).



Graph. 2 - Gender Distribution of the Marsiliana Group (MTC).



Graph. 3 - Birth Rate Distribution of the Bioparco Foundation Group (BPR).



with their corresponding TN%, the number of subjects transferred to other hosting facilities, and the number of subjects deceased. Over the entire duration of the animals' stay at the zoological facility, the TN% was 88% (36 births out of 41 subjects) with a sex ratio of 0.9.

Results of Haematological Examinations MTC₀, MTC₁, and MTC₂

Table 3 presents the results of the haematological examinations for the MTC₀, MTC₁, and MTC₂ samples.

Graph. 4 - Gender Distribution of the Bioparco Foundation Group (BPR).

Tab. 3 - List of Haematological Test Results for Samples MTC₀, MTC₁, and MTC₂. Values above the reference range are highlighted in blue, while values below the reference range are highlighted in red.

Parameters	MTC ₀			MTC ₁			MTC ₂		
	AVG	D.S. (±)	Mn.-Mx.	AVG	D.S. (±)	Mn.-Mx.	AVG	D.S. (±)	Mn.-Mx.
WBC	6,36	3,11	3,63-14,3	10,10	2,88	6,22-14,8	12,58	4,98	3,58-25,6
NEU	3,37	2,60	1,13-9,25	3,61	1,95	1,18-9,40	3,97	1,86	0,87-8,93
LIN	2,00	0,81	0,67-3,41	4,93	1,78	2,76-8,18	7,31	3,72	2,46-17,2
MON	0,52	0,38	0,10-1,40	0,10	0,05	0,03-0,18	0,24	0,20	0,04-0,91
EOS	0,29	0,32	0,03-0,91	1,49	1,00	0,36-3,85	0,94	0,65	0,17-2,36
BAS	0,17	0,16	0,04-0,51	0,67	0,26	2,23-1,06	0,09	0,04	0,03-0,19
%NEU	49,17	18,67	31,0-83,5	35,89	14,22	14,8-63,6	32,28	11,29	18,0-56,7
%LIN	33,88	12,19	9,63-46,4	48,09	0,85	29,5-69,7	57,41	12,06	33,0-77,2
%MON	8,21	4,29	2,11-15,7	0,93	0,27	0,40-1,30	1,81	0,84	0,70-3,60
%EOS	5,29	5,87	0,21-16,5	14,58	7,72	4,50-28,4	7,57	4,53	1,60-15,7
%BAS	3,42	4,32	0,55-14,1	6,71	2,32	2,90-12,8	0,73	0,30	0,40-1,80
RBC	12,03	1,54	8,88-13,6	20,31	2,27	17,4-24,6	18,21	3,51	11,2-23,5
HGB	10,35	2,50	6,36-13,9	12,23	1,09	10,8-14,1	11,02	2,86	7,40-20,7
HCT	18,60	3,14	14,3-25,0	37,09	3,04	33,3-42,1	30,56	4,65	21,9-38,3
MCV	15,49	1,79	12,7-18,4	17,64	3,46	6,17-21,1	16,96	1,47	14,7-20,6
MCH	8,37	1,11	7,16-10,4	6,04	0,52	5,40-7,00	5,82	0,53	5,00-7,10
MCHC	54,48	8,28	41,5-67,2	32,93	0,80	31,9-34,5	34,27	0,73	32,5-35,4
PLT	/	/	/	110,80	51,24	44,0-226	588,06	231,79	111-1044
MPV	12,82	4,07	8,53-20,4	8,51	1,13	7,10-11,4	8,45	0,9	7,6-11,4
PCT	78,78	39,88	30,6-149	/	/	/	/	/	/
PDW	17,86	1,69	16,3-20,1	/	/	/	/	/	/
RDW	37,66	11,23	18,5-59,5	20,73	1,22	18,8-23,1	21,44	1,65	19,3-24,8



Results of Biochemical Examinations MTC₀, MTC₁, and MTC₂

Table 4 shows the results of the biochemical examinations for the MTC₀, MTC₁, and MTC₂ samples.

Results of Bacterial and Viral Agents MTC₀, MTC₁, MTC₂, and BPR

Bacteriological investigations conducted on the subjects of the study, across the 4 different samplings, exclusively revealed seropositivity of 6 subjects to *Anaplasma phagocytophilum* in the MTC₂ sampling. Virological investigations, on the other hand, confirmed the presence of antibodies to:

- Blue Tongue Virus (BTV) in one subject from Marsiliana in two different subsequent samplings

(MTC₁ and MTC₂), as well as another subject from the BPR group. In both cases, the National Reference Center for the Study and Diagnosis of Exotic Animal Diseases (CESME), at the Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise, characterized it as serotype 4;

- Caprine alphaherpesvirus 1 (CpHV.1) in one individual before its transfer to Marsiliana, as well as in all animals from the same nucleus in the last sampling (MTC₂), determined by seroneutralization with dilutions ranging from 1:3 to 1:6;
- Schmallenberg Virus (SBV) in 6 subjects from the MTC₁ sampling and another 5 from MTC₂.

In none of these cases was the virus detected using real-time PCR.

Results of Other Blood Pathogens MTC₀, MTC₁, MTC₂, and BPR

Regarding other blood pathogens, seropositivity to *Toxoplasma gondii* was confirmed in one subject from the Marsiliana group before its transfer (MTC₀) and in a subject from the BPR group.

All animals tested were found to be homozygous (Q/Q) for the characterization of the 222 codon of the Caprine PRNP gene.

Results of Faecal Pathogens MTC₀, MTC₁, MTC₂, and BPR

Positive results of faecal pathogen investigations are reported in **Table 5**.

Tab. 4 - Results of Biochemical Tests for Samples MTC₀, MTC₁, and MTC₂. Values above the reference range are highlighted in **blue**, while values below the reference range are highlighted in **red**.

Parameters	MTC ₀			MTC ₁			MTC ₂		
	AVG	D.S. (±)	Mn.-Mx.	AVG	D.S. (±)	Mn.-Mx.	AVG	D.S. (±)	Mn.-Mx.
ALT	34	7,6	28-49	39,27	11,39	13-67	51,67	10,08	35-74
AST	117	24,3	90-174	116,33	24,78	91-188	110,44	26,04	79-179
Nitrogen	16	4	8-22	27,67	7,54	18-42	8,22	5,61	2-28
Cholesterol	75	17	55-111	73,33	8,3	55-85	79	18,55	53-124
Creatinine	0,86	0,17	0,61-1,13	1,37	0,24	1,08-1,82	1,44	0,23	1,12-2,11
Total Proteins	6,3	0,6	5,5-7,6	7,78	0,66	6,7-9,1	8,16	0,65	7,1-9,5
Alb/Glo	1,2	0,3	0,61-1,71	0,74	0,17	0,48-1,02	0,7	0,13	0,44-0,99
Triglycerides	18	9	9-34	26,27	23,98	10-105	31,94	16,34	12-75
Albumin	3,3	0,4	2,6-3,8	3,25	0,47	2,2-3,7	3,31	0,44	2,4-4,0
Alpha 1	0,5	0,1	0,4-0,6	0,5	0,08	0,4-0,6	0,53	0,11	0,4-0,8
Alpha 2	0,9	0,1	0,7-1,1	0,89	0,12	0,7-1,2	0,87	0,06	0,8-1,0
Beta	0,6	0,3	0,3-1,3	0,61	0,25	0,3-1,0	0,89	0,39	0,3-1,9
Gamma	0,8	0,5	0,6-1,9	2,52	0,74	1,3-3,7	2,56	0,48	1,7-3,4



Tab. 5 - Investigations conducted on faecal samples of specimens in the MTC0, MTC1, MTC2 and BPR samplings. NE = not executed.

Parameters Date	Location	Temperature		Precipitation	Wind intensity med.	Humidity		
		min.	max.			min.	med.	max.
01/12/2020	Montecristo	12.4	15.6	0	2.3 E	67.0	73.7	82.0
20/12/2020	Montecristo	12.8	15.6	0	4.4 SE	72.0	84.0	92.0
24/02/2023	Marsiliana	12.3	16.9	0	1.3 SE	75.0	85.2	94.0
26/07/2023	Marsiliana	19.2	29.6	0	3.1 O	41.0	57.0	71.0
21/12/2022	Roma	4.0	12.0	1 mm	4.0 E	82.0	90.0	100.0

Statistical analysis

The statistical analysis conducted using the panel of haematological tests routinely performed by the Laboratory of the Istituto Zooprofilattico Sperimentale del

Lazio e della Toscana yielded the following values for the parameters: Mean Value, Mean Delta, and Delta % for the significant correlations with $p < 0.05$ (*).

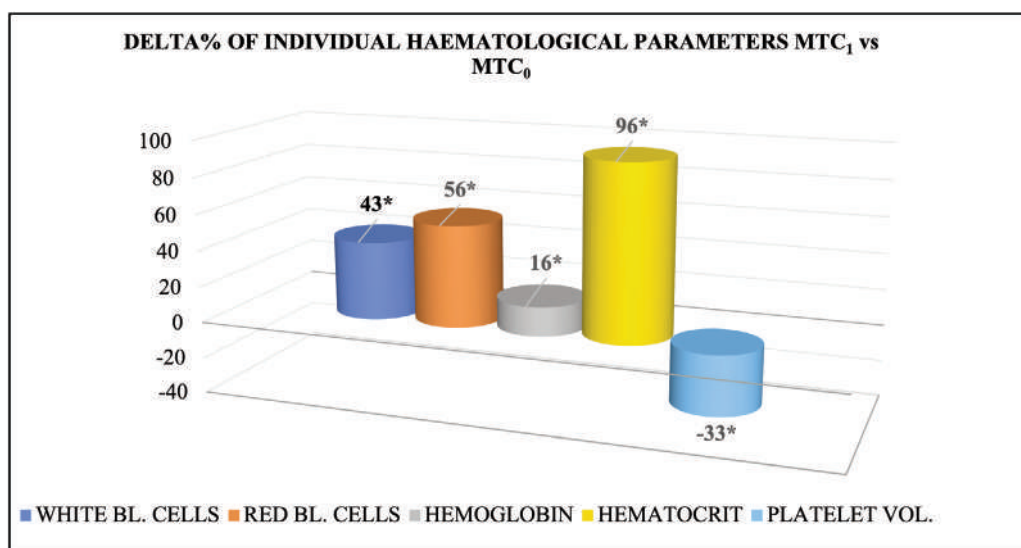
Correlations conducted include:

- MTC₁ vs MTC₀ (Tables 7 and 8; Graphs 5 and 6);
- MTC₂ vs MTC₁ (Tables 9 and 10; Graphs 7 and 8).

Correlation MTC₁ vs MTC₀

Tab. 7 - Average values, $\pm$ Average Delta, $\pm$ Delta%, and corresponding significance for each haematological parameter considered, referring to the correlation MTC1 vs MTC0.

