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Analyzing International Military Medical Services: Developing a Methodology for Information Acquisition from Open Source Data

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Military medical services provide an important supporting function to a country’s military forces, as well as being a component of a country’s overall health system. This has been emphasized by recent events such as the Ebola outbreak and COVID-19 pandemic. These complex situations require the effective synthesis and analysis of new sources of information and intelligence. However, it is challenging to determine where to start and how to conduct a valuable search.

Accordingly, this paper describes the development of a structured method to search for information on a country’s military medical system from open access sources accessible from the Internet. The first section of this article will outline challenges relating to military medical information. This will be followed by a description of the project’s methodology, focusing on the human factor in open source data collection. The methodology will be illuminated through two case studies (Germany and France). Finally, resulting questions and discussion points will be addressed, finishing with conclusions and recommendations.

BACKGROUND

Many countries have well-established partnerships between their military medical services as a means to augment diplomatic relationships. It is necessary for both parties in a partnership to understand each other’s health system and also the contextual factors that have influenced this. In addition to the bilateral exchange of information, it is imperative for practitioners to have a wider conceptual understanding of military health systems and their role nationally, regionally, and globally. This requires access to information on military medical systems, tools for analyzing them, and methods for comparison between systems.

Medical intelligence itself encompasses the collection, evaluation, and interpretation of information relevant to strategic planning for global health security. Medical intelligence is relevant to prevention, anticipation, and reaction to conflicts; complex humanitarian emergencies; national and international operations; and other military activities. Medical intelligence can be used to assess medical–healthcare infrastructures like hospitals and clinics, and to evaluate capabilities, such as emergency medical transport systems. It can also be used to analyze the production, movement, and disposal of hazardous materials that could pose serious chemical warfare or environmental health threats to both the military and civilians. The following section will review the components that make up medical intelligence, availability of information, search methods, and social factors that influence searches.
Medical intelligence can serve to assess foreign medical capabilities and overseas missions for all actors involved in emergency response. As such, background and baseline information on a country’s health system (including military medical systems) are essential in situations ranging from disease surveillance to health systems’ failure and the anticipated medical needs for groups including detainees and refugees. With that said, military medical services do not exist in a bubble. They are affected by institutional, social, and physical environments, interacting and overlapping with government as well as nongovernmental organizations. The analysis of military medical services should form part of a larger system of medical intelligence that provides situational readiness and awareness intended to effectively prevent, stop, and counter health threats. Notably, local conditions will almost always vary in terms of terrain, culture, environment, sanitary and hygiene systems, medical and health concerns, and biohazards. This means that information about the military medical system on the ground is crucial in establishing an accurate picture of the health infrastructure of a country.6

SOURCES OF INFORMATION ON MILITARY MEDICAL SYSTEMS

Medical intelligence can be gathered from both open sources and protected or classified sources—with this article focusing on the former. In particular, the Internet is becoming an increasingly important medium for information exchange and interaction. Research has shown that people are more likely to find relevant answers to questions online rather than offline (such as in libraries).7 This means that the Internet is now an essential source in the context of health and security research.8 With that said, limitations necessarily apply. Online information is often deemed less authoritative or trustworthy, and the potentially large number of search results requires filtering out “noise.” In addition, attention must be paid to commercial influences on search engine outputs, and it is necessary to recognize that searching academic databases may yield different results from search engine queries.

Available open source information on military medical services can be found through official government communication, international foundations,9 academic publications,10 news and social media, and—currently—an online database called “Worldwide Military Medicine,” also known as the Almanac.11 The Almanac comprises information provided to the publisher by each nation on their military medical services. This is based on an annual questionnaire that is sent to the head of a country’s military medical services. While a good source of basic information, the content and completeness of each entry varies. Accordingly, the project presented in this article has been designed to identify potential additional sources of publicly accessible information on a country’s military medical services to
complement a country’s entry in databases such as the Almanac. This means taking into account national-level elements such as language, regional databases, and the popularity of different media (such as social media platforms and video). Local media reporting particularly has been shown to form a significant source of information on operational health security.12

KNOWLEDGE ACCESS AND RESTRICTION

Individual countries maintain their own laws and systems regarding military medical services. For security reasons, publicly available information on the ways in which these services operate may be limited.13 Both military and medical practitioners often work with knowledge that could jeopardize national security if it were to become accessible to malign actors (e.g., hostile states or terrorist organizations), meaning that availability and transparency of information may be restricted. This ranges from doctor–patient confidentiality and military-grade document classification to the dangers of dual-use technology or potentially compromising public health missions. As a result, there exists a necessary tension between granting access and restricting access to information on military medical services. What is more, on top of the question of whether information can and should be shared, military medicine, as a field, is indeed situated within various local, national, and global structures. For example, both domestic and foreign policy can be seen to take precedence over the prevention or assessment of health threats.14 In addition, different parties will naturally have different threat perceptions and priorities.15 This multisectoral complexity of military medicine has been highlighted by outbreaks of diseases such as severe acute respiratory syndrome and COVID-19. These viruses have affected not only public health but also the global economy, including aspects such as hospitality and aviation. Cities, regions, or even countries “coming to a halt” have been devastating on more levels than one, forcing controversial policy decisions.16 Thus, countries may have national interests that lead to the restriction of information for public purposes.

On this basis, having a degree of access to carefully balanced information on military medical systems is necessary. A thorough understanding of different military health systems will be valuable for nations who seek to collaborate during multinational military and humanitarian missions. Reliable information can be directly linked to effective and secure operations on the ground and “to strengthen global health security and health intelligence, the traditional state-based intelligence community must actively engage with non-security stakeholders and incorporate space for new sources of intelligence.”17 Although some collaboration may already exist at the state level between allies, through security channels, open source information is
especially important for nonsecurity stakeholders who do not have this level of access.

