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Nominal Rolls: Lessons Learned from Developing the "Mustard Gas List"

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In Memoriam

The development of the list of Canadian Veterans exposed to chemical warfare agent testing would not have been possible without the extraordinary efforts of Mr. John Wickett, who was Chief, Business Planning and Reporting, Research Directorate, Veterans Affairs Canada. In 2006, Mr. Wickett was awarded the *Canadian Forces Ombudsman's Commendation for Complaint Resolution* for this work. The citation reads:

"Through his extraordinary dedication and compassion, Mr. John Wickett has provided invaluable assistance to countless Canadian veterans and former Canadian Forces members in need. Always going well beyond what was asked or expected of him, Mr. Wickett has helped to correct real injustices and inequities at both the individual and broader systemic level. Most notably, Mr. Wickett was instrumental in the successful implementation of the Chemical Warfare Agent Testing Program and in helping former soldiers and their families come to terms with a difficult period in Canada's history."

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Executive Summary

A nominal roll is a list of names. Traditionally, nominal rolls are developed to list all military personnel who served in a war, action or unit. Military Veteran nominal rolls have been used for a variety of purposes, including promoting comradeship and Veteran identity, recognition and commemoration, genealogy, research, and to administer Veterans' benefits.

Bound by oaths of secrecy, Canadian and American Veterans generally did not reveal their experience in chemical warfare agent testing until some began approaching their governments for compensation through the 1970s and 80s (Laforce 2006). In 2004,

DND initiated an ex-gratia payment to compensate former test subjects who had volunteered for trials at Suffield (Alberta) and Ottawa. Administration of DND and VAC compensation programs was hampered by lack of a comprehensive list of Veterans who participated in chemical warfare agent testing.

During 2002-9, the Veterans Affairs Canada (VAC) Research Directorate developed a computerized list of Canadian military Veterans who had participated in chemical warfare testing during the 1940s-70s. This was called “the mustard gas list”, although other chemical warfare agents had been tested. The list developed by the VAC Research Directorate complemented a list being developed by DND, to support both the process of tracking Veterans and proactive efforts to reach former test subjects or their survivors to inform them about compensation benefits.

The master list grew to 8,812 from 2,575 names initially supplied by DND, augmented by additional names supplied to VAC by: DND (5,142); various VAC sources (829); the United Kingdom (Porton Down research facility, 242 names); family members and Veterans (18); media articles (5); and the Veterans Review and Appeal Board (1). Not all the persons in the list had participated in chemical warfare agent testing. Some had participated only in chemical weapons training, and some may have not had any exposure to chemical warfare agent testing. VAC was able to confirm that 1,539 of the 8,812 had participated in chemical warfare agent testing, either because the Veteran had been accepted by DND for the ex gratia payment, or been given a favourable decision for entitlement to disability benefits attributed to chemical warfare agent testing.

Since the list was compiled retrospectively about half a century after the majority of the testing, it is unlikely that this is a complete nominal roll of Canadian Veterans exposed to chemical warfare agent testing during the 1940s-70s. This is in keeping with the experience of VAC and other agencies who have developed retrospective lists for other purposes. It is unlikely that a retrospective list can be expected to be perfect.

The work of finding, cross referencing and verifying names was very time-consuming, intricate and involved a variety of sources. Although some prospective lists had been archived from the time of various individual test trials, it was difficult or impossible to find other lists after so many years, or to verify the identities of individuals whose names were provided. In many cases, it was impossible to cross reference names between databases owing to lack of linkable identifying data. Many participants had remained loyal to their oaths of secrecy until the ends of their lives, which meant that even family survivors were not aware they had participated. Details on the precise nature and amount of exposures were often absent or lacking.

The “mustard gas list” proved useful to the Department of National Defence when it administered the ex gratia payments, and to VAC when adjudicating claims for disability benefit compensation by Veterans. It was used by VAC proactively to reach

out to Veterans and survivors who may have been eligible for the ex gratia payment or disability benefit entitlement but not aware of the programs. The list continues to be useful in adjudicating claims by Veterans and survivors for entitlement to VAC disability benefits.

Experience has shown that military Veterans will continue to come forward throughout their lives with concerns that past exposures in military service caused their health problems. Prospective nominal rolls may prevent many of the difficulties encountered by Veterans and Veterans' administrations when they need lists of Veterans who participated in various types of military service. Though costly to establish and maintain, prospective nominal rolls are likely to better identify military personnel who participated on various deployments, and may be cost effective compared to periodically compiling lists retrospectively.

Problems with retrospective nominal rolls could be obviated by prospectively developing a comprehensive, validated database showing who served when and where. Such records would assist in documenting the health effects of military service later in life, and could be more cost-effective than building nominal roles retrospectively.

Introduction

Traditionally, a *nominal roll* is a list of all military personnel who served in a war, action, unit or similar identifiable group. Military Veteran nominal rolls are used around the world for a variety of purposes, including comradeship (defining and sharing identity), recognition and commemoration (Veterans Affairs Canada 2008), genealogy, research, and to administer Veterans' benefits.