PARAMETER	MEAN VALUE	AVG Δ	Δ %	SIGNIFICANCE
WHITE BL. CELLS	6,3	2,68	43	*
RED BL. CELLS	12,18	6,79	56	*
HAEMOGLOBIN	10,4	1,66	16	*
HAEMATOCRIT	18,62	17,88	96	*
PLATELET VOL.	12,82	-4,2	-33	

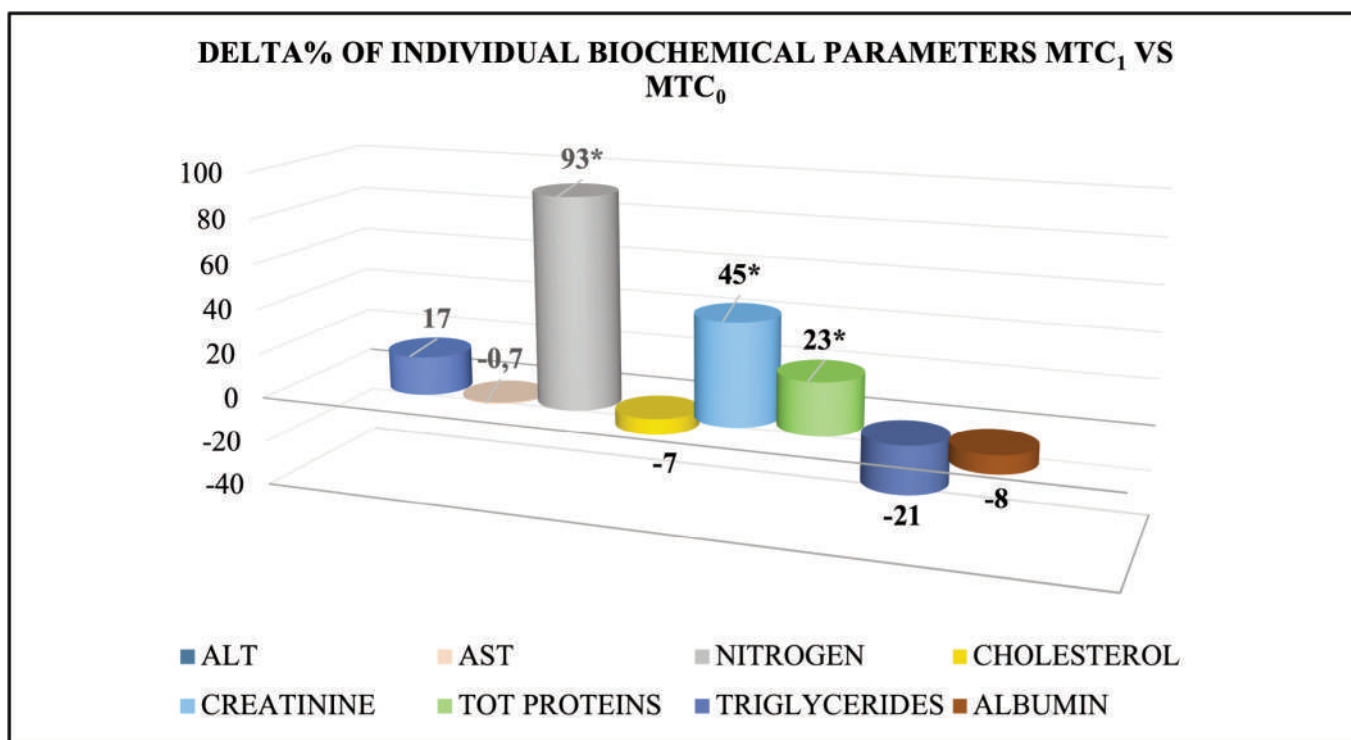


Graph. 5 - Histogram representation of the $\pm$ Delta% of individual haematological parameters considered and their respective significance (*), referred to the correlation MTC₁ vs MTC₀.



Tab. 8 - Average values, $\pm$ Mean Delta, $\pm$ Delta%, and relative significance for each biochemical parameter considered, referred to the correlation MTC_1 vs MTC_0 .

PARAMETER	MEAN VALUE	AVG Δ	Δ %	SIGNIFICANCE
ALT	33,75	5,87	17	NO
AST	118,37	-0,875	-0,7	NO
NITROGEN	16,25	15,12	93	*
CHOLESTEROL	76,12	-5,75	-7	NO
CREATININE	0,89	0,4	45	*
TOT PROTEINS	6,15	1,42	23	*
TRIGLYCERIDES	19,12	-4,12	-21	NO
ALBUMIN	3,39	-0,27	-8	NO



Graph. 6 - Histogram representation of the $\pm$ Delta% of individual biochemical parameters considered and their relative significance (*), referred to the correlation MTC_1 vs MTC_0 .

Correlation MTC₂ vs MTC₁

To further support the discussion of the data, an analysis was conducted to highlight which of the values (mean value $\pm$ mean delta) deviated from the threshold values indicated in the laboratory reports.

Discussion

In analysing the correlation between MTC₁ and MTC₀, it is observed that all values of haematological parameters fall within the physiological ranges indicated by the reference laboratory. Furthermore, the results demonstrate significant differences between the two samplings. Specifically, these values indicate an increase in lymphocytic and erythrocytic parameters and a decrease in Platelet Volume in the MTC₁ sampling (**Table 7; Graph 5**).

The two samplings occurred in the same season but in different years, indicating that meteorological conditions may not be the likely cause of the observed differences. Rather, varying management factors to which the animals were subjected could have influenced the results.

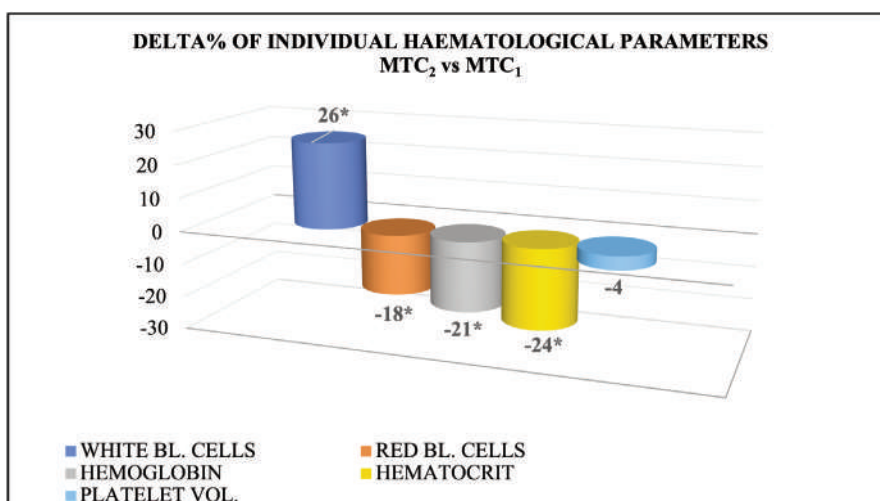
Similarly, the values examined in the MTC₂ vs MTC₁ correlation fall within the reference physiological ranges, but, except for leukocytes (increased), all components of the haematological profile analysed show significant decreases in the MTC₂ sampling (**Table 9; Graph 7**).

The trends in haematological parameters between these two samplings could be interpreted considering the different meteorological conditions present in the two seasons (summer and winter).

Regarding the comparison between MTC₁ and MTC₀, the evaluation of

Tab. 9 - Average values, $\pm$ Average Delta, $\pm$ Delta %, and relative significance for each haematological parameter considered in relation to the MTC₂ vs MTC₁ correlation.

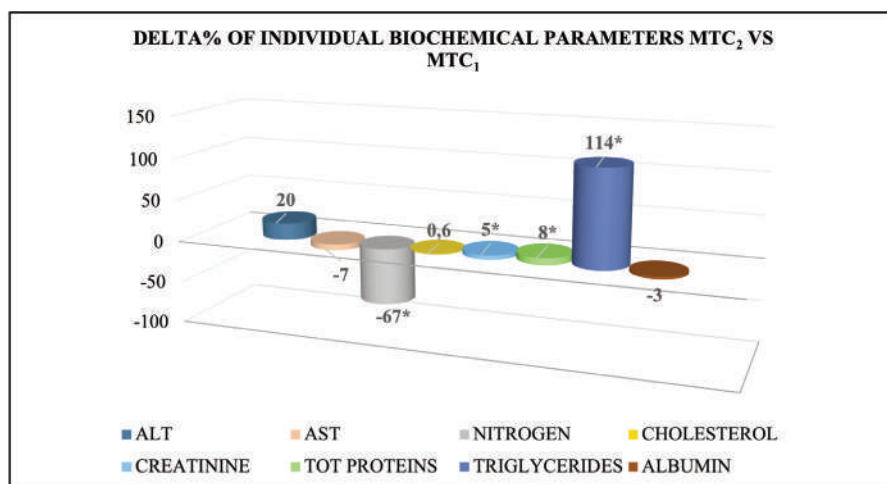
PARAMETER	MEAN VALUE	AVG Δ	Δ %	SIGNIFICANCE
WHITE BL. CELLS	8,61	2,22	26	*
RED BL. CELLS	19,2	-3,42	-18	*
HAEMOGLOBIN	12,24	-2,53	-21	*
HAEMATOCRIT	36,93	-8,73	-24	*
PLATELET VOL.	8,76	-0,36	-4	NO



Graph. 7 - Histogram representation of the $\pm$ Delta% of individual haematological parameters considered and their relative significance (*), referring to the correlation between MTC₂ and MTC₁.

Tab. 10 - Average values, $\pm$ Average Delta, $\pm$ Delta%, and their relative significance for each biochemical parameter considered, referring to the correlation between MTC₂ and MTC₁.

PARAMETER	MEAN VALUE	AVG Δ	Δ %	SIGNIFICANCE
ALT	40	8,28	20	NO
AST	115,57	-7,71	-7	NO
NITROGEN	29,86	-20	-67	*
CHOLESTEROL	68,86	0,43	0,6	NO
CREATININE	1,31	0,07	5	*
TOT PROTEINS	7,54	0,57	8	*
TRIGLYCERIDES	13,57	15,43	114	*
ALBUMIN	3,2	-0,1	-3	NO



Graph. 8 - Histogram representation of $\pm$ Delta% for each biochemical parameter considered, referring to the correlation between MTC₂ and MTC₁, with relative significance (*), referring to the correlation between MTC₂ and MTC₁.

biochemical data shows a significant difference from physiological values in only 3 parameters (Nitrogen, Creatinine, and Total Proteins). Specifically, ALT and Albumin fall within the reference ranges, while AST, Nitrogen, Creatinine, Cholesterol, Total Proteins, and Triglycerides show lower values.

Concerning the comparison between MTC₂ and MTC₁, the biochemical parameter data show a significant difference for Nitrogen, Creatinine, Total Proteins, and Triglycerides (**Table 10; Graph 8**). Specifically, ALT, Creatinine, and Albumin fall within physiological values, while AST, Nitrogen, Triglycerides, and Cholesterol show lower values, and only Total Proteins are higher.

To support the hypothesis of a significant variation between different seasons, it is observed that haematocrit values in summer (MTC₂) are lower compared to those in winter, as observed in our study; additionally, as seen in the MTC₁-MTC₀ comparison (winter sampling), both cases show a significantly higher trend, although they are physiological. Also, the AST value (markedly lower than

reference values) presents a significantly decreased difference in the MTC₂-MTC₁ comparison, confirming the trend observed in summer for this parameter, similar to that for ALT, which instead is higher in summer, exactly as evidenced by the results of the present study.

Creatinine also appears to confirm the summer trend with an increase in the MTC₂-MTC₁ comparison.

The diet of the MTC₁ and MTC₂ groups (correlations with significant differences), consisting of available wild vegetation with the addition of ad libitum hay, may have influenced some variations in haemato-biochemical profiles compared to the MTC₀ group, where animals were exclusively fed island vegetation.

Some parameters indicate patterns of liver dysfunction in translocated animals compared to MTC₀, more pronounced in the MTC₂ sampling, as indicated by the results obtained.

The results show a significantly more pronounced difference between MTC₁ compared to MTC₀ and subsequently between MTC₂ compared to MTC₁, indicating a progressive hepatic overload

likely related to a richer diet compared to that of the island animals.

It appears that patterns of liver alteration manifest with an increase in ALT and triglycerides, and a decrease in cholesterol, nitrogen, and albumin, as observed in the MTC₂ group. Regarding the results of haemato-biochemical tests related to the BPR sampling, it is not possible to comment on the outcomes in relation to meteorological conditions or the physiological status of the subjects, as mentioned earlier.

However, it is important to consider that assumptions about the results obtained in the samplings are critical due to the limited number of subjects examined (although sufficient for statistical analysis using randomization testing), which did not allow for an examination of potential influences such as sex, age, or physiological/reproductive status, certainly capable of affecting the trends of individual parameters (7, 8).

Moreover, for some haemato-biochemical parameters, given the generally high standard deviation, there is evident substantial individual variability that would be worthwhile to further investigate.

In regard to the results of infectious and parasitic pathogen investigations across all samplings (MTC₀, MTC₁, MTC₂, and BPR), the presence of *Toxoplasma gondii* positivity in one subject on the island can be explained by the introduction of domestic animals such as cats by humans over time, which are known hosts for the protozoan, along with other animals (birds, rodents, wild animals, and livestock) on the island as intermediate hosts in the cycle. The goats thus become infected by ingesting oocysts shed in the soil by Felidae family (domestic cats and similar) hosts (9).

Regarding the infectious agents identi-



fied in the Marsiliana nucleus, it can be hypothesized that the relocation from the island system to the continental structure exposed the group to new pathogens to which the species is susceptible.

Similarly to Marsiliana, the case of *Toxoplasma gondii* in a subject housed at the Bioparco di Roma can be explained by the likely ingestion of infected oocysts. The insular situation involves close contact between goats and other wildlife, increasing the spread of parasitic forms within the group.