SEARCH LANGUAGE

The English language has dominated the World Wide Web since its origin in the second half of the twentieth century. In 2019, over 25% of Internet searches were made in English (followed by Chinese, Spanish, and Arabic). In addition, English-using researchers tend to gravitate toward English as a working language. However, data show that on a national level users tend to navigate the Internet in their native language, or the language that is most popular in their area. For example, it has been shown that Spanish is used more than English to browse the Internet in Spain; the ratio of English to French content in Canada clearly differs between areas where English is dominant (e.g., Toronto) and areas where French is dominant (e.g., Quebec); and a division can also be found in Belgium, between Flemish-speaking Flanders and French-speaking Wallonia. When searching for country- or region-specific information, it is thus essential to consider in which languages the information is available, and in which languages a search is conducted.

Furthermore, it must be noted that linguistic differences can occur in keyword matching (when a user inputs a text, and this is linked to content containing the same text), search engine predictions (based on a user’s previous searches or general online activity), and automatic language-detection filters (returning results based on the predicted language of the user). First and foremost, this means that a user of, for example, French will receive different search results from a user of, for instance, English. However, this also means that even if a user of English conducts a search in French, their results will likely also differ from the results of a regular user of French or native speaker in France searching in French. Overall, qualitative open source research benefits from culture-general knowledge as well as culture-specific knowledge, meaning that it is important to have some idea of the practices, products, and perspectives of the country, sector, and situation under investigation. This will result in awareness of specific meanings, values, and connotations. Accordingly, the best search outputs for military medical services are likely to be obtained by conducting a search in the native language, or languages, of the country or region in question.

DIGITAL PRESENCE

Another crucial factor in Internet-based data acquisition is digital presence: low-income and resource-poor countries—especially those facing conflict or those in post-conflict situations—may have limited communication structures. As a result, there is a huge contrast in available information.
between those countries where there is funding and structure, and those where basic resources and support are lacking. Other situations to make note of are those where media are censored, but also those where media use is exceedingly liberal—for instance, where emerging thinking may be shared online prior to formal publication. Since almost all countries worldwide have multicultural, multiethnic, multiracial, and multilingual populations there is a need for sensitively designed and socially and culturally responsible information acquisition strategies to avoid taking certain concepts for granted.\textsuperscript{25}

For example, many low-resource nations provided minimal information to the Almanac of Military Medicine and 26 countries submitted profiles with no textual descriptions of their health system.\textsuperscript{26} The information in these “empty” profiles only included country demographics, the number of military medical officers, and the contact information for the nation’s surgeon general. Any text going beyond these features, which were present in nearly all 142 profiles, was absent.

**SOCIAL MEDIA**

Respectively, the popularity of certain media differs per country. Social media can serve as an example: internationally, popular social media platforms in 2020 include Facebook,\textsuperscript{27} Twitter,\textsuperscript{28} LinkedIn,\textsuperscript{29} YouTube,\textsuperscript{30} and Instagram,\textsuperscript{31} as well as Snapchat,\textsuperscript{32} TikTok,\textsuperscript{33} Pinterest,\textsuperscript{34} and Reddit.\textsuperscript{35} These have functions ranging from multimedia messaging to short- or long-form text posts, and video or image sharing. However, some social networks are country-specific and used more widely nationally than international equivalents for various reasons (e.g., VKontakte in Russia and Weibo in China). For the purpose of this article, considering the rapidly changing nature and relevance of social media platforms, only Twitter and YouTube were selected for investigation. The first because it includes a relatively large body of professional users sharing news and information (as opposed to personal updates and private data), and the second to test the relevance of video materials for collecting information on military medical services.\textsuperscript{36}

Broadly speaking, online presence among healthcare professionals as well as users has increased dramatically in recent years. This suggests “that these technologies will invariably be a part of the landscape of modern medicine.”\textsuperscript{37} However, social media are typically more difficult to search—not only because of differences in digital presence, but also because they involve data in the form of personal accounts or video materials rather than bodies of text. Searching for this kind of information often relies on the tags that users decided to apply to their content. Healthcare centers, hospitals, government departments, and so forth, are increasingly establishing and managing organizational presence on the Internet—but there is an enormous
imbalance in information between those organizations that do follow this route and those that do not. In addition, as described above, there is a tension between what can and cannot be shared, ethically and legally, in military medicine. As a result, social media should not form a primary search category for information on military medical services. Nonetheless, despite lack of reliability, social media can in some cases be considered an additional source to enhance existing knowledge when used in triangulation with other information.38

ACADEMIC PRESENCE

Search results for academic books and papers addressing national military medical services are often dated or even no longer relevant (e.g., descriptions of military medical services in the 1920s). In academia, there is a time lag and possibly data loss between organizational experiences and translation into publications.39 An initial test of online academic sources on military medical services websites such as JSTOR40 and Academia41 resulted in very few useful articles on military medical services, while ResearchGate42 yielded more fruitful results. The latter can possibly be attributed to the relative popularity of ResearchGate among scientists, and the majority of military medical practitioners are healthcare professionals rather than social scientists. Other sources particularly useful in health sciences are Scopus43 and Web of Science or Web of Knowledge.44 With that said, a generic Internet search is unlikely to pick up on military medical journals that are not formally indexed, such as Medical Corps International, or the International Review of the Armed Forces Medical Services. Furthermore, at the time of writing, our case study search results were heavily affected by the COVID-19 pandemic, which means that ongoing events will likely impact the design of search terms and exclusions.45

In summary, open-source information on military medical services will diverge across states, depending on factors such as a nation’s digital presence, popular forms of media, language-use, and level of government transparency. Taking this variation into account, the following section will outline steps which can be taken to gain information on any given country’s military medical services.