Like Veterans' administrations in other countries, Veterans Affairs Canada periodically develops lists and nominal rolls for a variety of compensation and recognition purposes. Nominal rolls often are not readily available. In times of heavy operational commitments, military administrations usually do not have resources to maintain nominal rolls for posterity. This means that nominal rolls often are reconstructed in retrospect.

In response to growing concerns among Veterans about health effects Veterans attributed to chemical warfare agent test-exposure from the Second World War to the 1970s (Bryden 1989), Canada's DND offered an ex-gratia payment. On February 19, 2004, the Ministers of National Defence and Veterans Affairs announced a recognition package which included an ex gratia payment of $24,000 for Veterans of the Canadian military who participated in chemical agent warfare tests during 1941 to the early 1970's. This special program was in addition to the usual option Veterans and survivors can exercise, such as applying to VAC for entitlement to disability benefits when they think the Veteran's health condition was caused or aggravated by military service.

To support these compensation activities, VAC's Research Directorate worked to develop a list of Veterans exposed to chemical warfare agents testing, half a century after the majority of the testing occurred. This report summarizes the experience of the VAC Research Directorate in developing the list, and discusses lessons learned. The project was known as "the mustard gas list" owing to the feared reputation of that particular chemical warfare agent; however, several agents were used in tests involving Canadian soldiers.

Background

The modern chemical weapon era began in the First World War, when troops in Europe were exposed to several agents, notably "mustard gas" (sulfur mustard) (Brown 2009a). In the First World War (WWI) and again in the Second World War (WWII), several nations developed, stockpiled and tested chemical weapons, and Canada's allies shared information they collected. By the end of WWII, it was estimated that 60,000 US service personnel were experimentally exposed to mustard gas and Lewisite (Brown 2009a).

A military research establishment was created during WWII at Suffield in Alberta to test the effects of chemical weapons and defenses on animals and humans (Bryden 1989). Testing involving Canadian military personnel also occurred in Ottawa, and in Porton Down in the U.K. During the 1970s, staff at Defence Research Establishment Suffield found, catalogued and preserved old chemical agent testing trial documents (Laforce 2006).

Chemical Warfare Agent Testing

Laforce (2006) reported several chemical warfare agents were tested on military subjects in Canada during the 1940s-60s, including mustard gas (sulfur mustard), nitrogen mustard, phosgene, cyanogen chloride, hydrogen chloride, lewisite (an organoarsenic compound with blistering effects that was sometimes mixed with sulfur mustard), ammonia, sarin and nerve agent VX. Medical countermeasures including atropine and caramiphen were also tested. Brown (2009a, 2009b) documented lists of agents used in testing US military personnel and reviewed evidence for the long term effects of chemical warfare agent testing on participants.

There are textual and photographic records of injuries among Canadian military test subjects (mostly skin) but no fatalities (Laforce 2006). Testing included exposing test subjects to aerial spraying, spray from simulated artillery rounds, maneuvers through contaminated ground, patch tests, drop tests, and wearing uniforms impregnated with protective countermeasures. In Canada and the US, medical reports were brief, and there was little long-term medical followup (Brown 2009a). Clinicians later had little or no access to medical records, owing to secrecy issues and documentation gaps.

Mustard Gas

Mustard gas is one of the most notorious chemical warfare agents, hence the term "mustard gas list". Mustard gas is discussed here to give the reader a sense of the significance of chemical warfare agent testing on Canadian troops, although it was not the only agent used.

More properly called sulfur mustard, the substance was introduced as a chemical warfare agent during the First World War in 1915[1]. It is not found naturally in the environment, and has no medical use. The name "mustard" comes from its odour, which is not always detectable. Mustard gas can be oily liquid, gas or solid. Used as a weapon it is a powerful irritant, a liquid that clings to surfaces to blister skin and mucous membranes on contact, and then vaporizes to damage lungs if it is inhaled. People are exposed through surface contact, or breathing in the vapour. In later years it was learned that the substance breaks down slowly in the body, accumulates in tissues, and potentially damages DNA.

Mustard gas was chosen as a weapon because the liquid form is very tenacious and damaging, and the gas it gives off can also cause tissue damage. Victims are not always able to detect its presence, and symptom onset can be delayed by hours. Washing may remove sulfur mustard from body surfaces. Exposure is not usually acutely fatal. There is no antidote.

The signs and symptoms of acute exposure are not specific to mustard gas, and depend on degree and type of exposure: redness and itching of the skin that may evolve to blistering; eye irritation, pain, swelling, light sensitivity or blindness; runny nose, cough and shortness of breath; and abdominal pain, swelling, diarrhea, nausea, vomiting and fever.

Mustard gas was later found to have long-lasting effects on health (Brown 2009b). Prior exposure has been associated with some chronic illnesses. Eventually, it was discovered that the compound is carcinogenic (Pechura and Rall 1993).