Conversely, the controlled area of Marsiliana housing the animals constitutes a protected zone barring the entry of other species, thereby providing greater protection against parasitic infestations. The negativity for all subjects to the analysed parasitosis at the Bioparco di Roma facility is attributed to the fact that these animals are periodically checked using pooled faecal samples and systematically treated in case of positivity.

Conclusions

The goat population on the Island of Montecristo, due to its unique characteristics, is heavily influenced by management, nutritional, environmental, and health factors, which can lead to periodic fluctuations in the numerical size of the group. These variables can represent some of the causes of modifications in the balance between the animals and the host environment, posing a risk of progressive reduction in the number of individuals to the point of threatening survival.

The objective of the transfers carried out over time from Montecristo to continental environments, as described in this study, aimed to create a controlled external resource to ensure a reserve of

the original population, from which resources could be drawn in case of a worrying decrease in individuals on the island.

The environment of Montecristo, with strictly regulated access, represents a closed system that can have both positive and negative repercussions on the confined population. In particular, habitat isolation could act as a barrier protecting the animals from external pathogen vectors. Indeed, serologically positive samples for antibodies to Blue Tongue Virus and Schmallenberg Virus were identified in both the translocated nucleus at Marsiliana and the one preserved at the Bioparco di Roma, indicating transmission mediated by haematophagous insects of the *Culicoides* genus not found on the island.

Additionally, the population size of the goat population, averaging 200-300 individuals, is also conditioned by seasonal variability in meteorological conditions, which can negatively impact available food sources. Despite these animals demonstrating remarkable adaptability to extreme and varied dietary regimes, thanks to a pronounced ability to select plants and metabolize highly fibrous components, unfavorable environmental conditions can have repercussions on their health status, reproductive capacity, and spatial distribution, as they exclusively feed on native spontaneous vegetation.

An ex situ presence of animals requires judicious management programs, not only respecting animal welfare but also paying due attention to selection aspects of the subjects. Indeed, from the results obtained, the controlled facilities at Marsiliana and Bioparco di Roma show a birth rate of 89% over 3 years (equivalent to 3.3 births/year) and 55% over 12 years (3.4 births/year), highlighting the

pivotal role of planned birth management based on careful selection of breeders and genetic variability within the group.

Genetic typing of goats from the Island of Montecristo is of extreme importance, allowing comparison of the population with results presented in 2022 (10) and confirming doubts expressed by Masseti (11, 12) regarding the selection of translocated subjects at the Bioparco di Roma. Efforts must indeed be concentrated on delving into this issue to effectively realize an ex situ group capable of supporting and integrating the island's presence in the event of potential negative situations, finalizing the selection to maintain necessary genetic variability over time.

Furthermore, as a future objective, it is crucial to integrate data on haemato-biochemical parameters related to Montecristo goats, evaluating the creation of multiple ex situ conservation facilities and monitoring a greater number of individuals in different environmental, seasonal, and physiological conditions. This would allow for correlation and interpretation of results based on a greater number of multifactorial variables, thus identifying not only pathological conditions early but also predisposing conditions leading to discomfort.

Studies aimed at assessing well-being, through monitoring of specific stress indicators with non-invasive biological material collection protocols (13) and species-specific ethogram behavioral analysis, can indeed represent a primary goal to ensure optimal management of animals housed in conservation facilities and the living conditions of those free on the island's territory.

Deepening knowledge can therefore help not only protect health aspects, ensuring



prevention and control plans (14, 15), but above all act on management factors influencing animal welfare conditions and, consequently, play a fundamental role in safeguarding and conserving over time this population of goats, a unique living example in Italy in a fully wild state.

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ESPERIENZE SUL CAMPO



Gestione efficace delle crisi e sicurezza sanitaria a lungo periodo: cooperazione sanitaria civile-militare in Italia in chiave One Health.

Noran Khalil*

Riassunto

In un contesto globale segnato da crisi sanitarie complesse e interconnesse, tra cui pandemie, conflitti armati, emergenze CBRN e resistenze antimicrobiche, l'integrazione tra sanità civile e militare rappresenta una risorsa strategica ancora poco valorizzata in Italia. Questo report, sviluppato nell'ambito del Master di II livello in One Health presso l'Università Sapienza di Roma e in collaborazione con l'Ispettorato Generale della Sanità Militare, esplora le potenzialità della cooperazione civile-militare in sanità attraverso il paradigma One Health, un approccio che riconosce l'interconnessione tra salute umana, animale e ambientale. Dopo un'analisi del sistema sanitario militare italiano e delle esperienze di collaborazione nazionali e internazionali, vengono identificati i principali gap strutturali, normativi e culturali che ostacolano un'integrazione efficace con il sistema sanitario civile. A partire da casi studio e modelli istituzionali esteri (es. Germania, Australia, Canada ed altro), il lavoro propone un piano d'azione per l'Italia, basato su protocolli operativi condivisi, interoperabilità dei sistemi informativi, formazione congiunta e task force permanenti. Il report sottolinea infine l'importanza di una strategia nazionale che istituzionalizzi la cooperazione civile-militare, rendendola parte integrante delle politiche di sicurezza sanitaria, con l'obiettivo di rafforzare la resilienza del sistema Paese e contribuire attivamente alle missioni NATO e alla sicurezza sanitaria globale.

Introduzione

In un'epoca caratterizzata dall'aumento di minacce sanitarie globali, tra cui pandemie, resistenze antimicrobiche e crisi ambientali, diventa sempre più evidente la necessità di risposte integrate, rapide e multidisciplinari. In questo contesto, i sistemi sanitari militari, originariamente concepiti per garantire la sicurezza nazionale e fornire assistenza in contesti bellici, stanno assumendo un ruolo sempre più rilevante anche nel campo della salute pubblica.

Le strutture sanitarie militari hanno dimostrato di essere risorse strategiche nella gestione di emergenze complesse, grazie alla loro capacità di mobilitazione rapida, all'elevato livello di specializzazione del personale e all'efficienza del supporto logistico. Un esempio emblematico è rappresentato dalla risposta alla pandemia di COVID-19, durante la quale le Forze Armate italiane hanno fornito un contributo determinante al sistema sanitario civile, allestendo ospedali da campo, attivando unità sanitarie mobili e impiegando personale medico e infermieristico militare (1).

Questo tipo di risposta coordinata mette in luce l'importanza di un approccio sistemico alla salute pubblica. In tale contesto emerge con forza il concetto di One Health, un modello integrato che riconosce l'interdipendenza tra la salute umana, animale e ambientale (2) (**Fig. 1**). Tale paradigma sottolinea come un problema in uno di questi ambiti possa avere ripercussioni significative sugli altri, rendendo indispensabile l'adozione di strategie coordinate e multidisciplinari per affrontare in modo efficace le sfide sanitarie presenti e future.

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Proprio in virtù di questa necessità di integrazione e collaborazione, il ruolo delle Forze Armate si configura come essenziale all'interno del sistema di sicurezza sanitaria nazionale. Le loro competenze operative, logistiche e mediche rappresentano infatti risorse preziose da integrare in modo strutturato con il comparto sanitario civile.

Metodi

Il presente report è frutto del lavoro di tesi che ho realizzato nell'ambito del Master di II livello in One Health presso l'Università Sapienza di Roma, svolto in collaborazione con l'Ispettorato Generale della Sanità Militare. Il documento intende esplorare il ruolo della cooperazione civile-militare in ambito sanitario, con particolare riferimento al paradigma One Health, analizzando il sistema sanitario militare in Italia e all'estero, nonché il suo coinvolgimento nelle operazioni NATO. L'obiettivo è duplice: da un lato, evidenziare come le capacità del settore militare possano integrare e rafforzare gli sforzi del sistema sanitario civile; dall'altro, proporre un percorso operativo per istituzionalizzare tale collaborazione, rendendo le strutture sanitarie militari parte integrante delle strategie nazionali di prevenzione, risposta e resilienza.

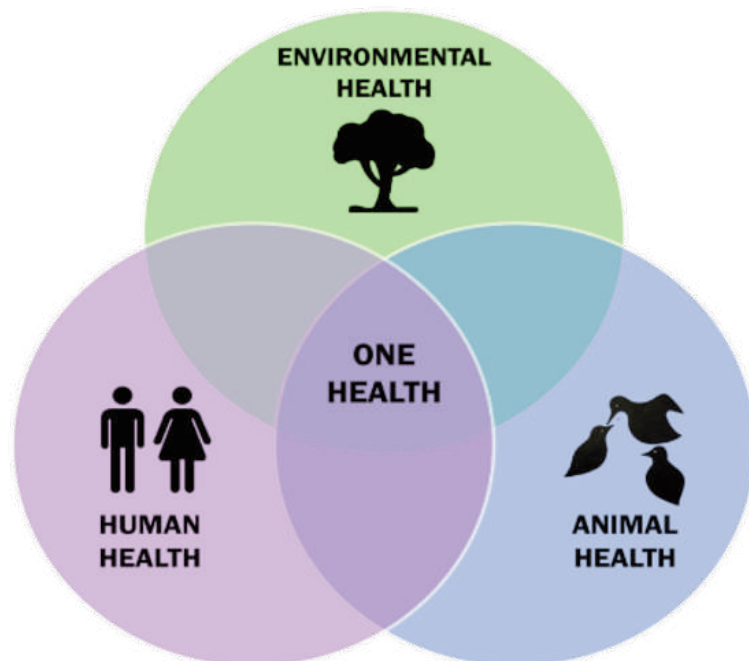


Fig. 1 - Approccio One Health.

Il ruolo delle Forze Armate nella sanità

L'Italia vanta una delle tradizioni più consolidate in Europa nel campo della medicina militare. Già durante le guerre d'indipendenza, i medici militari operarono non solo in ambito bellico, ma anche nella gestione di epidemie, evidenziando sin dalle origini una vocazione duale: militare e civile (3).

Attualmente, la sanità militare italiana è strutturata in modo articolato, comprendendo le componenti dell'Esercito, della Marina, dell'Aeronautica e dell'Arma dei Carabinieri, tutte coordinate dall'Ispettorato Generale della Sanità Militare (IGESAN), che garantisce una copertura capillare e adattabile, capace di rispondere alle esigenze delle Forze Armate e, all'occorrenza, del sistema civile (4). La collaborazione tra il sistema sanitario militare e quello civile è attualmente disciplinata da riferimenti normativi generali, tra cui gli articoli 181 e 182 del Codice dell'Ordinamento Militare (5).

L'articolo 181 definisce le funzioni del Servizio Sanitario Militare, che includono la valutazione dell'idoneità fisica e psicologica del personale militare, la tutela della salute nelle Forze Armate e la fornitura di materiali e supporti tecnici in tempo di pace, guerra o durante crisi internazionali. Questo assetto normativo riconosce il ruolo strategico della sanità militare all'interno del sistema di sicurezza nazionale.

L'articolo 182, invece, sancisce la possibilità di impiegare la sanità militare a supporto delle autorità civili in situazioni emergenziali, stabilendo la conformità delle attività sanitarie militari alle normative nazionali in materia di sanità pubblica, igiene, sicurezza alimentare e sanità veterinaria. Tale disposizione favorisce una collaborazione efficace tra autorità sanitarie militari e civili, anticipando di fatto i principi del modello One Health.

In linea con questa evoluzione operativa, negli ultimi anni la collaborazione tra sanità militare e civile si è ulteriormente rafforzata attraverso accordi, riforme istituzionali e iniziative congiunte, volte a integrare competenze e risorse per garantire servizi sanitari di alta qualità tanto al personale militare quanto alla popolazione civile.