METHODOLOGY

Open source information research can be conducted both quantitatively and qualitatively, or in combination.46 The aim of the study presented here is to provide a methodology that can be utilized by individuals with no prior knowledge or training in either search techniques or military medicine, and avoids specific coding, programming, software, or other tools.47 Accordingly, we will describe an analytical approach to identifying publicly available
sources on military medical services, and seek to determine its advantages and disadvantages. The emphasis in this article has been placed on qualitative research and the human factor in open source investigation. As described, besides considering accessibility and usefulness of different sources, this includes factors such as search behavior and meaning construction.48

Considering these observations, a comprehensive Internet search for information on national military medical services should include the following factors: (1) categorization of search input and output, (2) determination of key search terms, (3) linking search strategy to research field, and (4) addressing resulting questions.

**Categorization of Search Input and Output**

Categorization means dividing each type of search (e.g., websites, articles, social media) and making notes on the quantity and quality of every category. Types of information include people, facilities, research and development, and policy. Within this, it is important to determine which search engine should be used (e.g., Google), where it is hosted, and from what location(s) and device(s) the search is conducted. Suggested categories for evaluation are volume, relevance, precision, type of information, and timeliness.

**Determination of Key Search Terms**

Next, it is necessary to establish a combination of search terms that provides high sensitivity and/or high specificity and suitable volume for each type of search. While collecting and organizing this quantity of data may require specialist software, this will differ per case and research question. In addition, it may be useful to be aware of ways in which to refine Internet searches. Examples include placing an “@” symbol in front of a word to search social media (e.g., @twitter), adding quotation marks for an exact search (e.g., “military medical services”), or inserting a “-” mark in front of a word that should be left out (e.g., Militärmedizin -Österreich -Schweiz).49

**Linking Search Strategy to Research Field**

It is of course important to link search strategy to individual components of the military medical system. For example, if we have identified that a military medical school, academy, or training center is an important artefact, is there an electronic search technique that has a high probability of identifying or disproving the existence of one? This can be addressed by generating a list of all relevant military medical scientific journals, thinking
about indicators of other “artefacts” that are features of military medical systems (e.g., academic societies, such as a national society of military medicine), linking the search to wider social security systems or charities, and listing international alliances and collaborations that have been identified by these searches.

**Addressing Resulting Questions**

Analysis of the acquired information will result in refining the initial research questions. It may be possible to question whether the presence or lack of information in each type of search indicates anything about the subject area. An example is the difference between medical science– and social science–based literature. It is important to consider the factors that might influence the volume of material in each search category (e.g., databases searched). It is also relevant to question differences in search productivity by use of language and density of use of the English language in the case study country. In addition, it is useful to decide how the volume of information sources should be processed, in order to focus on a particular research question (e.g., limit the search to reviewing a certain number of results). Furthermore, it should be examined what elements make up a good question, as well as how questions may be refined. These queries should take into account the interpretation of so-called nonconventional sources such as social media and video materials. Analysis of this information might include a comparison between countries, between militaries, between wider security frameworks, or between military and civilian medical services.

To illustrate how such an open source Internet search for information on international military medical services may be conducted, this article will present two national case studies (France and Germany). According to the methodological decisions described above, a search strategy was developed that focuses on finding the most likely sources of information that will support an analysis and report on a country’s military medical services. The search strategy that we wished to test is described as follows: Will an open source Internet search provide additional sources of information on a country’s military medical service that add to those contained already in the Almanac? Based on this, we generated the following steps:

1. Assess the entry in the Almanac. This consists of identifying key features of the country’s military medical services, and investigating additional sources cited (such as webpages and journals).
2. Conduct a superficial Internet search engine search in English (the language of the Almanac). This entails forming a general impression of available
resources or “scoping the landscape.” Key Internet presence often comprises official government webpages (such as the Ministry of Defence websites). The first one to five pages of search results were found to yield the most informative results.

3. Carry out the same search in the native language of the country in question. This will produce additional authoritative webpages. The search should be divided into general Web search, media search, social media search, academic search, and searching specific academic databases, as well as any other category deemed relevant to the country in question.

4. Consolidate and review. This means considering which unique sources the search yielded, what is missing, and whether there is any “contamination” from other sources (such as irrelevant information published by, or about, other countries). In addition, outline which search categories were most fruitful for the country in question, scrutinize which sources were useful and which were not, and highlight “high value” sources.

5. Execute a final analysis. Discuss any questions raised about military medical information availability and access for the country under consideration and how further gaps in information may be addressed. This step would include a formal report on the military medical services of the examined country.

France and Germany were selected as case studies because they are both large European countries with substantial military medical services that also use dominant languages other than English. They have longstanding and sizeable military medical services, and they are members of the North Atlantic Treaty Organization (NATO) and the European Union. Accordingly, these countries are likely to have a digital presence in English as well as their native languages. We made this choice because the volume of information on military medical services for these countries would therefore likely be high, testing all aspects of our search methodology.

The search was conducted by a multilingual research team with knowledge of English, French, and German. Analysis and discussion were verified by experts who are closely familiar with military medical services in each country. The search was executed from the United Kingdom during March and April 2020—and it is expected that exact replication at another time is unlikely. The goal of these case studies is to identify digital sources and artefacts that would provide additional information on the military medical services of each country beyond their entries in the Almanac (n.b., they therefore do not represent detailed data collection). This has been used to develop an efficient, open-source search strategy that could be applied to other nations. The following discussion will examine how remaining gaps in information can be approached, suggesting particular countries, topics, and methods that can be explored further.
CASE STUDY I: AN OPEN SOURCE INTERNET SEARCH FOR INFORMATION ON INTERNATIONAL MILITARY MEDICAL SERVICES IN GERMANY

Overview
At the time of writing, Germany has a population of circa 83 million. It has five dedicated country pages for its “Bundeswehr Joint Medical Service” on military-medicine.com. German military medical services comprise a total of approximately 18,000 military and 3,000 civilian posts, and five military hospitals. Germany is one of a small number of nations with separate, detailed country profiles in the Almanac (air force, army, joint medical service, joint support and enabling service, and navy). The Almanac entry lists the following potential entities that may have an Internet presence: the Bundeswehr medical service headquarters, Bundeswehr medical service academy, operational medical support command, regional medical support command, and medical regiments and the Bundeswehr institutes of microbiology, pharmacology, toxicology, and radiobiology, as well as the Bundeswehr institute of preventive medicine.