During the Second World War, the allies began secret testing of mustard and other gases to find ways to protect troops and better understand the weapon (Pechura and Rall 1993). Canadian Forces Ombudsman André Marin (2004) reported that an experimental station was established at Suffield, Alberta in 1941 to study chemical weapons. Mustard gas was tested there, and at a Defence Research and Development Canada (DRDC) experimental facility in Ottawa. It was used at test sites in the U.S., Porton Down in the UK, and Australia. Subjects were tested with precise point skin applications, and in chambers while wearing protective gear. Patch exposures were used in chemical warfare training.

Mustard gas was used subsequently by various militaries in more recent decades.

[1] http://emergency.cdc.gov/agent/sulfurmustard/basics/facts.asp.

Compensating for Exposure to Chemical Agent Warfare Testing

Bound by oaths of secrecy US Veterans, as in Canada (Laforce 2006), did not reveal their experience until some began approaching the U.S. Veterans Administration for compensation through the 1980s, paralleled somewhat later by Canadian Veterans.

The U.S. Institute of Medicine (IOM) published its review of the medical-scientific information in 1993 (Pechura and Rall 1993). They found lack of medical followup of Second World War test subjects, and significant gaps in research evidence on the effects of sulfur mustard on humans. In particular, there were no epidemiologic studies. The IOM Committee found evidence of a causal relationship between exposure and a number of health conditions, suggestion of a causal relationship for others, and insufficient evidence for others. The Committee made these recommendations:

- Institute a program to identify Second World War human subjects and assess their health;
- Alert health care providers to the special concerns and problems of affected Veterans and their families;
- Convene a task force of experts in stress disorders and risk perception to aid the VA in establishing comprehensive guidelines for handling such cases[2];
- Identify all former chemical warfare production workers and individuals exposed to mustard gas for handling, training, known exposures and similar circumstances;
- Turn over records of former military personnel to VA for notification, study and health status evaluation;
- Widely publicize the situation, since the oath of secrecy was still preventing news from spreading to those who may have been affected.

In Canada, Canadian Forces Ombudsman André Marin (2004) noted that questions about chemical warfare agent test effects on Veterans had been raised in the House of Commons in 1988, and that DND publicized a call for former Veterans to come forward at that time. That same year, DND established a telephone hotline to handle enquiries from those who had participated in chemical agent testing. The hotline produced only 129 enquiries from the 1940s over the next two years, and it was subsequently discontinued owing to low demand.

As in the U.S., Canadian Veterans had been inhibited from disclosing their involvement in chemical warfare agent testing by the oaths of secrecy they had taken (Laforce 2006). Although VAC had been adjudicating claims, missing service records

[2] The IOM's 1993 report was produced shortly after the First Persian Gulf War, and before Gulf War illness became an issue. The US military and VA subsequently developed comprehensive clinical practice guidelines to standardize the approach to military personnel and Veterans who had concerns about symptoms they may attribute to prior military service.

made it difficult for Veterans to obtain entitlement to disability benefits. Marin described how Veterans politically mobilized in 2001, calling for proactive efforts to find and compensate test subjects.

In 2004, DND initiated an ex-gratia payment to compensate former test subjects who had volunteered for trials at Suffield and Ottawa. Another 1-800 hotline was implemented by DND with the announcement of the recognition (ex gratia) program.

In 2006, the UK provided information on Canadian military personnel who had participated in chemical warfare agent tests at Porton Down in England, and the terms of the ex gratia payment program were expanded to include the Canadian Porton Down Veterans.

The list developed by the VAC Research Directorate complemented one being developed by DND, and supported both the process of tracking Veterans and proactive efforts to reach former test subjects or their survivors. Throughout the ex-gratia program and to this day, Veterans and survivors who feel a Veterans' medical condition was caused by participation in chemical warfare agent testing are encouraged to make application to VAC for entitlement to disability benefits. DND's Ex-gratia Application Form had a section entitled "Notice from VAC" that the Veteran could complete if he/she had wanted to be contacted by VAC regarding information on potential disability or health benefits.

Compiling the List

Starting the List

The VAC chemical testing list project was initiated by Mr. John Wickett in 2001, then Chief, Business Planning and Reporting in the VAC Research Directorate[3]. He learned that an electronic database at Suffield had been lost for technical reasons, leaving only paper printouts, and he offered to re-computerize the lists to create a new electronic list, merging data from both Departments. From the outset, VAC recognized that its list was not the authoritative list for administering DND's recognition program.

The initial list from DND in 2002 contained 2,575 names of participants in certain chemical warfare agent trials, and individuals who responded to the 1988 DND hotline.[4] This founding list was a computer printout of individuals providing:

- Name (sometimes partial).
- Trial name (testing or training events).
- Trial date.