Tali sinergie non si limitano all'assistenza clinica, ma includono anche attività di formazione congiunta, ricerca scientifica e una risposta coordinata alle emergenze. Di seguito sono riportati alcuni dei principali accordi che hanno consolidato la collaborazione tra



sanità militare e civile in Italia:

- *Accordi IGESAN con Sanità civile (giugno 2024)*
L'IGESAN ha sottoscritto accordi Federazione Nazionale Ordini Tecnici Sanitari di Radiologia Medica e delle Professioni Sanitarie Tecniche, della Riabilitazione e della Prevenzione (FNO TSRM e PSTRP), la Federazione Nazionale degli Ordini dei Fisioterapisti (FNOFI) e la Federazione degli Ordini dei Farmacisti Italiani (FOFI), con l'obiettivo di rafforzare la cooperazione tra sanità militare e civile. Tali intese si concentrano su formazione, ricerca e sviluppo professionale, contribuendo a potenziare l'efficacia del sistema sanitario integrato (6, 7).
- *Accordo tra Ospedale Militare Celio e Policlinico Umberto I (2022)*
L'ospedale militare Celio e il Policlinico Umberto I hanno siglato un accordo nel campo dell'urologia, permettendo consultazioni specialistiche e trattamenti avanzati accessibili sia a militari che a civili, rafforzando l'integrazione tra i due sistemi (8).
- *Partecipazione a "Welfair: The Healthcare Fair" (2024)*
Per la prima volta, il settore sanitario della Difesa ha partecipato all'evento "Welfair" in collaborazione con la Federazione Nazionale degli Ordini dei Medici Chirurghi e degli Odontoiatri (FNOMCeO) con l'obiettivo di promuovere la collaborazione civile-militare, presentando tecnologie avanzate e modelli integrati di assistenza (9).
- *PEIMAF - Piano di Emergenza Interno per il Massiccio Afflusso di Feriti*
Il PEIMAF è un protocollo operativo per gestire emergenze con molti feriti, integrando ospedali civili e supporto militare. Prevede l'attivazione di un'Unità di Crisi ospedaliera che coordina risorse e comunica con enti esterni, assicurando una risposta efficace anche in scenari CBRN (Chimici, Biologici, Radiologici e Nucleari) (10). Sebbene non menzioni esplicitamente l'approccio One Health, ne riflette i principi attraverso la collaborazione multisettoriale tra sanità, protezione civile e ambiente.
- *Integrazione Sanitaria Civile-Militare a Vicenza*
A Vicenza, la collaborazione tra sanità civile e militare garantisce assistenza medica integrata al personale militare statunitense e alle loro famiglie. In assenza di pronto soccorso militare, il sistema sanitario civile, tramite il 118 e l'Ospedale San Bortolo, assicura interventi rapidi e trattamenti specialistici, rafforzando la collaborazione (11).
- *Collaborazione tra IGESAN e Policlinico Campus Bio-Medico*
La collaborazione tra la Fondazione Policlinico Universitario Campus Bio-Medico e le Forze Armate italiane è stata avviata nel 2018 con un accordo iniziale focalizzato sulla prevenzione del tumore del colon-retto per il personale della Difesa. Negli anni successivi, questo rapporto si è ampliato, includendo iniziative congiunte in ambito sanitario, scientifico e formativo. La visita dell'Ispettore Generale della Sanità Militare Carlo Catalano nel 2025 ha rappresentato un momento importante per consolidare e rafforzare ulteriormente questa collaborazione, puntando a nuove sinergie tra sanità militare e civile (12).

Questi esempi rappresentano i primi passi verso una collaborazione sempre più integrata tra sanità militare e civile, l'importanza di un approccio condiviso che però richiede ancora ulteriori sviluppi. Per una sintesi degli accordi e delle collaborazioni finora attivati, si rimanda alla **Figura 2**, che ne offre una panoramica dei principali aspetti.

Modelli Istituzionali di Integrazione tra Sanità Militare e Civile in diversi paesi

Dall'analisi comparativa condotta nell'ambito della presente ricerca sulle collaborazioni tra sanità militare e sistema sanitario civile in Italia e in altri Paesi, emerge che in molte realtà internazionali tali collaborazioni sono regolate da modelli istituzionali consolidati e strutturati.

Un esempio significativo è rappresentato dall'Australia, dove il supporto militare in situazioni di emergenza è organizzato attraverso strumenti ben definiti:

Il *Defence Assistance to the Civil Community* (DACC) coordina il supporto militare durante emergenze come pandemie e incendi. Il DACC regola l'intervento dell'Australian Defence Force (ADF) nelle attività di logistica, evacuazioni mediche e gestione dei centri di quarantena, mentre l'*Australian Civil-Military Centre* (ACMC) assicura il coordinamento operativo con le autorità civili e l'ADF (13, 14).

Analogamente, in Canada le forze militari sono integrate nel sistema sanitario civile attraverso i *Canadian Forces Health Services*, che forniscono supporto ai servizi civili durante le emergenze, mentre il National Emergency Response System coordina la collaborazione tra militari e autorità civili per garantire risposte rapide ed efficaci (15, 16).



Anche la Francia adotta un approccio strutturato alla gestione delle emergenze. Dal 2016 si avvale del piano *ORSAN (Organisation de la Réponse du Système de Santé en Situations Sanitaires Exceptionnelles)*, che organizza la risposta sanitaria nazionale attraverso cinque piani operativi specifici: gestione delle vittime, supporto medico-psicologico, epidemie, rischi biologici e rischi nucleari o chimici. Tale sistema è integrato con l'organizzazione *ORSEC (Organisation de la Réponse de Sécurité Civile)*, che garantisce il coordinamento tra



Fig. 2 - Accordi tra Sanità civile e militare in Italia.

biologiche. Tale modello rafforza il ruolo della Germania come attore di primo piano nella sicurezza sanitaria globale (18, 19, 20, 21). Anche paesi come Svezia, Regno Unito e Stati Uniti hanno sviluppato sistemi di cooperazione consolidati. In Svezia, le Forze Armate sono integrate nelle risposte alle emergenze sanitarie attraverso il concetto di Difesa Totale (*Totalförsvär*), che include esercitazioni regolari per assicurare un'elevata prontezza operativa (22). Il Regno Unito utilizza il *Military Aid to Civil Authorities (MACA)*, che prevede il supporto militare al sistema sanitario civile con squadre medici mobili e ospedali da campo, come durante la pandemia di COVID-19 e altri eventi critici (23, 24). Negli Stati Uniti, attraverso il *National Response Framework* e il *National Disaster Medical System*, viene coordinato l'impiego delle risorse militari per fornire assistenza medica e logistica su larga scala, assicurando una strutturata integrazione con il sistema civile nelle risposte alle emergenze.

In questo contesto, unità come il *Public Health Command-Pacific* adottano un approccio *One Health*, promuovendo interventi multidisciplinari che tengono conto delle interconnessioni tra salute umana, animale e ambientale, rafforzando così la resilienza sanitaria nazionale (**Fig. 3**) (25, 26, 27).

Tutti questi modelli migliorano significativamente la capacità di risposta coordinata e rafforzano in modo sostanziale la resilienza e l'efficacia dei sistemi sanitari nazionali dei vari paesi (**Fig. 4**).

NATO: Cooperazione Civile-Militare e nella Salute Globale

L'Italia, come alcuni Paesi citati, è membro della NATO, che tramite l'articolo 3 promuove il rafforzamento delle capacità di difesa di ciascun Stato membro, e con l'articolo 5 assicura la difesa collettiva in caso di attacco. Questi principi guidano la cooperazione militare e politica tra gli Stati, migliorando la sicurezza comune e la gestione coordinata di crisi ed emergenze.

sanità civile e militare, includendo il contributo di unità mediche specializzate (17).

La Germania si distingue per un'organizzazione altamente efficiente della cooperazione civile-militare, denominata *ZMZ (Zivil-Militärische Zusammenarbeit - Collaborazione Civile-Militare)*, che permette alla *Bundeswehr* (Forze Armate Tedesche) di intervenire rapidamente con risorse quali personale medico e attrezzature, sia in emergenze nazionali che internazionali. In particolare, il Servizio Sanitario della *Bundeswehr*, l'Istituto di Microbiologia e gli ospedali militari, integrati nel sistema sanitario nazionale, svolgono un ruolo chiave nel garantire assistenza medica e logistica a favore sia della popolazione civile che del personale militare.

Questa capacità di risposta integrata si inserisce in un quadro più ampio, in cui la Germania ha formalmente adottato l'approccio *One Health*, promuovendo una sinergia tra ministeri civili e istituzioni militari per affrontare in maniera coordinata sfide sanitarie complesse, come la resistenza antimicrobica, le zoonosi e le minacce



Negli ultimi anni, tuttavia, la natura delle minacce affrontate dalla NATO si è profondamente trasformata. Oggi, oltre alla difesa militare convenzionale, l'Alleanza si trova ad affrontare sfide complesse e interconnesse come pandemie, cambiamenti climatici, crisi umanitarie.

Proprio in questo nuovo scenario globale, le crisi geopolitiche attuali hanno reso ancora più evidente la necessità di un approccio integrato tra risorse militari e civili per la gestione della salute pubblica e dell'assistenza umanitaria, soprattutto in situazioni di conflitto, emergenze sanitarie, distruzione delle infrastrutture o blocchi umanitari.

In questo contesto si inserisce l'azione della NATO, che ha sviluppato una rete complessa e articolata di collaborazioni strategiche e operative finalizzate a garantire la sicurezza sanitaria globale. Attraverso queste collaborazioni, l'Al-

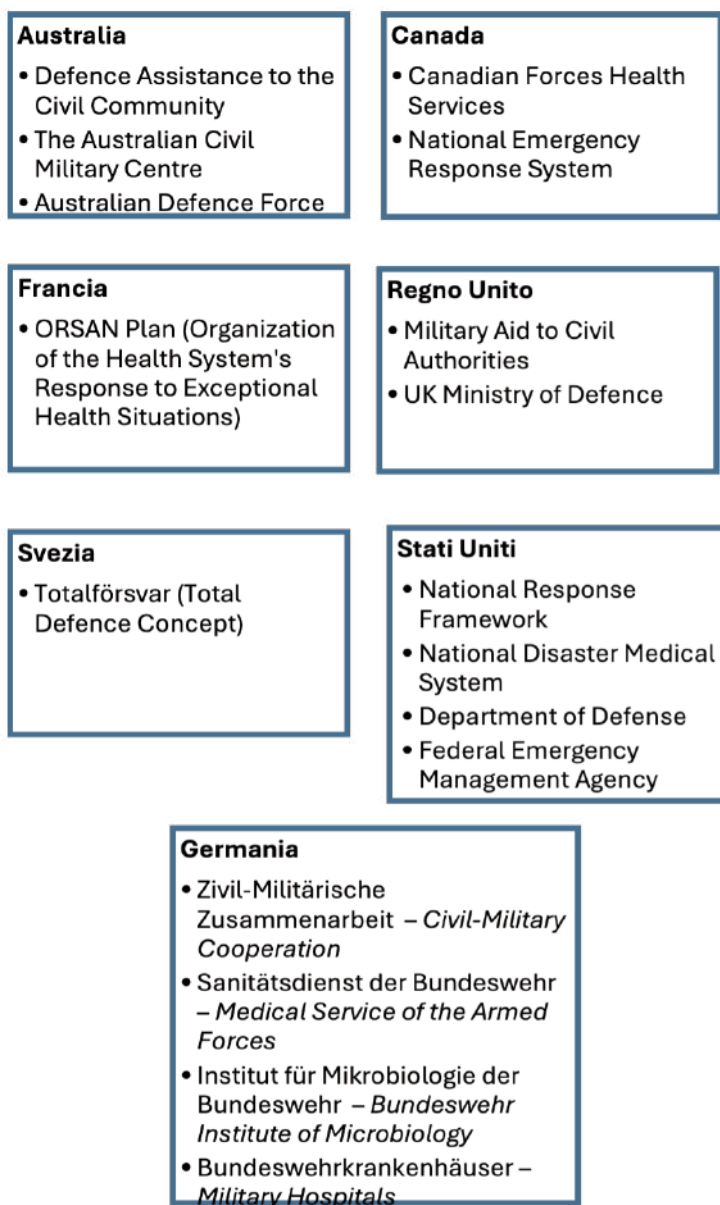


Fig. 4 - Collaborazioni formalizzate tra sanità civile e militare nei vari paesi.