English-Language Search
A basic English-language Internet search in a search engine using the key terms “military medical services Germany” and “German military medicine” identified a number of English-language websites that covered the medical services of the German armed forces, but also websites for the U.S. Army regional health command of Europe; the supreme headquarters of allied powers in Europe; an international health care system profile; as well as webpages with academic articles (mostly older articles, some relating to World War II, and some papers with medical rather than military details), an international military medicine conference website, and news about COVID-19.

Specific English-language academic searches on Google Books, Google Scholar, JSTOR, Academia.edu, and ResearchGate resulted primarily in general publications about the world wars and Cold War, as well as international military medical history and methods (e.g., military medicine from ancient times to present and global disaster medicine). Many results were works that focused on international comparisons and humanitarian operations (including medical ethics and humanitarian law). Only a handful of academic results yielded useful, albeit still dated, information on Germany’s present-day military medical services (e.g., an article describing a norovirus outbreak at a German military base, and an evaluation of labor market effects of compulsory military service in Germany). Some of these results were international comparisons as well (e.g., about the United...
Kingdom–Germany partnership), whereas others were specific to Germany (e.g., articles addressing the university medical curriculum in Germany), and many focused on specific aspects of medicine (psychiatric treatment, microbiological screening, parasitology).

An English-language search on YouTube resulted in videos of German army preparations and training missions, educational videos, and introductory explanations. These were mostly posted on non-German accounts (e.g., from the United States and China). Relevant results from Twitter included the NATO Centre of Excellence for Military Medicine (@MILMEDCOE) and Berlin Policy Journal (@BerlinPolicy).

**German-Language Search**
A German-language search for “Zentraler Sanitätsdienst der Bundeswehr” and “Militärmedizin” yielded far more results than the English search. These included government websites, such as sanitaetsdienst-bundeswehr.de, bundeswehr.de, and service.bund.de, as well as career service bundeswehrkarriere.de and the Facebook page for “Zentraler Sanitätsdienst der Bundeswehr.” Other outcomes included news sites, such as large newspapers but also specialized papers (e.g., the German medical magazine and news for military personnel). Another result was the webpage for the Centre for Military History. When the search did not specify Germany (“Deutschland”), some results were for non-German countries that use (variants of) the German language, such as Switzerland.

An academic search in German yielded a completely different set of articles from English—but often on the same themes, such as historical overviews and analyses of specific aspects of medicine (*Sturzereignisprotokollen, Transfusionsmedizinische Einrichtungen*). With that said, the number of articles specifically addressing the operation of military medical services in Germany was much higher in German than in English (*Einsatzregister, Basisausbildung von Notärzten, Simulationsausbildung*) and studies of international collaboration were more detailed. What is more, there is a large number of databases specific to Germany (e.g., the Deutsches Institut für Medizinische Dokumentation und Information, Informations- und Dokumentationsstelle in Ethik der Medizin, and Bioethik-Literaturdatenbank). German-language results on YouTube were similar to English, but likewise more detailed and relevant. The Bundeswehr has its own YouTube account, on which it has placed videos, such as “Jobportrait: Rettungsassistentin im Sanitätsdienst.” There are also personal videos, such as *Meine Zeit im Militär!* Relevant Twitter accounts included Real Scientists
DE (@realsci_DE), as well as accounts run by news outlets, and personal accounts from Bundeswehr staff and medical practitioners.

Consolidation

While the English-language search results were satisfactory, the German-language search yielded more results, additional sources (such as news outlets, further academic publications, and more social media profiles), and generally more relevant information. In particular, national databases can be difficult to identify for someone searching in English and not professionally active in Germany. These form an especially useful source category and need to be identified as part of any search for information on aspects of national military medical services.

This search identified information on the medical services of the German armed forces that was additional to the detailed descriptions in the Almanac. It showed the importance of searching for websites for the Ministry of Defence, the armed forces, and the individual services of the army, navy, and air force. It also showed the value of searching for an Internet presence for each institution described in the Almanac. An example is the information provided on tropical medicine to the Almanac—which was submitted by only 6.06% of participating countries (8 out of 132). It is not mentioned in any of Germany’s five profiles, but it is mentioned by the German military tropical medicine hospital and institute. This can be identified through a search engine search (“Germany military medical services tropical medicine”). The English-language website provides information on a hospital in Hamburg, with a section that specializes in tropical diseases. A search for “Zentraler Sanitätsdienst der Bundeswehr Tropenmedizin” reveals that the same author composed an overview in German as well. Other English-language results include academic publications. However, as before, there are more German-language results. These include additional publications, but also the Hamburg hospital website, and the website for information on public services in Germany.

This case study illustrates that, even for countries that have comprehensive entries in the Almanac (population and army size, media use, data transparency, etc.), searching the Internet will yield further details on specific categories of information. This applies especially when such a country produces a substantial range of sources (academic, print media, visual media, social media, etc.). In the case of Germany, it is important to conduct a search in the country’s primary language. Within this, it is imperative to pay attention to non-German information and sources (e.g., information about other countries, or information on Germany published by other countries).
CASE STUDY II: AN OPEN SOURCE INTERNET SEARCH FOR INFORMATION ON INTERNATIONAL MILITARY MEDICAL SERVICES IN FRANCE

Overview

France currently has a population of circa 67 million people. Its “Service de santé des armées” includes eight hospitals, almost 280,000 armed forces personnel, and 1,800 medical officers.53 Its Almanac entry lists military hospitals (including the medical services headquarters), armed forces medical clinics, and specific centers, such as the armed forces blood transfusion center and the armed forces center for epidemiology and public health. It also describes the French military medical supply chain and medical education and training. Finally, the profile provides details on the defense biomedical research institute and the military radiation protection service.