[3] In 2006, Mr. Wickett was awarded the CF Ombudsman's Commendation for Complaint Resolution for this work.
[4] Personal communication from Clement LaForce, Deputy Director General DRDC, to John Wickett at Veterans Affairs Canada, 22 July 2002.

- Regimental number (in some cases).

From the initial list, the VAC Research Directorate team constructed a new SPSS electronic database, adding additional variables to merge the information with information from VAC's administrative database (Table 1). A VAC Statistics Officer entered the initial DND lists to the new database.

Expanding the List

To administer the ex gratia payment, DND established the Chemical Warfare Agent Testing Recognition Program (CWATRP). The DND program developed its own list, and shared it with VAC as it evolved. More lists came in periodically from a variety of other sources (Table 2), including DND, other government sources, Veterans, families, and other VAC sources. All names were entered into the electronic database as they arrived at the Research Directorate, excluding none. Criteria for including names in the VAC database included:

- Alleged or documented participation in chemical warfare agent testing.
- Canadian military service.

Veterans who contacted the DND ombudsman were told that the VAC Research Directorate had a list. Some individuals then contacted the Research Directorate staff directly. A few Veterans were very active in gathering names of other Veterans and providing them to VAC. Probably owing to oaths of secrecy to which the Veterans had adhered throughout their lives, some of their survivors were not aware of the chemical testing when they were contacted proactively about the ex-gratia payment program.

A list of Canadian troops who had participated in chemical warfare agent testing at Porton Down was released by the U.K. government to Canada in 2006, at the time a followup mortality study was being done (Venables et al 2009). Those 242 "Porton Down" Veterans were added to the database.

Verifying the List

DND researchers were able to verify the names of some Veterans who had participated in various chemical warfare agent tests (trials) using archived administrative records. Those names came to VAC with test subject status confirmed. DND also verified the status of names that VAC found and forwarded to DND.

Some Veterans had not applied for the DND ex gratia payment, but VAC was able to verify their test subject status in various ways, for example finding evidence in their service records that they had received additional pay related to a trial, or other similar types of evidence acceptable to VAC. These Veterans were given entitlement to disability pensions, if their existing disability was related to exposure as a test subject,

or other aspects of their military service. In some cases, benefit of the doubt may have been used to resolve doubt in favour of the applicant.

The VAC Research Directorate Statistics Officer meticulously cross-referenced the various lists to identify those who were VAC clients, allowing for proactive communication about compensation programs with Veterans, survivors and caregivers.

By the end of the project in 2009, VAC's database contained 8,812 names (Table 3), but the list included those who may not have participated in chemical warfare agent testing. Table 3 summarizes the numbers of names in the nominal list. Of the total of 8,812, 4,923 did not receive ex gratia payments and could not be identified as VAC clients, and so could not be verified as test subjects. Reasons for not being able to identify names as VAC clients included:

- Insufficient identifying information to cross reference to VAC administrative data.
- Incorrect identifying information, such as wrong regimental numbers.
- No record in VAC administrative dataset, for example for a specific name or regimental number.

A further 2,350 names could be identified as VAC clients, but those persons or survivors did not apply for VAC disability benefits for disabilities related to chemical agent test exposure or were unsuccessful when they applied for the DND ex gratia payment or for VAC disability benefit entitlement for conditions related to chemical warfare agent test exposure.

The VAC Research Directorate Statistics Officer continued to compile and maintain the list from 2002 to June 2009 after the ex gratia program ceased 28 February 2007, and the final lists of those who had received ex-gratia payments had been received by VAC from DND.

Ultimately, 1,539 Veterans were confirmed as being exposed to chemical warfare agent testing by virtue of being approved for either the DND ex gratia payment, or through evidence discovered for a VAC disability pension, or both. It was clear to staff at the time that, while they had attempted to make the list as complete as possible, doing so half a century later meant that inevitably it was incomplete.

Benefits of the List

The list facilitated Veteran access to compensation and benefits, improving "reach" of programs to which they were entitled. Had the list not been developed, it is possible that some Veterans or survivors may not have benefitted from the compensation programs because they may not have known about it, or realized they may be eligible.

VAC's list was used by DND's CWATRP to supplement its own list in administering the ex gratia payments, and the VAC list is still being used by VAC's adjudicators as confirmation of exposure when they assess claims for entitlement to disability benefits claimed for chemical warfare agent test exposure. The list was used by the VAC Proactive Screening Unit, who contacted clients and survivors to provide information about application for the ex-gratia payment, and to conduct basic VAC screening which led to access to various VAC client services. The list is still used to maintain VAC's administrative data on clients for various payments and disability benefits.

The list proved very useful in facilitating program access for Veterans, or their survivors: 96% (1,332) of the Veterans who were found eligible for the DND ex gratia payment were or became VAC clients. Applicants' successes in receiving the ex gratia payment were partly due to receiving VAC assistance in making them aware of the program through the proactive screening service, or helping them to meet application deadlines. In some cases, Departmental lawyers (Bureau of Pension Advocates) visited clients in their homes or met with them in VAC offices to aid them in providing statutory declarations.