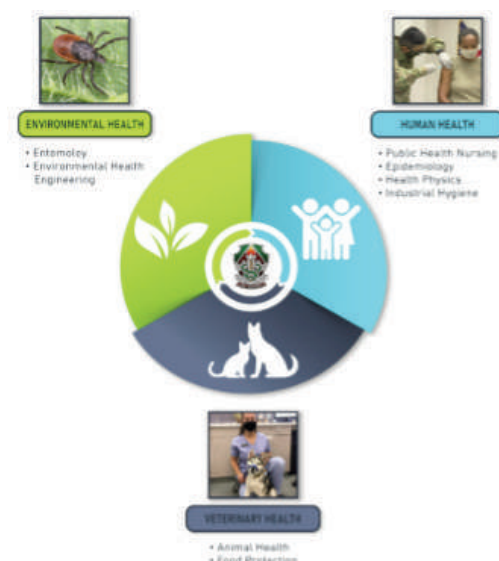


Fig. 3 - Approccio One Health adottato dal sistema sanitario militare statunitense (PHC-P).

leanza promuove il coordinamento e l'integrazione efficiente tra risorse militari e civili, con l'obiettivo di migliorare la capacità di risposta comune alle emergenze sanitarie. Ciò avviene tramite iniziative che assicurano interoperabilità, formazione specializzata e sorveglianza continua. Di seguito, una panoramica dei principali enti e iniziative coinvolti (**Fig. 5**):

Attraverso il *Comitato dei Capi dei Servizi Medici Militari (COMEDS)*, la NATO fornisce consulenza medica strategica, coordina il supporto sanitario e promuove l'interoperabilità tra le forze militari alleate, sviluppando linee guida per la gestione delle minacce sanitarie emergenti e facilitando la collaborazione civile-militare in situazioni di crisi (28).

Il *Centro di Eccellenza per la Medicina Militare (MILMED COE)* sostiene l'Alleanza nello sviluppo e innovazione delle capacità medico-militari, promuovendo formazione, interoperabilità e sorveglianza sanitaria. Offre supporto medico ai comandi NATO e alle organizzazioni civili e militari degli Stati membri, facilitando la cooperazione nelle emergenze (29). Parallelamente, il NATO CIMIC (*cooperazione civile-militare*) Centre of Excellence potenzia la cooperazione *civile-militare* sviluppando dottrina, formazione e best practice. Favorisce il coordinamento efficace tra

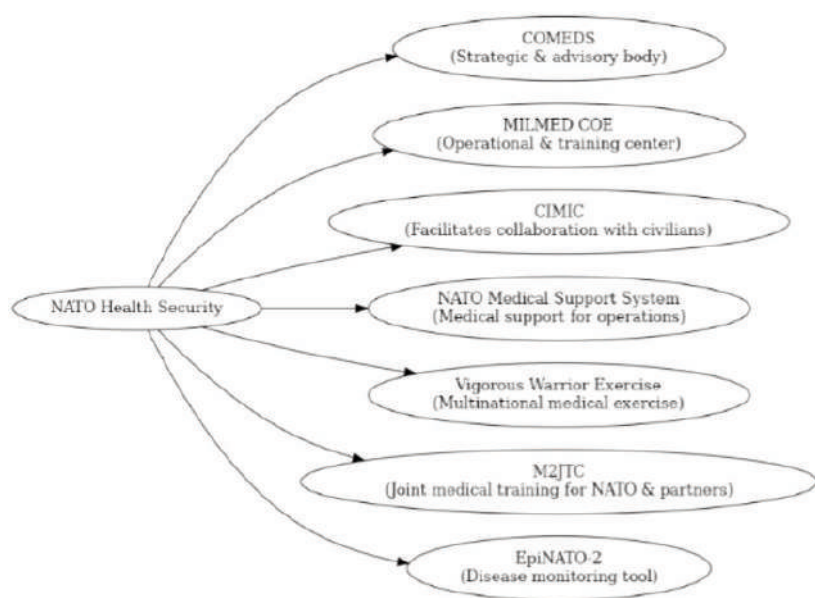


Fig. 5 - Sistemi di sicurezza sanitaria della NATO.

forze militari e attori civili, migliorando interoperabilità e supporto nelle situazioni di crisi, ricostruzione e governance. Ciò contribuisce a rafforzare resilienza e unità in ambienti operativi complessi (30).

Inoltre, il sistema di supporto sanitario della NATO assicura l'assistenza medica durante le missioni, integrando strumenti come EpiNATO-2 per coordinare la sorveglianza epidemiologica e garantire una risposta rapida alle emergenze sanitarie, come dimostrato nel 2016 durante l'identificazione tempestiva di un focolaio di febbre Q nella missione KFOR in Kosovo (31).

La preparazione collettiva viene inoltre rafforzata da esercitazioni multinazionali come Vigorous Warrior, organizzata da MILMED COE, una simulazione civile-militare di crisi sanitaria su larga scala, e dal Multinational Medical Joint Training Center (M2JTC), che fornisce formazione

congiunta per migliorare l'interoperabilità tra i diversi attori coinvolti nelle operazioni multinazionali (32, 33).

Questo approccio integrato e sinergico tra mondo civile e militare permette alla NATO di affrontare in modo coordinato le sfide sanitarie globali, garantendo una maggiore resilienza e sicurezza per le popolazioni coinvolte.

La NATO integra l'approccio One Health in maniera diretta e indiretta, riconoscendo l'interdipendenza tra salute umana, animale e ambiente come elemento chiave per la sicurezza operativa. Attraverso enti come COMEDS e MILMED COE, vengono sviluppate linee guida e programmi di formazione multisettoriale, mentre esercitazioni civili-militari mettono alla prova la cooperazione tra i diversi settori. In particolare, l'evento MILMED COE "One Health Approach in NATO's Force Health Protection" ha evidenziato l'importanza di coordinare biosicurezza, gestione delle zoonosi e preparazione pandemica tra attori civili e militari. Inoltre, il sistema EpiNATO-2 monitora in tempo reale l'insorgenza di malattie durante le missioni, permettendo risposte rapide e integrate a minacce sanitarie emergenti (34). Nonostante questi significativi progressi, permangono ancora sfide rilevanti nell'adozione piena e uniforme del modello One Health, rendendo necessari ulteriori sforzi per rafforzare la collaborazione tra tutti gli attori coinvolti.

Risultati

Gap e criticità nella collaborazione civile-militare in ambito sanitario in Italia

L'analisi effettuata ha evidenziato numerosi divari e criticità nella collaborazione tra i sistemi sanitari militari e civili in Italia, dove spesso si interviene con soluzioni ad hoc durante le crisi sanitarie. Questi limiti rappresentano ostacoli significativi a una risposta integrata ed efficace in situazioni di emergenza, inclusi conflitti e crisi sanitarie complesse.

In particolare, sono stati identificati i seguenti punti critici:

- *Limitata integrazione normativa:* assenza di un quadro giuridico e regolatorio chiaro e condiviso che definisca ruoli, responsabilità e protocolli comuni tra istituzioni sanitarie civili e militari.
- *Barriere culturali e operative:* differenze organizzative, procedurali e terminologiche tra personale civile e militare che ostacolano coordinamento e fiducia reciproca.
- *Mancanza di interoperabilità infrastrutturale e informativa:* limitata condivisione di dati e integrazione tecnologica che rallentano la gestione tempestiva delle informazioni critiche.
- *Limitata pianificazione e coordinamento strategico:* L'assenza di strategie condivise e il numero ridotto di esercitazioni congiunte diminuiscono la prontezza operativa.



- *La cooperazione militare-civile transfrontaliera limitata* per la sicurezza sanitaria globale è ancora limitata, come dimostrato dalla gestione frammentata del COVID-19, evidenziando la necessità urgente di un quadro strutturato e globale
- *Applicazione frammentata dell'approccio One Health*: l'approccio è riconosciuto ma applicato in modo frammentato, richiedendo maggiore coordinamento tra enti civili e militari.

Inoltre, le esercitazioni congiunte sono rare e non vincolanti, e il personale civile spesso non conosce a fondo strutture e competenze militari disponibili.

Questi divari ostacolano la costruzione di un sistema sanitario integrato e resiliente, in linea con il paradigma One Health, che riconosce l'interconnessione tra salute umana, animale e ambientale.

La letteratura internazionale e le esperienze di altri Paesi mostrano come superare queste barriere sia cruciale per la sicurezza sanitaria nazionale e per migliorare la capacità di risposta alle emergenze.

Proposte operative per l'Italia

In assenza di collegamenti istituzionali stabili tra sanità civile e militare, l'adozione di un approccio integrato One Health rimane limitata, compromettendo la risposta coordinata alle crisi sanitarie.

Le seguenti raccomandazioni possono costituire la base di un piano d'azione nazionale:

- *Protocollo istituzionalizzato*
Accordo interministeriale tra Ministero della Difesa, Salute, Interno e Protezione Civile per definire ruoli, responsabilità, tempi di attivazione e risorse condivise.
- *Formazione congiunta obbligatoria*
Moduli interdisciplinari nei programmi di formazione medica civile e militare che includano l'approccio One Health e altri ambiti chiave come bio-sicurezza, gestione emergenze, risposta ad attacchi biologici, contaminazione ambientale e comunicazione di crisi.
- *Task force civili-militari permanenti*
Squadre congiunte per rispondere a emergenze sanitarie complesse, con personale formato e addestrato insieme.
- *Interoperabilità dei sistemi informativi sanitari*
Creazione di interfacce più sviluppate tra database militari e ASL per facilitare scambio dati e tracciamento tempestivo; investimento in infrastrutture e piattaforme digitali interoperabili.
- *Promozione della ricerca civile-militare*
Finanziamento di progetti di ricerca congiunta su biosicurezza, resistenza antimicrobica e minacce CBRN.

Queste proposte rappresentano un punto di partenza strategico per rafforzare e istituzionalizzare la collaborazione civile-militare nel settore sanitario in Italia, cruciale per affrontare efficacemente le sfide sanitarie presenti e future.

Conclusioni

In Italia, la collaborazione civile-militare in ambito sanitario è ancora insufficiente e frammentata. Nonostante la presenza di strutture militari e civili capaci, mancano protocolli operativi chiari, legalmente vincolanti e un sistema unificato di coordinamento, indispensabili per gestire emergenze complesse come guerre, pandemie, attacchi bioterroristici o crisi ambientali.

L'integrazione del modello One Health e la formalizzazione della cooperazione civile militare rappresenta una svolta strategica per migliorare la capacità nazionale di risposta alle crisi sanitarie. Questo approccio favorisce un coordinamento efficace tra competenze civili e militari, fondamentale per la gestione di guerre, sorveglianza zoonotica, gestione di minacce CBRN ed altro.

L'Italia, in quanto membro fondatore della NATO e parte attiva nelle iniziative di collaborazione sanitaria multilaterale, ha la responsabilità e l'opportunità di sviluppare un protocollo nazionale di coordinamento civile-militare. Questo dovrebbe includere procedure legali precise, un piano operativo condiviso, formazione congiunta continua e una struttura di comando integrata che faciliti decisioni rapide e flessibili. Implementare tali misure non solo colmerebbe le lacune attuali, ma posizionerebbe l'Italia come leader in Europa nella gestione integrata della sicurezza sanitaria, migliorando sia la resilienza interna sia la capacità di contribuire alle strategie di difesa sanitaria collettiva della NATO.



L'Italia ha tutte le competenze e le risorse per essere modello europeo in questo ambito. Serve ora la volontà politica e strategica di rendere la collaborazione civile-militare in sanità non più un'eccezione, ma una prassi.

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L'Ospedale Militare «ALESSANDRO RIBERI» di Torino

Paolo Cadeddu*

Dal vecchio al nuovo Ospedale Militare

Dal discorso pronunciato da Cavour alla camera il 17 febbraio 1855 nella discussione del «progetto di legge per la soppressione di alcune comunità e stabilimenti religiosi», si apprende che *«Quando recentemente venne ad invaderci il cholera, una necessità assoluta di provvedere al miglioramento della condizione dei militari ammalati ci ha costretti ad occupare il locale del monastero di Santa Croce, il quale con poca spesa fu trasformato in ospedale militare e tale rimarrà per sempre, se questa legge verrà approvata. Quel locale fu stimato, come vi ho detto, lire 900 mila; supponiamo pure che questa somma venga portata sino ad un milione trattandosi di fabbricarlo; questo vi cagionerà una spesa annua di lire 40 mila; ma se invece di aver adattato il locale di santa Croce ad uso di ospedale militare si fosse dovuto mandar ad effetto uno dei numerosi progetti che furono fatti per edificare in Torino un ospedale militare, certamente voi avreste dovuto spendere per lo meno due milioni, perché a questa somma ascendevano appunto i calcoli degli ingegneri. Ora nello stato attuale del credito pubblico, due milioni impiegati nella costruzione di un ospedale militare, vi cagionerebbero l'annuo dispendio di lire 120 mila. È dunque manifesto che con questa sola operazione dell'adattamento del locale di santa Croce ad ospedale militare, l'erario pubblico ha guadagnato lire 80 mila all'anno; e mi pare che questo non sia un beneficio da disprezzare»*¹.