English-Language Search

A basic English-language Internet search in a search engine using key terms such as “military medical services France” and “French military medicine” resulted in webpages of the French Ministry of Defence, the Défense Conseil International (reference operator of the Ministry of Armed Forces of France, which provides consulting, training, and technical assistance), a country profile from the U.S. Central Intelligence Agency, a French newspaper, several pages on training and education, some academic publications (such as trauma among French service members, and contributions of the French army health service), and the Museum of the Army Service de Santé Medical Corps.

An English-language academic search on Google Books, Google Scholar, JSTOR, Academia.edu, and ResearchGate resulted primarily in general publications about history and global international studies (including textbooks and conference proceedings). Many of the results were antiquated, such as The Medical Times and Gazette: A Journal of Medical Science, published in 1873. More relevant recent publications tended to be dated in the last ten to twenty years, with a handful of papers published in 2019 and 2020 (topics ranging from trauma and field hospitals to terrorist events). Some publications treated specific location case studies (e.g., a French parachuting unit, a facility in Afghanistan, local drinking water) as well as specialized aspects of medicine (such as French disaster medicine). Besides describing the functioning of the French Military Medical Services, the results of some of these publications are also generally educational and internationally applicable (French triage categorization, forward combat casualty care).
Social media results from English included YouTube clips addressing recent events, such as “Coronavirus: French Field Hospital Begins to Take Shape” (by AFP News Agency) and “French Military Doctors Start to Set Up a Mobile Hospital for Syrian Refugees” (from the AP Archive). Other relevant videos addressed recruitment (“How France’s Voluntary Military Service Is Benefiting Young People,” by FRANCE 24 English) and international missions (“French Medical Embedded Training Team,” by AFN Afghanistan). English-language results from Twitter were not country-specific to France. They included accounts such as Military Health System, @MilitaryHealth (a source for news and information on military health) and CIMM-ICMM, @cimmicmm (the International Committee of Military Medicine).

French-Language Search

A basic search in French, using keywords “Service de santé des armées” and “médecine militaire (française)” yielded more results, which were balanced differently. Besides the website of the Ministry of Defence, this search found career profiles, extensive training and education overviews, and additional news sources (including a dedicated medical news page). The search also resulted in the website for the committee of international military medicine and other academic articles. When the search did not specify France, results included pages from French-speaking countries such as Canada, Belgium, and Morocco.

The academic search in French likewise generated archival results, such as Archives de médecine militaire, published in 1852, as well as publications focusing on the history of the French military medical services. Like the English search, some results focused on specific countries or cases—although the topics differed (Gulf War, a report on cyclone Mitch). As before, a number of papers emphasized specific aspects of medicine as well (épidémiologique du paludisme, les sacs médicaux à visée opérationnelle). A difference with the English search is that a larger number of papers discussed French military medical services more generally (modernisation du Medecav, loyauté et management, les réserves spécialistes, médecine d’urgence et engagements opérationnels) and some publications addressed education and training (e.g., École du Service de santé des armées de Lyon). Specific French sources include the bulletin of the Académie Nationale de Médecine, the database and journal run by the Institut de Médecine Tropicale du Service de Santé des Armées, and Portail Epidémiologie France (a catalog of individual health databases in France).

French results from YouTube were more specific, particularly because the Service de Santé des Armées as well as the Ministère des Armées have their own channels. Videos included detailed services introductions, overviews,
staff profiles, and hospital tours (La médecine de guerre au plus près des combats by Ministère des Armées, L’hôpital militaire Bégin, Ecole de santé des armées (une première année)). An account run by Medecine en Action also placed a documentary on the platform, Médecins militaires: juste avant le front— Santé.

A French search, comparable to German, resulted in more personal accounts. For example, an account for a health and medicine journalist, the minister for the Armed Forces, as well as the secretary of state to the minister for the Armed Forces. More general accounts were SantéArmées, @santearmees (the official account of the French military medical services), and the État-Major Armées, @EtatMajorFR (the official account of the General Staff of the Armed Forces).

Consolidation
Although the English-language search results were adequate in this case study, the French-language search yielded more results, additional sources (such as news outlets, further academic publications, and more social media profiles), and generally more relevant information. These similarities may persist across other similarly positioned nations but could be expected to fall short in less developed ones.

This case study likewise demonstrated the value for searching for an Internet presence for each institution described in the Almanac. Another thematic example: information on mental health and psychiatry was provided to the Almanac by only 4.55% (6 out of 132) of participating countries. The French profile mentions “military non-platform hospitals (…) activities are based on several principles such as (…) the rehabilitation of physical and mental injuries” but provides no other details. An English-language search on this topic reveals very little, but a French-language search resulted in official government pages addressing psychiatry in the French army, as well as a newsletter. Notably, French-language search results for mental health more generally are primarily associated with Canada rather than France, indicating a difference between their military medical services.

Overall, the Service de Santé des Armées has a relatively well-established Web presence, but more so in French than in English. Reasons for this are multifold, but they may include the status of French around the world (spoken as a major language in a large number of countries and an official language in more than two dozen countries, also making it a popular language to learn in other countries). In a case like this—a country with sizeable military medical services, providing relatively good access to information, with a native language that is globally well known—the country’s primary language should take precedence over languages like...
English in an Internet search. This can be compared closely to the conclusions drawn from the case study on Germany.

DISCUSSION

In summary, the two case studies illustrate that open source search significantly enhances data available through official profiles and databases such as the Almanac. A search strategy is beneficial as a checklist of specific categories of information, and to improve efficiency and detail. In particular, target language and media availability are important to take into account. Overall, this means that there is a clear difference in information that can be obtained from an external evaluation versus directly provided data contained within the Almanac.