Statistics were provided on a monthly basis from the Research Directorate to the Program Policy Directorate, who used them to provide background for Parliamentary business, the media and public communications.

Acknowledgement of being a test subject in the DND ex gratia program did not automatically confer eligibility for VAC disability compensation. It is one piece of evidence that the adjudicator uses in determining eligibility on a case by case basis. Similarly, a negative decision for the ex-gratia payment would not necessarily mean a negative disability decision since, for example, the Veteran's disability could be related to other types of military service than participating in chemical warfare agent testing.

Discussion – Lessons Learned

VAC's chemical warfare agent testing list attempted to capture as many Canadian military personnel as possible who participated during the 1940s - 1970s, half a century after the testing. The VAC list assisted DND in compensating Canadian Veterans for their participation in chemical warfare agent testing, facilitated access to compensation benefits for Veterans, and enabled VAC to determine exposure for potential disability benefits. When development of the list ceased in June 2009, following the end of the DND/CF ex gratia program in 2007, the list contained 8,812 names, and 1,539 had confirmed exposure to chemical warfare agent testing. This is the current list of Canadian Veterans with exposure to chemical warfare agent testing, but it is not a perfect nominal roll.

Is the List a Nominal Roll?

VAC worked hard for more than 5 years to compile its list of Canadian Veterans exposed to chemical warfare agent testing. It is a list of military Veterans who were verified to have participated in chemical warfare agent testing. If an ideal nominal roll is a complete and accurate list of all persons who participated in an event or served in a unit, then this may not be achievable. It may never be possible to establish a complete list for large military operations in retrospect. All such lists should be considered “works in progress”, in the words of one of this paper’s reviewers from a Veterans administration in another nation.

There are many reasons to think the list of 1,539 is not complete. For example, archived test trial records from the Second World War and subsequent years are not complete (Laforce 2006). Some Veterans may have gone to their graves honoring oaths of secrecy. Some Veterans and survivors may not have come forward for a variety of personal reasons. There is anecdotal information from VAC personnel that their own relatives from that era, for example, were reluctant to apply for disability pensions because they thought they did not deserve them or they were not disabled to a degree to require them.

The list of 1,539 may not be accurate, for a variety of reasons. To grant a disability pension, VAC did not need absolute proof that a Veteran had been exposed to chemical warfare agents during tests, rather the evidence threshold for decision-making was measured on the balance of probabilities and benefit of doubt along with other evidence such as the presence and cause of a disability.

The VAC list of Canadian Veterans of chemical warfare agents testing is considered neither complete nor fully accurate, but given the retrospective nature of the project, and the strong efforts by DND and VAC staff to construct the list, it probably is the best that can be done. Laforce (2006) reported that as many as 4,285 human subjects were listed in various types of chemical warfare trial records; however he pointed out that this overestimates the number of military personnel actually exposed because it includes civilians, and because not all of those persons were actually used in the tests of chemical warfare agents, for example when tests were cancelled. Therefore, the best estimate of the size of the Veteran nominal roll is between 1,539 and 4,285, and probably closer to the lower end of that range.

Need for Nominal Rolls

Historically, DND has not had a personnel database that captures all postings and movements. For this reason, VAC and the Department of National Defence/Canadian Forces (DND/CF) have been required to develop nominal rolls to assist in identifying Veterans who may have been exposed to various hazards, and will need to do so until

a comprehensive, validated DND personnel database is available. Knowing about the effects of military service on later life may help to mitigate Veteran health outcomes by suggesting preventive measures that can be taken while in service. This knowledge can help DND to maintain a healthy and effective operational force, and help VAC decision-makers to verify a service relationship when Veterans apply for compensation and access to disability benefits and programs related to current health problems.

Examples of retrospective nominal rolls developed by Veterans Affairs Canada (VAC) and/or DND/CF to meet various needs include lists of persons present at Canadian Forces Base Gagetown during herbicide spraying periods[5]; 4,500 Veterans of the Gulf War (Veterans Affairs Canada 2006) later revised to 5,117 (Statistics Canada 2005); and Veterans exposed to nuclear weapons testing to support the "Atomic Veterans" DND recognition program in a similar way (1,276). No nominal roll for asbestos exposure could be developed after the strong link between asbestosis and certain respiratory disorders was established because records were not available for service on navy ships during the era when asbestos was used, and VAC had to wait for Veterans to come forward. It was known which ships, ship types, and ships built in certain eras were likely to have been built using asbestos, but individual exposures were not documented and crew lists are no longer available.

