

**Report to the Minister for Veterans
from
The Veterans' Health Advisory Panel**

**Review and Summary of Information on
the Health Impacts of Exposure to Ionising Radiation**

March 2023

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Introduction

1. In April 2021 the Minister for Veterans asked the Veterans' Health Advisory Panel to provide a review and summary of the most up-to-date information on the health impact of exposure to nuclear radiation on veterans and their descendants; and to provide their views on whether that information suggests there should be any changes to the approach that New Zealand currently takes to these veterans and their families.
2. The Panel engaged an independent third party to undertake a systematic literature review. Applications were sought from New Zealand-based researchers and, following a selection process, the successful applicant was Allen and Clarke Consulting.
3. Work on the review got under way in May 2022. It soon became clear that the scope of the project would need to be extended to provide maximum value.
4. The original statement of work had focused the review on military populations only, and thus excluded the significantly larger body of evidence extending back 70 years from civilian exposures. Once it was realised that this limited the usefulness of the study and effectively excluded any reasonable statement of risk, the project was re-scoped to ensure that a broader range of material would be taken into account. While this extended the timeframe for the work, it has resulted in a final report that covers information that can be used with confidence to understand the implications of nuclear radiation exposure for New Zealand veterans and their whānau.
5. The Panel considers that the methodology used in the review was robust. It is noted that the review focused on high quality literature that has been critically appraised using internationally accepted guidelines.

Limitations of the studies that were reviewed

6. The authors of the review make it clear that there is not a simple relationship between exposure events and effects. They note, for example, that determining levels of ionising radiation is complex - including what is measured, how it is measured, what units are used, what organs are studied, whether the dose received was low, medium or high, and whether exposure was chronic or acute. Adding to the complexity is age at exposure. There are more studies available on mortality (death from radiation) than morbidity (having a disease or medical condition as a result of exposure); the level of detail in reports varies; and as some of the research was authored in Japan, translations may have resulted in lost or inaccurate information.
7. The study notes that "the level of information in the academic literature relating to New Zealand Defence Force personnel was limited". The report does, however, acknowledge previous studies on Operation Grapple (Massey University 2005-07) and Operation Pilaster – Mururoa (ESR - 2015). As one of the inclusion criteria in the literature review was that the studied papers had been published in the scientific literature, these reports were not included, as neither had been promulgated in peer reviewed sources. The findings of the previous papers were not discounted, and the review included current peer reviewed papers considering the potential for genetic damage after exposure to ionising radiation.

The overall conclusions of the literature review

8. The review concluded:

- there is strong and well-documented evidence confirming the impact of radiation on non-solid cancers, and solid cancers, including a number of site-specific solid cancers; there is considerable evidence of psychological effects of exposure; and there are more diverse findings in relation to other non-cancer effects;
- there is mixed evidence about health effects from genetic alterations in adults exposed to ionising radiation; and
- none of the studies that were reviewed (and robustly re-analysed) reported statistically significant findings about the effects on the descendants of people exposed to ionising radiation.

The impact of exposure to radiation on solid and non-solid cancers

9. The literature review states the following:

Non-solid cancers. Findings for non-solid cancers vary by cohort characteristics and the multiple types of disease. There appears to be more and stronger evidence of an association between exposure to ionising radiation and leukaemia, lymphoma, and multiple myeloma than for other non-solid disease conditions. This review found associations in relation to Hiroshima and Nagasaki, the Marshall Islands and Three Mile Island, and Sellafield/Windscale Fire.

Solid cancers. The evidence suggests an excess risk of solid cancer incidence and solid cancer mortality among the [Japanese life span study] cohort and nuclear workers. However, this remains a contested finding. This review found associations in relation to Hiroshima and Nagasaki, Chernobyl, and Fukushima.

Site-specific solid cancers. Site-specific solid cancers considered to have a well-documented dose-response relationship with ionising radiation include the bladder, breast, colon, oesophagus, lung, and thyroid. There is some evidence for a dose-response relationship for bone cancer. The evidence is mixed for associations between ionising radiation and prostate, testicular, liver, and central nervous system cancers. This review found associations for Nagasaki and Hiroshima and colon, liver, lung, prostate, and kidney cancers; the Marshall Islands and Three Mile Island and oesophagus and lung cancers; and Sellafield/Windscale Fire and lung cancer.