Organizational websites with information on military medical services that are common in several counties, in particular the two cases presented here, are pages for the Ministry of Defence, armed forces, joint forces organization, joint medical command organization, army, navy, air force, military hospitals, military medical academies and training centers, military medical museums, military medical research institutions, and military medical associations. Some countries will also have dedicated military medical journals and academic databases. Altogether, these pages can provide further detailed insight into more specialized areas, such as tropical medicine; chemical, biological, radiological, and nuclear weapons; aviation medicine; underwater medicine; and military recruiting, as well as research topics, research institutions, and individual researchers.

For the two cases studies, searches of social media and academic literature in German and French produced better results than searches in English. Besides language-popularity factors such as society and education, the use of a specific language can also serve particular national and international interests. This is likely to apply to other languages and countries. An example is the continued use of Russian in post-Soviet states. It was an official language for a significant period of time, so it cannot be changed without mistakes and miscommunication one day to the next. Additionally, many of these countries continue to maintain close ties with Russia and its military, so the language remains important in high-level information exchange.

What is more, German and French both held positions as international languages in the past—particularly as languages of literature and research. German was once used more widely than any other language, and French is still spoken and used in publications by many people outside France—making both important secondary languages for non-natives. A contrast can be found in Irish Gaelic, because Gaelic is not used more widely than (Hiberno-) English in Ireland. While a general Web search will result in Gaelic language websites (such as those relating to government and law),
social media and academic search results will differ strongly (more results in English). This means that an Internet search for information on military medical services will be influenced by the primary national language(s) of the country in question and to some extent the number of language users and popularity of this language in other countries. Further research could be done here on any country, for example by comparing countries by density of use of first or second language (e.g., the balance of information per language in Switzerland, the use of Dutch outside the Netherlands, or the status of minority languages like Berber in Morocco).

Using a country’s own name for its military medical services (such as German “Zentraler Sanitätsdienst der Bundeswehr” and “French Service de santé des armées”) yields more accurate search results than English searches for “insert country Military Medical Services.” This can likely be attributed to “Military Medical Services” not translating well from English or not being attributed with the same meaning or understanding in other countries. Additionally, it may also relate to the different structures military medical services are embedded in, in various countries. This applies in particular to training and education (more results in the country’s own language) and social media (a larger number of personal accounts run by relevant authors like national journalists and medical practitioners).56

Notably, many military services have specific budgets and subsections for public relations. Offline examples include televisions ads, posters, and recruiters. Online, this affects digital visibility. For example, in recent years the French military has seen an increasing digital presence, especially on social media platforms. This activity is designed to support foreign affairs, to cultivate a positive image, and to increase recruitment.57 Strategic motivations for military medical services to have an Internet presence thus go beyond crisis response and scientific communication and include external publicity as well. Put together, this has made the Internet a highly accessible source of information.

With that said, information on military medical services does often suffer from top-down bias. Content meaning and value depend on the conditions of delivery: by whom, to whom, when, where, and how it is produced and conveyed.58 What is more, some military medical services have traditionally received less attention than others; for instance, those provided by groups such as the Kurdish Peshmerga. Therefore, follow-up research should explore other methods of data collection (or enhancement), such as interviews. Interviews best reveal the narratives and orientations of speakers, articulating identities and policies.59 Although some may wish to restrict information, in other cases sharing information can serve national interests. Interviews also form a much greater source of information from the receiving-end of military
medical care: how it is perceived and experienced by those using the services (as opposed to those providing or analyzing them).

CONCLUSIONS

The described search methodology has proven useful because it provides a structure to systematically highlight the range of public sources of information on military medical services for a given country. Because of the large volume of information that is available online, it is important to refine and balance search methods. This allows the searcher to realize which sources are worthwhile. It is significant to take into account search language (in the cases described here, the primary native language of the country in question). It is also important to be imaginative, relying not only on standard search engine searches and generic keywords but seeking out specific institutional websites or academic databases.

France and Germany were selected specifically because they are democratic countries that were expected to yield a substantial number of high-quality sources. A constructive next step would be to apply the proposed framework to further countries, particularly those that challenge the methods applied in this article. This would mean countries with smaller military medical services, less data transparency, lower digital presence, or different language practices. Further factors that will impact searches are a country’s research capacity, publication opportunity, and media use. In some regions or social environments, unofficial media have much higher circulation and impact than official media. In addition, our search has highlighted that it can be difficult to find information on certain topics—such as mental health—not because the information is not available, but because it is lacking attention within many global military medical services. This means that the described methodology may also be used to highlight military medical agenda items in certain countries.

Finally, this article has also addressed information security—especially the balance between protection and openness. While some countries restrict information sharing, others use it as an opportunity for promotion. Information on military medical services thus serves particular national and international interests. This demonstrates that the evaluation of open source information on military health systems is not only valuable in filling gaps in directly reported information but also in developing a deeper understanding of international collaboration.