The CF Ombudsman's investigation of the complaints of the treatment of 1 Combat Engineer Regiment Veterans following their 1991 deployment to Kuwait concluded (Côté 2006):

> "*Regarding documentation, this investigation found that some of the problems identified in the case of 1 CER veterans of the Kuwait deployment remain unaddressed more than a decade later. These problems are significant because they may render it more difficult for a Canadian Veteran to obtain a disability benefit, in the event that an environmental exposure results in some form of ill health at some future date. This was the experience of some 1 CER Veterans. Also, we have found that the fact that DND/CF cannot, with certainty, account for every person who has served in a particular deployment is a systemic impediment to the organization's ability to communicate with Veterans of a specific campaign, and to track and analyze health outcomes over time ... DND/CF should ensure that it has the ongoing ability to produce complete and accurate lists of all personnel deployed on each mission ...* ".

This difficult problem is shared by other nations. In Australia, a Senate committee recommended, "*that the ADF (Australian Defence Force) develop a comprehensive and reliable database on Australian peacekeepers that would provide accurate statistics on where and when ADF personnel were deployed. The database would also enable correlations to be made between particular deployments and associated health problems*" (Australia 2008).

[5] Task 1 of the fact-finding project (http://www.dnd.ca/site/reports-rapports/defoliant/index-eng.asp).

In the US, the Department of Veterans Affairs developed lists to support "Atomic Veterans" research and compensation, finding 195,000 servicemen involved in the occupation of Hiroshima and Nagasaki, and 210,000 personnel participating in about 200 post war nuclear tests (National Research Council 2003). In Australia, researchers developed nominal rolls of all Australians who participated in the Korean War[6] and the Vietnam War, and then conducted both cross-sectional surveys and database linkages to measure self-reported health, cancer incidence and mortality compared to the general male population.[7] These are only a few examples of many projects where nominal rolls have been developed retrospectively to support Veterans' compensation.

The development of military Veteran nominal rolls is becoming increasingly popular among Veterans and the public as more is learned about the effects of military service on the life of Veterans and their families, as more Veterans organize to record their service participation, and as more families become interested in their ancestors' military service. Electronic information systems facilitate this activity.

On many websites, Veterans gather to build nominal rolls of their former units or service teams. Much remains to be learned about how Canadian military Veterans formulate their self-identities with respect to former military service, but it is clear that the great majority are proud of their service (Veterans Affairs Canada 2008), and nominal rolls may play important roles in unit histories, and the development and maintenance of Veteran identities among military personnel.

In Canada, more than 800,000 attestation papers of more than 600,000 First World War Veterans were scanned into an electronic database in the late 1990s (http://www.collectionscanada.gc.ca/databases/cef/index-e.html). Individuals can be found online at the public website simply by entering a Veteran's given names or regimental number. The value of this First World War attestation record database for health research or Veterans' administration is not clear, since it was not developed for those purposes; however, it is conceivable that linking this database to others could provide valuable insights into the impact of military service on later life, if individuals can be cross-identified accurately.

Problems with Retrospective Nominal Rolls

Our experience in developing the "mustard gas" list demonstrates how difficult it is to compile an accurate, complete nominal roll retrospectively, and how difficult it is to determine the precise dose and nature of exposures. As Brown (2009a) noted from a clinical perspective, inadequate documentation hampers not only population-based research into potential long-term health outcomes of exposures in military service, but also clinical care of individuals.

[6] http://www.koreanroll.gov.au/
[7] Study reports available at www.dva.gov.au.

Retrospective development of nominal rolls is labour-intensive, costly and difficult. The chemical warfare agent testing list required thousands of hours of VAC staff time. From 2002 to 2009, one VAC Statistics Officer and Mr. Wickett worked extensively and intermittently on developing and maintaining the list. There were particularly intensive work periods each time new aspects of the ex gratia payment program were announced. For several months at a time, the Statistics Officer was tasked solely on this list. Documenting any one of the 8,812 names usually required from a quarter of an hour to many hours.

No nominal roll developed retrospectively is ever likely to be complete. Out of 8,812 names in the mustard gas list, 4,923 did not receive ex gratia payments and could not be confirmed as VAC clients owing to problems with identification data. Other sources of information such as Canada 411 and other available resources were engaged to try to identify clients from often fragmentary information.

It is probable that VAC did not achieve a complete nominal roll of Canadian Veterans who participated in chemical warfare agent testing. The majority of the 8,812 names in the list included persons who participated in training only, participated in neither training nor testing, or had uncertain status.

There are many reasons why the list is likely to be incomplete, and why there were so many difficulties developing the list retrospectively:

- Oath of secrecy issues (Veterans did not disclose their participation to family and caregivers).
- Missing records of persons present at testing trials, due to loss of records, or records not being kept at the time of the trials.
- Incomplete or incorrect data made it impossible to link databases to prove the identity of individuals.
- Difficulty in obtaining lists from various sources.
- Issues relating to information privacy.

The nature, extent and degree of exposures were difficult or impossible to determine for both groups and individuals after so many years. Individuals were rarely named in the reports of specific trials, or individual records were lost over time. Sometimes, devices and compounds used for military purposes or testing in ways thought to be safe at the time are subsequently found to have long-term health consequences. This has been the most common reason for compiling nominal rolls for Veterans' compensation purposes.