Psychological effects of exposure to radiation

10. The literature review states the following:

There is considerable evidence that people exposed to ionising radiation experience adverse effects on mental health, in particular PTSD, depression, anxiety, alcohol and tobacco use, and suicide. This review found associations in relation to adverse mental health and Hiroshima and Nagasaki, Chernobyl, and Fukushima.

11. The Panel noted that much of the evidence regarding psychological outcomes is related to traumatic exposures to radiation through acts of war and accident. The effect of exposure in less traumatic circumstances is less clear, although it is reasonable to assume that fear of radiation exposure would likely have had adverse effects on the psychological wellbeing of those exposed and possibly their families.

Other non-cancer effects of exposure to radiation

12. The literature review states the following:

The literature produced diverse findings regarding cataract; excess risk of circulatory disease; increased incidence of Parkinson's disease; some evidence that low-dose environmental exposure may be associated with higher-than-expected prevalence of antithyroid antibodies; and a possible association between chronic renal dysfunction and later cardiovascular disease mortality. This review found associations for circulatory disease and Hiroshima and Nagasaki, and Fukushima, as well as for Parkinson's disease and the Marshall Islands and Three Mile Island.

Genetic effects for exposed adults

13. The literature review states the following:

There is mixed evidence about health effects from genetic alterations in adults exposed to ionising radiation. There is some evidence for changes in molecular markers demonstrating DNA damage, and some evidence for genomic changes in mutated genes for people who later developed MDS [Myelodysplastic syndromes]. This review found associations in relation to Chernobyl and Fukushima.

Genetic effects for descendants

14. The literature review states the following:

Among 15 reviews and studies included in this review, and despite the reanalysis of data using more robust methods, none reported statistically significant findings about effects on the descendants of people exposed to ionising radiation.

New Zealand's nuclear veterans

15. The purpose of this literature review was to establish whether the most up-to-date evidence indicates that there may be implications not previously identified for New Zealand veterans who may have been exposed to ionising radiation; and whether the new information indicates that New Zealand should change the approach it currently takes to these veterans and their families.

16. There are three main groups of veterans in New Zealand whose deployments may have exposed them to ionising radiation: those who served in Jayforce in Japan (1946 – 1949); those who served in Operation Grapple (Kiribati – Christmas and Malden Islands 1957 - 1958); and those who served on the New Zealand frigates that deployed to Mururoa in 1973.

Entitlements specifically for New Zealand's nuclear veterans

17. New Zealand has had, since 2007, a list of presumptively accepted conditions related to ionising radiation exposure. All veterans who served in Jayforce, Operation Grapple, or at Mururoa are covered by this. Under the Presumptive List, an injury or illness is automatically deemed to be attributable to service if the veteran served in the deployment for which there is a presumptive list; and the injury or illness is on the list.

18. The following table summarises what entitlements are available specifically for New Zealand's nuclear veterans.

Veterans' Affairs entitlements for veterans of Jayforce, Operation Grapple, and Mururoa deployments

Note: In addition to the entitlements set out in the table below, veterans (and their families) may apply for any of the entitlements available under the Veterans' Support Act 2014 (and previously could do so under the War Pensions Act 1954).