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REFERENCES

1. Martin C. M. Bricknell and Donald F. Thompson, “Roles for International Military Medical Services in Stability Operations (Security Sector Reform),” BMJ Military Health, Vol. 153 (2007), pp. 95–98.
2. Rose Bernard and Richard Sullivan, “The Use of HUMINT in Epidemics: A Practical Assessment,” Intelligence and National Security, Vol. 35, No. 4 (2020), pp. 493–501.
3. Douglas M. Bowley, David Lamb, P. Rumbold, Paul Hunt, Javid Kayeni, and Asif M. Sukhera, “Nursing and Medical Contribution to Defence Healthcare Engagement: Initial Experiences of the UK Defence Medical Services,” BMJ Military Health, Vol. 165 (2019), pp. 143–146; Matthew Lim and David Blazes, “Collateral Duty Diplomacy: The U.S. Department of Defense and Global Health Diplomacy,” Science & Diplomacy, Vol. 4, No. 3 (2015).
4. Gemma Bowsher, Ciaran Milner, and Richard Sullivan, “Medical Intelligence, Security and Global Health: The Foundations of a New Health Agenda,” Journal of the Royal Society of Medicine, Vol. 109, No. 7 (2016), pp. 269–273.
5. Frank G. Rando, “In the Know: Medical Intelligence in CBRN Health Security Threats,” 31 August 2016, http://www.cbrneportal.com/in-the-know-medical-intelligence-in-cbrn-health-security-threats/ (accessed May 2020).
6. Robert S. Anderson, Preventive Medicine in World War II, Volume IX (Washington, DC: Office of the Surgeon General, 1969).
7. Yan Chen, Grace YounJoo Jeon, and Yong-Mi Kim, “A Day Without a Search Engine: An Experimental Study of Online and Offline Searches,” Experimental Economics, Vol. 17 (2014), pp. 512–536.
8. Danielle Arigo, Sherry Pagoto, Lisa Carter-Harris, Sarah E. Lillie, and Camille Nebeker, “Using Social Media for Health Research: Methodological and Ethical Considerations for Recruitment and Intervention Delivery,” Digital Health, Vol. 4 (2018).
9. For example, the Commonwealth Foundation, the World Health Organization, and the Organisation for Economic Co-Operation and Development.
10. Most recently Racheli Magnezi, Rachel Dankner, Mordechai Shani, Yehekzel Levy, Isaac Ashkenazi, and Haim Reuveni, “Comparison of Health Care Services for Career Soldiers throughout the World,” Military Medicine, Vol. 170, No. 12 (2005), pp. 995–998.
11. “Military Medicine Worldwide,” https://military-medicine.com. Information available in this database is being analyzed in detail in an upcoming publication by Ryan Leone, Zenobia Homan, Antonin Lelong, Lutz Bandekow, and Martin Bricknell, “An Analysis of International Military Health Systems Using the Military Medical Corps Worldwide Almanac,” Military Medicine (2020).
12. James M. Wilson, Garrett M. Scalaro, and Jodie A. Powell, “Influenza Pandemic Warning Signals: Philadelphia in 1918 and 1977–1978,” Intelligence and National Security, Vol. 35, No 4 (2020), pp. 502–518.
13. On military information in general, see Agata Ziółkowska, “Open Source Intelligence (OSINT) as an Element of Military Recon,” Security and Defence Quarterly, Vol. 19, No. 2 (2018), pp. 65–77.
14 Gemma Bowsher, Ciaran Milner, and Richard Sullivan, “Medical Intelligence, Security and Global Health: The Foundations of a New Health Agenda,” *Journal of the Royal Society of Medicine*, Vol. 109, No. 7 (2016), pp. 269–273.

15 Stéphane Lefebvre, “The Difficulties and Dilemmas of International Intelligence Cooperation,” *International Journal of Intelligence and CounterIntelligence*, Vol. 16, No. 4 (2003), p. 543.

16 Marta Paterlini, “Interview with Anders Tegnell—‘Closing Borders is Ridiculous’: The Epidemiologist behind Sweden’s Controversial Coronavirus Strategy,” *Nature*, Vol. 580 (2020), p. 574.

17 Filippa Lentzos, Michael S. Goodman, and James M. Wilson, “Health Security Intelligence: Engaging across Disciplines and Sectors,” *Intelligence and National Security*, Vol. 35, No. 4 (2020), pp. 465–476.

18 [https://www.statista.com/](https://www.statista.com/) (accessed 16 April 2020).

19 Neslihan Onder Ozdemir, “The Role of English as a Lingua Franca in Academia: The Case of Turkish Postgraduate Students in an Anglophone-Centre Context,” *Procedia—Social and Behavioral Sciences*, Vol. 141 (2014), pp. 74–78.

20 Mark Graham and Matthew Zook, “Augmented Realities and Uneven Geographies: Exploring the Geolinguistic Contours of the Web,” *Environment and Planning*, Vol. 45 (2013), pp. 77–99.

21 This statement becomes more complicated when addressing smaller language groups and, for example, African countries: while there are around 6,000 languages in use, globally, many are not frequently used on the Internet or supported by popular search engines.

22 Danièle Allard, Jacqueline Bourdeau, and Riichiro Mizoguchi, “Addressing Cultural and Native Language Interference in Second Language Acquisition,” *CALICO Journal*, Vol. 28, No. 3 (2011), pp. 677–698.

23 On cognitive bias, also see Martha Whitesmith, “Experimental Research in Reducing the Risk of Cognitive Bias in Intelligence Analysis,” *International Journal of Intelligence and CounterIntelligence*, Vol. 33, No. 2 (2020), pp. 380–405.

24 Rose Bernard, Gemma Bowsher, Ciaran Milner, Peter Boyle, Preeti Patel, and Richard Sullivan, “Intelligence and Global Health: Assessing the Role of Open Source and Social Media Intelligence Analysis in Infectious Disease Outbreaks,” *Journal of Public Health*, Vol. 26 (2018), pp. 509–514.

25 Anne Burns and Celia Roberts, “Migration and Adult Language Learning: Global Flows and Local Transposition,” *Teachers of English to Speakers of Other Languages (TESOL) Quarterly*, Vol. 44, No. 3 (2010), pp. 409–419.

26 Reference list: Angola, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo (Republic), Côte d’Ivoire, Djibouti, Gabon, Guinea, Honduras, Iran, Iraq, Liberia, Madagascar, Namibia, Oman, Paraguay, Peru, Qatar, Sudan, Tajikistan, Tanzania, Uganda, United States (Army), and Zambia (n.b., It is important to consider the willingness of states to share such information to serve national or international interests, especially in the case of conflict-affected states).
Website that allows users to connect with friends online, to share pictures, music, videos, and articles, as well as their own thoughts and opinions, https://www.facebook.com/ (accessed July 2020).