Typically, nominal rolls have to be developed in retrospect, often long after service. Australian researchers spent several years in the 1990s developing a nominal roll of Australians who had served in Korea during the 1950s war (Sim et al. 2005). Even with the assistance of government agencies and Veteran's organizations, they were

unable to compile a complete list, but managed to find a significant majority. The roll was used to conduct studies of mortality rates, cancer incidence and general health half a century after the War (Ikin et al. 2009).

An informal literature search produced little that was published on best practices in assembling nominal rolls. A Google search turns up many websites listing various nominal rolls. Many contain descriptions of the methods used to develop them, and problems encountered in assembling, publishing and maintaining them. Holden (2003) described how the Canadian Forces ran a self-identification census in 2001 in an attempt to build a nominal roll for the CF, emphasizing the need to keep the nominal roll up to date from then on. Park (2009) analyzed the structure and development of an Australian Second World War nominal roll compared to methods used in journalism to assemble information for memorialization. Park found that development of that nominal roll may have benefitted from routines used by journalists researching stories. There is literature describing methods used to develop nominal rolls in other sectors, such as the civil service (McCallum and Tyler 2001), but this literature was not reviewed.

In the absence of consensus statements on developing nominal rolls retrospectively, the work is guided by principles in epidemiology, history, information and records management, and VAC's long experience working with Veterans since the First World War.

Database Linking

Databases containing the identity, health, determinants of health and military service of military Veterans are scattered through independent administrative databases held by DND and VAC; various federal, provincial, sub-provincial regional and municipal government agencies; and even within agencies. Theoretically, systems can be built to link these databases together to develop more complete retrospective and prospective nominal rolls, however in reality this is far from a trivial task.

There are early attempts under way to link administrative databases to facilitate the development of nominal rolls of Canadian military Veterans. The task is challenging owing to privacy legislation and information technology complexities, however DND and VAC researchers are gradually working toward solutions.

As VAC found in developing the list of Veterans exposed to chemical warfare agents, it can be challenging or impossible to merge data from various sources, once the way is clear to make the attempt legally and software programming is done. It was often impossible to verify many names on lists provided to VAC and DND staff tasked with verifying exposures to chemical warfare agent testing, owing to the absence of common, consistently used, accurate and unique identifying data.

In the US and Australia, administrators and researchers have been able to link databases to build lists for a variety of purposes. In the US, suicide rates were estimated by Kang and Bullman for Veterans who had served in Iraq and Afghanistan and released during 2001-2005 (2009). They linked data provided by the Defense Manpower Data Center on a cohort of 490,346 Veterans to Veterans Administration electronic health records. Australian researchers linked a nominal roll of Australian men who served in the Korean War with national cancer and mortality databases to compare cancer incidence and death rates with men in the general Australian population (Harrex et al 2003, Pieris-Caldwell et al 2003).

The public and administrators not familiar with the intricacies of data linkage tend to greatly underestimate the difficulty of obtaining valid results from database linkages. Results of retrospective database linkage can be misleading when data are not collected for the purpose of the study, as is usually the case. In the UK, Roff (2003) found one third more cases of melanoma among participants in nuclear weapons tests by direct ascertainment than had previously been estimated from linking administrative databases. This is only one example of the many complex problems encountered when conducting database linkages. Researchers must be careful to fully understand the underlying data before drawing conclusions about linked databases.

Prospective Nominal Rolls and Population Health Studies

Although startup costs, policy development, information technology challenges and infrastructure maintenance are significant, in the long run it could be cheaper to maintain a prospective nominal roll than to periodically mount labour-intensive projects to develop lists retrospectively. Prospective rolls would facilitate both Veteran disability recognition and compensation, and deciding whether certain military service exposures could cause adverse health outcomes later in the life course.

Prospective, longitudinal population health studies can help to shed light on later life effects of military service better than studies based on retrospective nominal rolls. Rather than attempting to follow all Veterans, a population health study like the U.S. Millennium Cohort Study[8] typically follows a sample of Veterans before and after leaving military service. Prospectively collected and maintained nominal rolls make it possible to establish a more valid sub-sample, or even attempt to study all members of the roll ("total population" sampling) to minimize common sources of sub-sampling bias, as was attempted in the Australian studies of Korean War Veterans (Ikin et al 2009).

Like retrospective nominal rolls, valid prospective nominal rolls can be difficult to develop and maintain, requiring dedicated staff and infrastructure. Privacy legislation, organizational boundaries, software and hardware evolution and information technology challenges make it difficult to link databases collected for other purposes. Veterans often are lost to followup when they change addresses or telephone

[8] http://www.millenniumcohort.org/.

numbers, so a nominal roll would have to be continually updated with new contact information, requiring collaboration by Veterans who may not wish to participate. Experience in the digital age has shown that all databases contain some errors, in spite of best efforts.