Entitlement	Jayforce	Operation Grapple	Mururoa
<p>Conclusively presumed injuries, illnesses and conditions</p> <p>For these deployments there are lists of conclusively presumed injuries, illnesses, and conditions, which have been incorporated into legislation, and which must be treated as service-related. In other words, if a veteran with the relevant service applies for cover for one of the conditions on the list, it is automatically accepted.</p>	<p>Exposure to nuclear radiation</p> <p>(Regulation 12 of the Veterans' Support Regulations 2014).</p> <p>(a) all forms of leukaemia (except for chronic lymphocytic leukaemia);</p> <p>(b) bronchioloalveolar carcinoma;</p> <p>(c) cancer of the thyroid, breast, pharynx, oesophagus, stomach, small intestine, pancreas, bile ducts, gall bladder, salivary gland, urinary tract (renal, ureter, urinary bladder, or urethra), brain, bone, lung, colon, or ovary;</p> <p>(d) lymphomas (other than Hodgkin's disease);</p>	<p>Exposure to nuclear radiation</p> <p>(Regulation 12 of the Veterans' Support Regulations 2014).</p> <p>(a) all forms of leukaemia (except for chronic lymphocytic leukaemia);</p> <p>(b) bronchioloalveolar carcinoma;</p> <p>(c) cancer of the thyroid, breast, pharynx, oesophagus, stomach, small intestine, pancreas, bile ducts, gall bladder, salivary gland, urinary tract (renal, ureter, urinary bladder, or urethra), brain, bone, lung, colon, or ovary;</p> <p>(d) lymphomas (other than Hodgkin's disease);</p> <p>(e) multiple myeloma;</p> <p>(f) primary liver cancer (except if</p>	<p>Exposure to nuclear radiation</p> <p>(Regulation 12 of the Veterans' Support Regulations 2014).</p> <p>(a) all forms of leukaemia (except for chronic lymphocytic leukaemia);</p> <p>(b) bronchioloalveolar carcinoma;</p> <p>(c) cancer of the thyroid, breast, pharynx, oesophagus, stomach, small intestine, pancreas, bile ducts, gall bladder, salivary gland, urinary tract (renal, ureter, urinary bladder, or urethra), brain, bone, lung, colon, or ovary;</p> <p>(d) lymphomas (other than Hodgkin's disease);</p> <p>(e) multiple myeloma;</p> <p>(f) primary liver cancer (except if</p>

	<p>(e) multiple myeloma;</p> <p>(f) primary liver cancer (except if cirrhosis or hepatitis B is indicated).</p>	<p>cirrhosis or hepatitis B is indicated).</p>	<p>cirrhosis or hepatitis B is indicated).</p>
<p>Services for children specific to nuclear veterans</p>	<p>Not available for Jayforce.</p>	<p>Provided under Cabinet decisions made in 2001 and 2002.</p> <ul style="list-style-type: none"> • Family/psychological counselling (usually up to 10 sessions, but there is discretion to approve more); • Genetic Counselling (GP appointment and costs for counselling that are not publicly funded); • As clarified by 2021 VA policy, Genetic Testing may be funded if not covered by public policy, but must always be preceded by genetic assessment and genetic counselling (may include pre-symptomatic/predictive or diagnostic testing if a possible genetic condition has been identified through the family history, or the genetic testing of other family members); • Out-of-pocket health costs for an accepted condition (accepted conditions include: cleft lip; cleft palate; adrenal gland cancer; 	<p>Not available for Mururoa.</p>

		<p>acute myeloid leukaemia; spina bifida manifesta).</p> <p>Costs that can be reimbursed without pre-approval include GP visits, pharmaceuticals on the PHARMAC list, and scans up to \$1,000. Other services, such as physiotherapy, may be funded if incurred as part of treatment in the public system.</p> <p>Most of the services are restricted to a veteran's natural born children, born after return (temporary or permanent) from Operation Grapple). The exception is psychological counselling, which can be for the veteran's natural children; adopted children, including whāngai; stepchildren, if raised as the veteran's children; and grandchildren, if raised as the veteran's children.</p>	
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19. It is noted that all of the cancers where the literature review reports that the evidence is relatively strong and consistent across explored exposures are included on the New Zealand Presumptive List.

Entitlements for nuclear veterans under the Veterans' Support Act 2014

20. In addition to the presumptively accepted conditions listed above, New Zealand's nuclear veterans, like other eligible veterans, can apply for cover under the Veterans' Support Act for any condition which they believe to be related to their qualifying operational service.

21. Veterans' Affairs is required to make decisions on applications according to a process set out in its legislation. It must consider all relevant information and decide whether it is consistent with a hypothesis that the veteran's illness, injury, or death was service-related. In this, Veterans' Affairs is guided by Statements of Principles, developed in Australia and confirmed in New Zealand by the Veterans' Health Advisory Panel.

22. These Statements of Principles contain a list of factors that, on the basis of sound medical-scientific evidence, link the condition to service. The factor may link to causation or aggravation (clinical worsening of an existing condition). If there is no Statement of Principles, decisions are made on whether a hypothesis is reasonable i.e. more than a possibility, consistent with known facts, and not inconsistent with provided or known scientific facts.