Fig. 1 - Il vecchio ospedale militare S. Croce era stato ricavato da un ex convento. Cartolina Grand Didier & C. Torino (Collezione privata).

Le preoccupazioni di Cavour miravano a realizzare economie di gestione della spesa pubblica in un momento cruciale per la Nazione che, cinque anni dopo, avrebbe celebrato l'unità d'Italia. La trasformazione dell'ex convento in Ospedale Militare Divisionario di Torino incominciata nel 1856 si concluse già nel 1858 cosicché la struttura fu in grado di assolvere i fini sanitari disponendo di 400 posti letto per i militari e dodici per gli ufficiali (**Fig. 1**).

La previsione cavouriana durò fino al 1914 quando, il rosso edificio di via S. Croce, dopo oltre cinquant'anni di servizio, lasciava definitivamente il testimone alla nuovissima struttura realizzata in corso Vinzaglio 196 (oggi corso IV Novembre 66). La necessità di realizzare

¹ Maggiore Emilio Gaiani, cit.

* Magg. (EI) - Riserva Selezionata dell'Esercito Italiano, Brigata Alpina «Taurinense»



Fig. 2 - Il nuovo Ospedale Militare Principale della Divisione di Torino. In evidenza l'ampio cortile centrale realizzato con giardinetti. Cartolina numerata 11214 G.V.T. del 1917 - (Collezione privata).

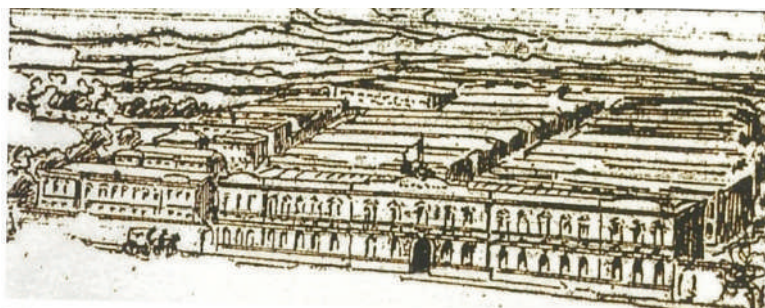


Fig. 3 - Schizzo dell'Ospedale Militare - «La Gazzetta del Popolo» n. 147 del 29 maggio 1907, pag. 4 - (Collezione privata).

militare si comporrà di 26 fabbricati, suddivisi in due reparti, uno per le malattie comuni ed uno per le malattie infettive (Fig. 3). I vari padiglioni sono pressoché paralleli in direzione da Nord-Est a Sud-Ovest in modo di avere i lati più corti quasi normali alla direzione dei venti dominanti. Potrà essere ultimato nell'anno 1909; il suo costo sarà di circa lire 2.000.000». La «Gazzetta del Popolo» n. 2 del 2 gennaio 1911 si limita a riportare solo una fotografia dell'ospedale militare nuovo quasi ultimato nei suoi 14 padiglioni con il portone principale affacciato sulla piazza d'armi. Il completamento richiederà ancora ben tre anni di lavori e l'inaugurazione ufficiale avverrà solo nel luglio del 1914, un anno prima dello scoppio della grande guerra. Il disegno architettonico risenti di analoghe opere realizzate ai primi del Novecento fra le quali spicca l'Ospedale Militare del Celio di Roma, inaugurato nel 1891 (Fig. 4).

L'edificio romano si caratterizza infatti per la presenza di padiglioni lineari paralleli opportunamente distanziati per evitare pandemie ed infezioni ma in ogni caso raccordati con gallerie di collegamento metalliche a due livelli, aperte, ossia prive di vetrate. Confrontando i due ospedali, romano e torinese, quello capitolino ha un aspetto più monumentale mentre quello di Torino dà vita ad una curiosa commistione di stili dove la parte interna

una nuova e moderna struttura era data dall'esigenza di avere un numero adeguato di posti letto tramite la costruzione di un ospedale militare. I primi progetti per l'ospedale militare torinese risalgono al 1905; redatti dal Genio Militare, prevedevano una capienza iniziale di quattrocentoventi posti letto poi implementati a seicento, nella realizzazione esecutiva. Il progetto recepi le nuove tendenze salutiste che propugnavano il layout a padiglioni, la corretta ventilazione, l'igiene, l'esposizione al sole delle strutture, la costruzione ex novo dei fabbricati preferita alla ristrutturazione di opere preesistenti che aveva contraddistinto il «modus operandi» del passato. La nuova tipologia costruttiva, nel privilegiare la salubrità dell'aria, richiedeva zone fuori dal centro cittadino, lontane da industrie ed in ogni caso facilmente accessibili tramite la rete viaria e tramviaria pubblica. L'area in corso Vinzaglio, nella zona a sud della piazza d'armi, ben rispondeva a questi requisiti. I criteri adottati erano di assoluta avanguardia per quei tempi e portarono a dotare l'ospedale di sistemi di riscaldamento degli ambienti e di ricambio d'aria. Fu perseguita la separazione dei percorsi tramite la realizzazione degli edifici su più livelli; a quelli inferiori fu deputata la gestione dello sporco e delle catene alimentari mentre i livelli superiori erano legati alle degenze (Fig. 2).

Nel commentare lo schizzo dell'Ospedale Militare la «La Gazzetta del Popolo» n. 147 del 29 maggio 1907 a pag. 4 così descriveva la struttura: «Il nuovo ospedale



Fig. 4 - Cartolina storica raffigurante l'Ospedale Militare Celio di Roma - (Collezione privata).

risente di una forte corrente Liberty mentre il fronte esterno è tipicamente neorinascimentale; un'architettura nel complesso funzionale e lineare. Il progetto esecutivo finale del «Riberi» è caratterizzato da trentuno edifici a fronte dei 26 previsti nei primi disegni (**Fig. 5**). Il padiglione d'ingresso, a modello degli edifici militari coevi, ospita la direzione (comando) dell'ospedale. Sul cortile centrale, un autentico giardino, si affacciano in simmetria i padiglioni a due piani destinati ai malati comuni e raccordati dalle gallerie di collegamento con vetrate liberty. Il perimetro di raccordo, a forma di «u» rovesciata, si chiude con una costruzione destinata a cucine, mense e sale riunioni. Oltre alle strutture raccordate, completano il complesso ospedaliero corpi isolati destinati a bagni, locali per la cura delle malattie per la pelle, magazzini, caldaie, lavanderia, tre padiglioni destinati alle malattie infettive, un padiglione per gli ufficiali ammalati, sala mortuaria, altre strutture di servizio oltre l'artistica chiesa e la scuderia destinata ai cavalli degli ufficiali. L'Ospedale verrà intitolato al protomedico «Alessandro Riberi», considerato un luminaire della medicina torinese capace

di dare un essenziale contributo alla riforma degli studi di Medicina. L'impegno del Riberi nell'ambito della Sanità militare e civile, il suo costante sforzo di adeguare le strutture sanitarie alle nuove realtà socio-politiche del Regno di Sardegna, gli valse la nomina nel 1843 da parte di Carlo Alberto a Presidente del Consiglio Superiore di Sanità Militare. Il prestigioso incarico verrà mantenuto anche sotto Vittorio Emanuele II. Il complesso ospedaliero fu efficacemente messo alla prova durante la grande guerra. Alla struttura dovettero affiancarsi altri ospedali provvisori per far fronte all'impressionante flusso dei feriti provenienti dal fronte. Anche nell'immediato dopoguerra, per il diffondersi dell'epidemia «spagnola» l'ospedale continua un'intensa attività sanitaria. Durante i bombardamenti della seconda guerra mondiale furono le incursioni del 9 e 19 dicembre a provocare i danni più gravi; un'ala del padiglione «17 A» - uno dei tre dedicati alle malattie infettive - viene infatti completamente distrutta (**Fig. 6 e 7**).

Nel dopoguerra l'edificio verrà ristrutturato ma risulterà nella pianta più corto rispetto agli altri due. Il 5 aprile 1945, come riporta Carlo Chevallard nel suo diario, «tre formazioni di bombardieri hanno sganciato bombe sul deposito locomotive dello Smistamento - che è stato centrato in pieno - e sulla zona circostante. Molto colpiti alcuni stabilimenti vicini: Emanuel, Siata, Santagata e Porino, Samma, la casa di spedizioni Ambrosetti, meno colpita la Riv. Leggermente toccati la Maternità e l'Ospedale Militare. Vittime sinora accertate: circa cinquanta morti ed oltre un centinaio di feriti»².



Fig. 5 - Nella cartina: esemplificazione delle principali strutture caratterizzanti il complesso dell'Ospedale Militare «Riberi» nella sua forma originaria. La pianta è stata realizzata a computer osservando la planimetria generale del progetto definitivo risalente al 1906 e pubblicato sulla Rivista di Artiglieria e Genio n. XXXI del 1914. Ben visibile è il corridoio a ferro di cavallo che collega i padiglioni che si affacciano sul grande cortile-giardino centrale (realizzazione Paolo Cadeddu).

² Maggiore Emilio Gaiani, *Rivista Eroica-Collezione, Arte della Stampa* in Pescara, 1916, pag. 117.



Fig. 6 - Il nuovo Ospedale Militare Principale della Divisione di Torino. In evidenza l'ampio cortile centrale realizzato con giardinietti. Cartolina numerata 11214 G.V.T. del 1917 - (Collezione privata).



Fig. 7 - Il nuovo Ospedale Militare Principale della Divisione di Torino. In evidenza il padiglione d'ingresso che ospitava la Direzione. Cartolina numerata 11219 G.V.T. del 1918 (Collezione privata).

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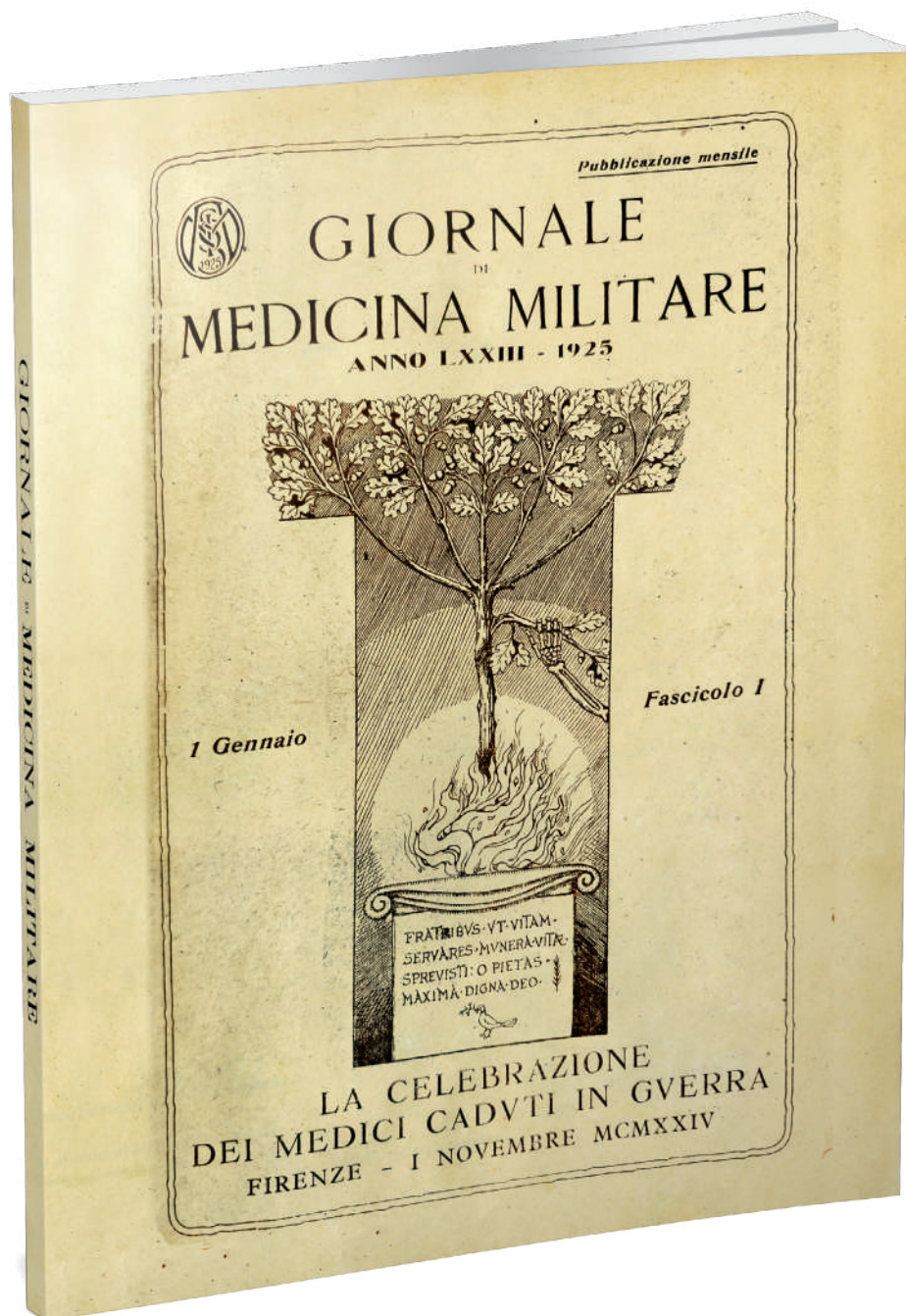
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LE PAGINE DELLA STORIA



SPUNTI DAL GIORNALE DI MEDICINA MILITARE DI CENTO ANNI FA: 1925





RIVISTA SINTETICA SCUOLA DI SANITÀ MILITARE LA FIGURA DEL MEDICO MILITARE

per il capitano medico Arrigo Pedrazzi.