Microblogging and social networking service on which users post and interact with short messages limited to a certain number of characters, https://twitter.com/ (accessed July 2020).

Business and employment–oriented service used for professional networking, https://www.linkedin.com/ (accessed July 2020).

Video-sharing platform, https://www.youtube.com/ (accessed July 2020).

Photo- and video-sharing social networking application, which allows users to upload either edited or instant media organized with tags (shared publicly, or with pre-approved followers), https://www.instagram.com/ (accessed July 2020).

Multimedia messaging application, on which pictures and videos are only temporally accessible, https://www.snapchat.com/ (accessed July 2020).

Video-sharing social networking service limited to short clips, https://www.tiktok.com/ (accessed July 2020).

Website designed to enable discovery, saving, and sharing of information on the Internet, particularly images, available via https://www.pinterest.com/ (accessed July 2020).

Social news aggregation, Web content rating, and discussion website with emphasis on popular media, https://www.reddit.com/ (accessed July 2020).

At the time of writing, video analysis remains comparatively more difficult because it is generally not possible to search based on the content within a video. Most sources will be found through title or tags, but valuable information may also be embedded within the video (e.g., a video on medical training that does not have “military” in its title).

Daniel R. George, Liza S. Rovniak, and Jennifer L. Kraschnewski, “Dangers and Opportunities for Social Media in Medicine,” Clinical Obstetrics and Gynecology, Vol. 56, No. 3 (2013), pp. 453–462.

Also see Shirley Ann Williams, Melissa Terras, and Claire Warwick, “What People Study When They Study Twitter: Classifying Twitter Related Academic Papers,” Journal of Documentation, Vol. 69, No. 3 (2013), pp. 1–74.

See Bo-Christer Björk and David Solomon, “The Publishing Delay in Scholarly Peer-Reviewed Journals,” Journal of Infometrics, Vol. 7, No. 4 (2013), pp. 914–923.

Digital library of academic journals, books, and primary sources with emphasis on arts, humanities, and social sciences, https://www.jstor.org/ (accessed July 2020).

Social networking website for academics, https://www.academia.edu/ (accessed July 2020).

Social networking site for scientists and researchers, https://www.researchgate.net/ (accessed July 2020).

Abstract and citation database of peer-reviewed literature, https://www.scopus.com/ (accessed July 2020).
Large publisher-neutral citation index and research intelligence platform, https://www.webofknowledge.com/ (accessed July 2020).

Comprehensive analysis of the COVID-19 experience will likely appear in academic literature over the course of the coming year—but the international community is already publishing material on COVID-19 in policy papers, commentaries, and indeed some academic journals.

On social media, see Chareen L. Snelson, “Qualitative and Mixed Methods Social Media Research: A Review of the Literature,” International Journal of Qualitative Methods (December 2016), https://doi.org/10.1177/1609406915624574.

See Michael Heron, Vicki L. Hanson, and Ian Ricketts, “Open Source and Accessibility: Advantages and Limitations,” Journal of Interaction Science, Vol. 1, No. 2 (2013), https://doi.org/10.1186/2194-0827-1-2.

Sean Mckeown, David Maxwell, Leif Azzopardi, and Willian Glisson, “Investigating People: A Qualitative Analysis of the Search Behaviours of Open-Source Intelligence Analysts,” IIIIX 2014: Fifth Information Interaction in Context Symposium, Regensburg, Germany, 26–29 August 2014, pp. 175–184.

Google Search Help, “Refine Web Searches,” 2020, https://support.google.com/websearch/answer/2466433?hl=en (accessed May 2020).

“Federal Republic of Germany (Joint Medical Service),” 2020, https://www.military-medicine.com/almanac/56-germany-joint-medical-service-federal-republic-of.html (accessed May 2020).

Joachim Hoitz, “German Military Hospital in Hamburg: Regionally Potent, Internationally Cross-Linked,” Medical Corps International Forum, 2018, https://www.military-medicine.com/article/3431-german-military-hospital-in-hamburg-regionally-potent-internationally-cross-linked.html (accessed May 2020).

Joachim Hoitz, “Fachbereich Tropenmedizin - Kompetenz- und Ausbildungszentrum des Sanitätsdienstes,” Wehrmedizin und Wehrpharmazie, 2017, https://wehrmed.de/article/2965-fachbereich-tropenmedizin-kompetenz-ausbildungszentrum-des-sanitaetsdienstes.html (accessed May 2020).

“French Republic,” 2020, https://www.military-medicine.com/almanac/53-french-republic.html (accessed May 2020).

Simone Pilon, “Why Study French,” The French Review, Vol. 86, No. 6 (2013), p. 1134.

According to the 2016 census, only around 70,000 people speak Gaelic on a daily basis.

In this sense, it is important to be able to focus on the ability to function in the language in question (rather than on knowledge about the language). See Ki Hwan Lee, “Age Differences in Second Language Acquisition: An Educational Perspective,” The Korean Language in America, Vol. 1 (1995), pp. 281–291.

Daniel Chaize, François-Bernard Huyghe, Fabio Liberti, Jean-Pierre Maulny, Philippe Migault, and Alexandre Tuaillon, “Les Communications Institutionnelles de la Defense en Europe: Comment Les Pays Europeens Communiquent sur leurs Armees,” Etude EPS Dossier, No. 2011/74, Institut de Relations Internationales et Strategiques (2013), pp. 34–36.
58 Maria Pavlou, “Attributive Discourse in the Speeches in Thucydides,” *Thucydides: Between Historical Research and Literary Representation, Trends in Classics*, edited by A. Tsakmakis and M. Tamiolaki (Berlin: De Gruyter, 2013), pp. 409–433.

59 Senem Aydin-Düzgit, “Critical Discourse Analysis in Analysing European Union Foreign Policy: Prospects and Challenges,” *Cooperation and Conflict*, Vol. 49, No. 3 (2004), pp. 354–367.