23. There are Statements of Principles for a number of the conditions for which the literature review found studies that showed possible associations with exposure to ionising radiation, including cataracts, Parkinson's disease, circulatory and cardiovascular diseases. The underlying pathologies causing renal dysfunction are considered in various Statements of Principles, and there are Statements of Principles for thyroid disease.

24. The literature review recognises that the evidence supporting the relationship between exposure to ionising radiation and most of these conditions is inconsistent and the relationships unclear. A quantitative factor is included where the evidence is strong enough to support the inclusion of such a factor in the relevant Statements of Principles. The exception is Parkinson's disease. The evidence relating Parkinson's disease to ionising radiation is contradictory and inconclusive. This is reflected both in the review and in the exclusion of a radiation factor in the related Statement of Principles.

25. The literature review noted that there is strong evidence of the psychological impact of being exposed to ionising radiation. Treatment of mental health conditions is available to veterans under the Veterans' Support Act. Although the literature review did not focus on the psychological impact of the exposure of a parent to ionising radiation, the Panel notes that section 107 of the Act makes provision for counselling funded by Veterans' Affairs to be made available to the families of veterans suffering from mental harms or illness associated with the veteran's service-related conditions.

The Panel's conclusions

26. The Panel considers that this systematic literature review has been robust and is academically sound. Those conducting it followed best practice in selection and assessment of the available material. Although they carried out their work independently, they were responsive to Panel requirements to amend the scope of the project in order to encompass a broader range of research than that initially agreed, in order to enhance the value of the work.

27. The final document confirms what has been known for many years, in particular, the link between exposure to radiation and a number of cancers. It does not, however, highlight any significant new information from strong and consistent studies to show previously unknown links between exposure to ionising radiation and illnesses that result from that exposure.

28. Based on this systematic literature review, the Panel sees no need for New Zealand to add new conditions to the current list of conclusively presumed conditions that applies to those exposed to nuclear radiation (the Presumptive List).

29. The Panel is aware of concern amongst veterans about the possible impact of their deployments on their descendants. We note that, while the literature review reported mixed evidence about health effects from genetic alterations in adults exposed to ionising radiation, the review found no statistically significant findings about genetic effects on the descendants of those who had been exposed.

30. We have noted, however, the difference in treatment of veterans from Operation Grapple and those who served in Jayforce or deployed to Mururoa. The children of Operation Grapple veterans have some entitlements that are not provided to the children of Jayforce or Mururoa veterans. While the family/psychological counselling that has been available since 2001/02 for the children of Grapple veterans is now available to the families of all eligible veterans, genetic counselling, genetic testing, and out-of-pocket health costs for accepted conditions are not. Accepted conditions for the natural born children of veterans born after the veteran's return (temporary or permanent) from Operation Grapple include cleft lip; cleft palate; adrenal gland cancer; acute myeloid leukaemia; and spina bifida manifesta.

31. We learned nothing from the literature review to indicate that the children of Operation Grapple veterans are likely to face different risks compared to the children of veterans deployed in Jayforce or to Mururoa. The Minister may wish to consider whether, in the interests of equity, the entitlements that have been available for more than twenty years to Grapple children could now be extended to also include the children of Jayforce and Mururoa veterans.

32. Our final recommendation relates to the need to keep this matter under review. While the work just completed has summarised the evidence that is currently available, it is recommended that consideration be given to repeating a review every seven to ten years (unless a major new study provides grounds for earlier review). That would ensure New Zealand remains aware of the most up-to-date information, and can respond to any new evidence that could be relevant to those veterans who served in nuclear deployments and to their whānau.

Summary of recommendations

33. The Panel recommends that:

- a. no new conditions need to be added to the current list of conclusively presumed conditions that apply to those exposed to nuclear radiation (the Presumptive List);
- b. consideration be given to extending the entitlements that are currently available only to the children of Operation Grapple veterans to the children of Jayforce and Mururoa veterans; and
- c. consideration be given to repeating a review on the health impacts of exposure to nuclear radiation every seven to ten years (unless a major new study provides grounds for earlier review).