Di questo breve, intenso, e non inutile corso, che segue i vostri studi già fatti come necessario completamento per la vita, alla quale avete voluto indirizzarvi, la materia che più si allontana da quelle che eravate abituati a studiare, la materia più nuova per voi in questa nostra famiglia militare, ma anche la materia che dovrà essere la pratica sintesi della vostra multiforme attività futura, è quella che tratta il servizio sanitario in tempo di pace ed in tempo di guerra. Se le lezioni di Chirurgia d'urgenza, di Medicina legale, di Igiene, di Chimica clinica, ecc., continuano qua dentro le vostre abitudini di studiosi, affinandovi non poco, per chi segua con amore, nelle singole discipline che ho citate, il servizio sanitario, vi trasporta di colpo in un ambiente nuovo, vi svelle dalla serena placidità universitaria per portarvi a diretto contatto di quel mondo complesso ed interessante, che è l'Esercito, di quel mondo a parte, segnato da barriere rigide e da leggi inflessibili, mondo nel quale trascorrete la vita domani nell'adempimento di una missione, della quale i profani non riusciranno mai ad intravedere la vera profonda bellezza.

Chi infatti non si accosta con animo pensoso alla personalità del medico militare, chi non ne giudica l'attività, che da qualche lato, che può essere anche manchevole, come del resto avviene in tutte le categorie sociali, chi insomma non si arresta che alla troppo facile critica del dettaglio, perdendo di vista l'insieme, non può immaginare quale intima poesia sia latente in questa figura di giovane medico, chiamato ad esercitare la propria alta missione in un organismo così gagliardo, eppure così delicato quale è l'Esercito, in un organismo del quale in certi momenti può sembrare una figura anacronistica, e che invece proprio in lui trova uno dei servitori più efficaci, una delle forze più salde a sostegno della sua stessa vigoria.

Medico militare, parola spesso bistrattata dagli ignoranti, parola che il volgo molte volte travede o misconosce, il volgo, che ne ignora i silenziosi sacrifici e la umile, serena, feconda attività per la patria: medico militare, figurazione recente sbocciata nell'ultimo cinquantennio della vita dei popoli, saggiata alla pietra di paragone di innumerevoli prove, figura che nell'urto di una vita quotidiana aspra e tormentata, in mezzo a difficoltà, che trovano raramente riscontro in altre attività mediche civili, ha rivelato come nella classe medica non sia andata perduta quella qualità, che dovrebbe essere fondamentale per la fortuna dei popoli: «la forza di carattere». Quando questo servizio sanitario vi avrà trasportato un po' addentro alla struttura dell'Esercito, quando questo corso di servizio sanitario vi avrà portato un po' addentro all'anima della vostra futura missione, voi vedrete quale enorme importanza avranno per voi non soltanto l'intelligenza, il che è naturale, non soltanto la preparazione scientifica, il che è logico, ma anche il buon senso e la tempra del carattere. In ogni istante il medico militare è costretto a basare la sua azione su queste due qualità fondamentali, che potrei chiamare la chiave di volta della sua professione. Sia nella rude gagliarda vita del reggimento sia nella cosiddetta tranquillità degli uffici, sia nella serenità dell'ambiente ospitaliero, ogni istante i dettami delle leggi assimilate nell'Università urtano in qualche particolare contro le esigenze del nuovo ambiente, ogni istante i bisogni della professione cozzano in qualche lato colle deficienze dell'organismo, dove siete costretti ad agire, e perciò solo al vostro criterio, solo alla vostra energia, solo al vostro carattere è affidato il difficile compito di armonizzare quei bisogni con quelle deficienze. Delicata perciò è in ogni istante la posizione del medico militare, soprattutto presso i reggimenti Solo organo tecnico in mezzo ad ambiente diverso, la sua autorità morale è sempre infinitamente maggiore del grado che ricopre, e comincia subito per lui una non agevole fatica, quella di dettare le proprie direttive, nel campo che lo riguarda, presso persone a lui tanto superiori nella scala gerarchica e senza urtarne la suscettibilità.



Questione di tatto direte voi? Sì, anche questione di tatto, ma soprattutto questione di carattere. Quello che è difficile non è trovare la frase tornita per dire un no, per esempio, quando dall'altra parte si desidera un sì; quello che è difficile è il dire quel no, avere la volontà di dire quel no, ben sapendo che ciò possa qualche volta contrastare col desiderio del superiore, superiore al quale siete così profondamente legati da vincoli di rispetto e di subordinazione. Ogni giorno vi è adunque un'intima battaglia nel vostro io tra il dovere puro, semplice, ferreo, ed un desiderio nascosto di tranquillità, per il quale siete trascinati a lasciar correre per non aver noie, a seguire le idee dell'ambiente per non sembrare importuni o pedanti. Battaglia che la diversa psicologia inasprisce quotidianamente e che solo il simpatico cameratismo del reggimento riesce a smorzare, quel simpatico cameratismo, che insieme allo spirito di sacrificio è la cosa più bella, che viva sotto le bandiere.

Abissi di concezione sono infatti fra voi e gli altri. Voi venite da una severa preparazione di studi indirizzati ad un fine profondamente umanitario, essi vengono dalla preparazione delle scuole militari severa anch'essa, ma che dona una concezione meno universale del problema della società; voi vedete nel soldato l'uomo, l'uomo con tutte le sue debolezze, molte volte scusabile, sempre degno di conforto e d'aiuto, essi vedono nel soldato la macchina da guerra, verso la quale sono affettuosi, premurosi, è vero, ma con ben altra linea di rigidità; voi considerate lo sforzo come cosa sempre dannosa all'organismo, essi considerano lo sforzo come meta ultima, alla quale si deve giungere attraverso un allenamento razionale, e qualche volta, per esigenze di servizio, anche senza tale razionalità; voi vi irritate per vedere un reggimento marciare in condizioni di clima avverse, sotto una pioggia dirotta, per es., per una esercitazione, la cui utilità giudicate non adeguata alle sofferenze di chi la compie, ed essi considerano questa marcia in quelle condizioni come utile per l'anima della truppa, come necessaria per dare la tempera al reparto. Abissi, ripeto, di concezione separano gli uni dagli altri.

Chi avrà dunque ragione? La verità come sempre sta nel mezzo, ma se si guarda nel fondo io penso che siano più vicini al vero loro di voi. L'Esercito, se si consideri le cose con serenità, è una macchina da guerra, macchina delicatissima, perché formata di uomini, ma è e deve essere una macchina con tutte le sue leggi inflessibili. L'Esercito presuppone solo organismi gagliardi che lo servano, deve espellere i deboli, che non possono seguire il ritmo della sua rude esistenza, ma dai gagliardi ha diritto di pretendere tutto quanto essi possono dare: l'Esercito non può avere dei sentimentalismi, il giorno che li avesse, sarebbe a priori votato alla sconfitta. E voi dovrete perciò fare una profonda, ma sana, revisione delle vostre concezioni, senza spingervi a conseguenze estreme, perché siete sempre dei medici, ma ricordandovi anche che avete l'appellativo di militari: deve premere a voi il malato, dovete sentire la vostra anima medica battere per lui con tutta la sua violenza, ma non dovrete, non potrete mai perdere completamente di vista l'efficienza del reparto. Il giorno che voi lo faceste, sareste sempre dei buoni medici, ma cessereste di essere dei buoni medici militari. E crediate che si può essere tali nel senso ampio della parola. Certo, per es., non sarà facile per voi la quotidiana visita mattutina, l'esame del soldato del reggimento, che si presenta al suo medico. Manca una base formidabile, per ben giudicare: la fiducia nella sincerità del paziente. Il soldato tende spesso ad esagerare i propri mali, qualche volta giunge persino ad inventarli, e questo quotidiano credere e non credere, questo quotidiano dover sceverare il vero dal falso, questa quotidiana battaglia fra ciò che viene deposto dal malato e ciò che vi può essere di sostanziale, a lungo andare turba il medico, lo esaspera, e può togliergli in parte la serenità di giudizio. Ma anche in questo non bisogna esagerare. Conosco medici militari per i quali ogni malato è degno di fede; conosco medici militari per i quali ogni soldato, che si presenta alla visita, è potenzialmente un simulatore. Sono nel falso ambedue le categorie. Non bisogna mai, ripeto, nel nostro campo andare per vie estreme.

Il soldato, in fondo, è un grande fanciullo, un grande fanciullo che ha bisogno di affetto e di cure. La vita del reggimento col trascinarlo lontano dalla casa paterna, in ambiente rude, gli fa sentire ancora maggiormente la mancanza di quelle affettuosità delle quali ha ancora desiderio, e l'unico uomo per lui che possa sostituire in parte le cure lontane, nel quale possa vedere la stoffa di un consolatore, è il medico, il buon medico di reggimento, che sa dare il riposo al momento opportuno, che sa concedere un po' di respiro, tra le assillanti fatiche del servizio.

Quanto vi è da fare in questo campo! La maggior parte dei soldati si contenta di una buona parola, di essere rassicurata che non ha nulla di grave, di poter narrare diffusamente qualche piccolo guaio personale, narrazione che se fatta in compagnia lo farebbe passare per un seccatore, si contenta insomma di un piccolo conforto morale, così facile a darsi e denso di risultati. Questa sarà la grande massa dei soldati, che affluiranno alle visite mattutine presso i reparti, massa docile, piena di ingenuità ed anche di sincerità. Poi vi saranno i malati veramente tali, e questi sarà facile scorgerli nella folla, e vi saranno infine i simulatori. Oh! su questi simulatori di malattie, che la leggenda ha fatto legione, e che la mia lunga pratica di reggimento mi permette di presentarvi come una esigua schiera, su questi simulatori occorre battere con inflessibile energia. Lo so anch'io che non è facile prendere la decisione di dichiarare un soldato immune da qualsiasi lesione od infermità, il che non



basta, ma anche da qualsiasi dolorabilità, quando tutta la sintomatologia subiettiva (il grande aiuto del medico) è da prendersi con beneficio d'inventario; ma a lungo andare, per mezzo di accurate osservazioni in infermeria e fuori, per mezzo delle informazioni dei comandanti di reparto su precisi quesiti, che voi potrete loro fare, si riesce a scoprire il simulatore, ed allora, ripeto, con tali individui occorre abbandonare false pietà, occorre essere inflessibili. Ecco dove deve spuntare fuori il medico militare con tutta la sua energia. Per un simulatore cacciato in prigione a tempo opportuno, rientrano sulla retta via altri fiacconcelli, che attendevano a varare i propri malanni appena avesse avuto esito felice il tentativo del compagno più audace. Vedete quanti problemi di ordine non medico si presentano a voi durante un atto che dovrebbe essere puramente medico, ecco dove, oltre la preparazione professionale, affiora la necessità del buon senso, ecco dove si presenta come nota dominante il carattere.