It may be difficult or even impossible to properly measure exposures to nuclear, biological, chemical, radiation, electromagnetic and mental stress hazards during both training and operational deployments. Some hazards may not even yet be known. For example, the carcinogenic effect of mustard gas was not appreciated until years after the Second World War.

Veteran identity cards have been proposed as a method of recruiting Veterans to keep contact information current after leaving service. It is thought that Veterans would seek the cards to preserve their proof of Veteran status for a variety of reasons, including recognition and compensation.

Conclusion

The list of 1,539 Canadian Veterans of chemical warfare agent testing was retrospectively compiled half a century after the majority of testing was conducted. The list proved useful in reaching Veterans and providing their survivors with compensation including the DND ex gratia payment and, in cases with relevant disabilities, VAC disability pensions, benefits and programs.

Experience has shown that military Veterans will continue to come forward throughout their lives with concerns that past exposures in military service caused their health problems. In spite of more than 5 years of intensive work by DND and VAC with participation by Veterans themselves, it is unlikely that the “mustard gas” list is complete and accurate. DND and VAC can expect to continue to expend significant resources developing nominal rolls to facilitate compensation and mitigation. It may be more cost-effective to invest in prospective nominal rolls and longitudinal population health studies than to continue to mount the effort required to develop nominal rolls retrospectively as issues arise.

Problems with retrospective nominal rolls could be obviated by prospectively developing a comprehensive, validated database showing who served when and where. Such records would assist in documenting the health effects of military service later in life, and could be more cost-effective than building nominal roles retrospectively.

Pre-Publication Reviews

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Table 1. Variables in the VAC SPSS[9] electronic database list of Canadian Veterans who may have participated in chemical warfare agent testing.

Variable	Comments
Service number	
Surname	
First name	
Physiological #1	
Physiological #2	
Location of exposure	
File number	
DOB	
DOD	
Survivor	
Agent of exposure	
Trial numbers 1 to 5	
Trial dates 1 to 8	
Service	
Pension	(is client in pay yes or no)
Total Percent	
Notes or comments	
Condition Numbers 1 to 13	List all pensioned and non-pensioned conditions not necessarily related to mustard gas exposure
Results of application for disability benefits	Favourable, Unfavourable, Withdrawn or Pending
Decision dates	
Disability assessment for each condition	
Source	
Testing	
Training	
Location	
File checked	
CSDN checked	
Ex-gratia received	
Cheque amount	
Ex-gratia declined	
Province	

[9] Statistical Package for Social Sciences.

Table 2. Sources of data for the list.

Type of Source	Number of Persons
DND – initial list	2,575
DND – subsequent lists	5,142
VAC – various sources	829
UK Porton Down	242
Family members or Veterans	18
Media articles	5
VRAB	1
Total	8812

Table 3. Summary numbers of persons in the VAC database master list, as of June 2009.

Number of names in the database	**8812**
Did not receive ex gratia payments and cannot be identified as VAC clients.	4923
Able to identify names as being VAC clients, but they were not successful in receiving disability benefits and either did not receive ex gratia payment or did not apply for it: 250 applied for disability benefits related to chemical warfare agent testing but were not successful owing to unfavourable decision or claim withdrawn (Lack of diagnosis of an existing disability related to exposure was one of the leading reasons for withdrawal of claims); 2100 did not apply for entitlement by VAC for disability benefits related to chemical warfare agent testing.	2350
Received ex gratia payments and/or entitlement for disability benefits related to chemical warfare agent testing: 1332 were VAC clients and received ex gratia payments; 245 also received entitlement for disability benefits related to chemical warfare agent testing; the remainder did not; 145 were entitled by VAC for disability benefits related to service factors and potential chemical warfare agent testing but did not receive ex gratia payments; 62 received ex gratia payments but could not be identified as VAC clients.	1539

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Appendix 1. Summary numbers of persons in the database as of June 2009.

Number of names in the dataset	Did not receive *ex gratia* payment	Received *ex gratia* payment	Subtotals	Totals
VAC client status				
VAC file numbers identified (known to be VAC clients)	2,495	1,332	3,827	
VAC file numbers missing (VAC client status not known)	4,923	62	4,985	
VAC client status total	*7,418*	*1,394*		*8,812*
Deceased				
Deceased with survivors			827	
Deceased without survivors			262	
Deceased total				*1,089*
WordPerfect file				
Applied for ex gratia payment only	165	953	1118	
Favourable decision for entitlement to disability benefits	145	245	390	
Unfavourable decision for entitlement to disability benefits	198	117	315	
Pending decision	0	1	1	
Withdrawn by representative			71	
Withdrawn by client			34	
Withdrawn, lost to followup			9	
Withdrawn, client died			2	
Withdrawn, without prejudice			13	
Withdrawn, not ready to proceed			1	
Total Withdrawn	52	78	130	
Applied for disability benefit entitlement related to exposure	395	441	836	
Total records in WordPerfect file				*1,954*