E se a queste, che sono piccole difficoltà, aggiungete infinite altre inerenti alla costituzione dell'organismo nel quale dovete operare: personale non pratico, che le leggi di reclutamento cambiano con frequenza; una certa scarsità di mezzi che vi obbliga a una continua ginnastica di ripieghi; disciplina, severa, necessaria, ma che nei primi tempi, può anche pesare, su persone che vengono dalla sconfinata libertà universitaria; disagi fisici, che si esacerbano nei periodi di istruzione delle reclute e nelle fatiche dei campi o delle manovre, se aggiungete, ripeto, queste ed altre spine ancora del servizio sanitario, avrete la prova provata di quanta forza di volontà, di quanta energia fisica e morale, debba disporre il medico militare per adattarsi prima ed agire poi serenamente nelle file dell'esercito. E di tutte queste spine, che dovrà occuparsi il corso presente, è attraverso questa enumerazione di regolamenti, di prescrizioni, di ordini, che voi a poco a poco, dopo il primo periodo di smarrimento, comprenderete la bellezza di vivere in questo ambiente militare, in questo ambiente fiero e gagliardo, il solo che, mentre tutto il mondo vive della parola *Diritto*, abbia saputo conservare inalterata la parola *Dovere*, come indice della nobiltà dei suoi ordinamenti; il solo che, mentre tutto intorno aleggia la parola *Libertà*, intesa anche come *Licenza*, abbia risposto e risponda tutt'ora con una parola più umile, se volete, in apparenza, ma infinitamente più alta nella sostanza: *Disciplina*.

Disciplina, sì, eccolo il grande spauracchio degli imbelli, ecco la grande forza degli uomini di carattere. Non abbiate paura di essa. Questo vincolo magnifico, che ci innalza nella bellezza di una dedizione assoluta, quando sembrerebbe abbassarci nella umiltà della obbedienza, che ci eleva alla dignità di strumenti inflessibili e pensanti, mentre sembrerebbe avvilarci nella schiavitù della subordinazione, che ci sublima sempre in ogni momento a compartecipi di ordini, le lontane origini dei quali si perdono nei supremi concilii, che presiedono alla vita della nazione, questo vincolo è la nostra forza, è il documento, ripeto, della nostra nobiltà. Per essa il limite delle gerarchie nettamente segnato, precisa la gamma delle responsabilità e dei doveri, per essa l'inferiore esegue l'ordine ricevuto serenamente, anche se qualche volta possa essere in contrasto colle proprie concezioni, per essa ognuno acquista netta una inequivocabile fisionomia nelle singole azioni compiute.

Essa è adunque la forza del superiore e nello stesso tempo è la difesa dell'inferiore.

Non crediate alle apparenze. Nell'ambiente militare voi troverete sempre dei subordinati, mai dei servitori, come tanto spesso accade nelle carriere civili.

Voi siete uomo tra uomini, pari tra i pari nel senso profondo della parola, perché, se il grado nettamente separa, la divisa unisce, ed il grigio-verde non consente gradazioni di dignità umana attraverso la scala gerarchica. Questa è la base del nostro orgoglio, per questa superiori ed inferiori, lealmente operando, adempiono funzioni diverse, ma con lo stesso tono di fierezza. Vedrete quando entreremo nei dettagli, quando questo corso vi avrà esposto la vostra missione, sia nei reparti, sia negli ospedali, sia negli uffici, vedrete quanto, in fondo, sia bella e poetica questa esistenza, lucida e tersa come una lama forbita, senza l'assillo quotidiano della lotta per la vita, senza i quotidiani urti delle concorrenze, che inacidiscono e turbano, bella, ripeto, anche nei momenti di dedizione profonda, anche nella apparente umiltà della subordinazione.

E soprattutto siate sempre orgogliosi di essere medici militari. Siatelo ed anche un poco, con buon garbo, mostratelo. Dobbiamo anche noi avere uno spirito di corpo? Dobbiamo anche noi sentire quell'orgoglio di categoria che è così diffuso in tutto l'Esercito? Io credo fermamente di sì. A parte tutte le dissertazioni sul- l'arcaismo di questo sentimento, su «questa medioevale sopravvivenza», come venne da alcuni chiamata, lo spirito di corpo in un organismo come il nostro è una forza di incalcolabile valore, quando sia bene inteso, è uno stimolo per sempre correttamente agire, è uno sprone ad essere sempre degni della nobiltà della nostra missione.

Spirito di corpo che in noi medici militari può essere facile e nello stesso tempo difficile. Facile perché da quasi tutte le altre categorie di ufficiali ci separa un crisma, che è una barriera non agevole a valicarsi, la laurea; difficile perché, dato che il medico si trova quasi sempre isolato, solo della sua classe in mezzo ad amici, che hanno il loro orgoglio di categoria,



orgoglio che le gloriose tradizioni delle armi combattenti radicarono tenacemente nei cuori, egli perciò deve nutrire da solo un sentimento, che per sua definizione ha bisogno di essere nutrito in compagnia.

Vedrete che potrà accadere a voi quello che accadde a noi: la lunga permanenza nei reparti cercherà di sostituire l'anima del nuovo ambiente alla vostra personalità. È umano ed è anche logico. Troppo grande è il fascino che emana da quelle comunità mirabili per slancio, per coraggio, per ardore, che sono i reggimenti, troppo grande è questo fascino perché voi non dobbiate sentire l'influsso, e sentiate in conseguenza diminuire un poco alla volta la vostra personalità di medici militari, per considerarvi quasi soltanto un membro della nuova famiglia. È umano, ripeto; accadde a noi, potrebbe accadere anche a voi. Vi sentirete fanti coi fanti, alpini cogli alpini, bersaglieri coi bersaglieri e così via, figli del reparto, in tutto e per tutto uguali agli altri. È più facile infatti questo fondersi nella nuova famiglia, più facile e meno faticoso, che non conservare una propria linea di pensiero lucida, una propria psicologia, che basi, anche nei particolari, soltanto su quel meraviglioso corredo di studi e di meditazioni, che ci ha portato alla nostra missione di medici; è più facile, ripeto, e forse anche non inutile dal punto di vista dell'interesse della collettività. Ma se questo poté essere in passato, se questo poté essere costume di quei tempi nei quali il Corpo Sanitario, formazione giovanissima del nostro Esercito, non poteva ancora presentare un degno battesimo per la sua gloria, oggi questo non deve più avvenire.

Oggi un luminoso periodo di sacrifici e di eroismo pone la nostra categoria su di un piedistallo così alto, che essa può guardare fieramente in faccia i confratelli di qualsiasi arma, oggi i nostri caduti di guerra, i nostri feriti attestano con la loro formidabile percentuale, che i medici pagarono un tributo di sangue, che se in proporzione per numero cede il primato alla fanteria, precede altre armi combattenti.

È in nome di questi caduti, è in nome di questi feriti, che voi avrete il dovere di tenere sempre alta in ogni istante ed in ogni occasione questa giovane e pur già così robusta gloria del corpo sanitario militare. E ce ne sarà sempre bisogno Dovunque voi sentirete dai vostri futuri camerati di armi rievocare con parole di passione le glorie del passato.

L'Esercito vive e respira ancora l'eroica atmosfera dei quattro anni della tragedia europea; l'Esercito si nutre diuturnamente dei ricordi di gloria e per essi si prepara alle nuove venture con animo gagliardo. Esso, sotto apparenza gelida, è un organismo passionale, nel quale il sentimento agita profondamente i cuori e nel quale i ricordi lasciano tracce indelebili, l'esercito è forse l'unico organismo italiano che non dimentichi mai e che celebri anche adesso i suoi morti colla stessa commozione, collo stesso animo affettuoso col quale li accompagnò l'ultima volta all'estrema dimora ed incise il nome sulla rozza croce disadorna.

Sempre voi udrete rifiorire il passato. Sia nelle tranquille serate dei villaggi di montagna, mentre il reparto dorme il sonno duro e convinto di truppa in riposo e gli ufficiali si stringono intorno alla rozza tavola di una modesta osteria, sia nel silenzio delle pianure libiche mentre ardono i fuochi dei bivacchi e gli indigeni bisbigliano nel loro idioma armonioso i ricordi delle case lontane, sia nella tranquillità delle sale-convegno dei reggimenti, sia nel fervore della vita dei campi, sia nelle fatiche delle manovre, appena per un momento taccia il servizio e cadano le preoccupazioni del domani, l'anima fresca (l'anima resta sempre fresca sotto le bandiere) si libera, ed i ricordi affiorano in numeri intorno alla comitiva stanca degli ufficiali adunati: ricordi di donne, di amori, di giuoco, di mille cose, ma soprattutto ricordi di guerra.

Ed i vostri compagni narreranno le glorie del reggimento, del battaglione, della compagnia, le tenaci difese e i disperati attacchi, racconteranno le gesta eroiche, forse qualche volta arricchite nei particolari dalla fantasia accesa, ma sempre vere nel fondo, e sempre piene di suggestiva bellezza. Ascoltateli e lasciateli parlare. È l'anima eroica del nostro Esercito che parla in loro, è il mirabile slancio di questa giovane Italia, che in un cinquantennio di vita ha saputo salire dalla schiavitù a dominatrice del Mediterraneo, è l'eroico spirito di questa razza immortale, che millenni di storia affinarono colla luce di lunghe Ere di civiltà, e che tornerà in futuro, dobbiamo crederlo, o donare la propria impronta per la terza volta alla civiltà del mondo. Lasciateli adunque parlare in silenzio ed ascoltateli con religiosa attenzione.

Ma quando avranno terminato di narrare, quando il silenzio della meditazione sarà caduto, come sempre avviene, sul ricordo lontano, prima che i canti, i nostalgici canti delle trincee vengano a fondere i cuori in una armonia di sacrificio e di dedizione, nella quale cade ogni spirito di corpo e domina eccelsa l'idealità della Patria, prima che questo avvenga, come quasi sempre avviene, cominciate voi a narrare, e raccontate pianamente le gesta di queste mostrine colore di sangue, narrate il sacrificio silenzioso e sereno dei compagni caduti e le ore tragiche piene di infinita poesia di coloro che tornarono. E davanti alla bellezza della rievocazione della compagnia lanciata allo sbaraglio, rievocate la bellezza dei piccoli posti di medicazione sparsi per tutti i campi di battaglia, le are sulle quali arse nel sacrificio la purezza dei nostri compagni caduti per la Patria. Piccoli posti di medicazione o affondati nel fango dell'Isonzo o del Piave, o abbruciati nel fondo delle doline ardenti, o



aggrappati all'orlo degli abissi dolomitici, o perduti nei silenzi dei ghiacciai dell'Adamello, tutti uguali fra loro nella umile povertà dei mezzi, tutti uguali nella infinita serenità davanti al pericolo, tutti uguali nell'ardente slancio di pietà e di amore patrio.

Fateli rifiorire sulle ali della narrazione questi piccoli posti di medicazione, che furono il nostro Calvario e la nostra Gloria, fateli rifiorire perché essi hanno un altissimo significato, perché essi rivelano ai popoli che non invano passarono sulla umanità secoli di progressivo affinamento morale, perché essi ricordano popoli che ormai anche nel furore della mischia il ferito è sacro per tutti, anche per i nemici, e che la pietà non ha vincoli di razza.

Per questa pietà discesa finalmente fra le schiere in armi al suo posto di dovere accanto al sacrificio, al coraggio, alla rassegnazione, per questa pietà umana, sorella in guerra di tutte le audacie, e tenace al fianco delle più tenaci ostinazioni, per questa pietà umana che arse come unica face là dove sembrò cadere ogni speranza, per questa pietà umana che lasciò brandelli del corpo dei suoi devoti, per tutti i campi di battaglia, per questa pietà umana, della quale voi sarete domani i sacerdoti fedeli fino all'estremo sacrificio, tenete alto l'orgoglio della nostra categoria, cercate che mai una macchia, anche la più piccola, venga ad intaccarne la purezza.

Questo io avevo il dovere di dirvi prima di iniziare il corso, che vi metterà a contatto della nuova vita in tutti i suoi particolari, qualche volta noiosi, ma anche in tutta la sua intima e profonda poesia; questo avevo il dovere di dirvi affinché voi domani, uscendo da questa modesta Scuola di sanità, dove tanti caratteri si prepararono ad un agitato futuro, dispersi forse per le città d'Italia, dispersi forse per le pianure libiche o per le montagne eritree, portiate profondo nel cuore l'orgoglio della nostra classe e mostriate alla luce del sole col vostro carattere, colla vostra energia, la fierezza di essere dei medici militari.



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