



Specialist Medical Review Council

Reasons for Decisions

*Section 196W
Veterans' Entitlements Act 1986*

**Re: Statements of Principles Nos. 33 & 34 of 2005
In Respect of Cervical Spondylosis**
Matter Nos. 2006/15
Request for Review Declaration No. 15

SUMMATION

1. In relation to the Repatriation Medical Authority (the RMA) Statements of Principles Nos. 33 & 34 of 2005 (as amended) in respect of cervical spondylosis and death from cervical spondylosis, made under subsections 196B(2) and 196B(3) of the *Veterans' Entitlements Act 1986* (the VEA), the Specialist Medical Review Council (the Council) under section 196W of the VEA:

DECLARES that

- the sound medical-scientific evidence available to the RMA is insufficient to justify an amendment of the Statements of Principles in respect of the factors (at 6(i) and 6(s) of Statement of Principles No 33 of 2005 (as amended) and 6(f) and 6(r) of Statement of Principles No 34 of 2005 (as amended)) relating to carrying loads on the head while upright

AND FURTHER DECLARES THAT:

- the sound medical-scientific evidence available to the RMA is insufficient to justify an amendment of the Statements of Principles

to include a factor or factors in respect of:

- a) carrying loads on the shoulder girdle and the resulting effect on the neck;
and/or

- b) repetitive movement either separate to, or in conjunction with, loads on the head.

AND

- RECOMMENDS the RMA carry out a new investigation to find out whether there is sound medical-scientific evidence to justify including a factor or factors in respect of:
 - carrying loads on the shoulder girdle and the resulting effect on the neck; and/or
 - repetitive movement either separate to, or in conjunction with, loads on the head

in Statements of Principles Nos. 33 & 34 of 2005; and

- for the purposes of the investigation, consider asking the Secretary of the Department of Veterans' Affairs (DVA) under section 196C(2) of the VEA to:
 - carry out research (including any test or experiment) to obtain, confirm, or disprove, specific information about the prevalence of cervical spondylosis in service personnel and any potential association with carrying loads on the shoulder girdle and the resulting effect on the neck and/or repetitive movement either separate to, or in conjunction with, loads on the head; and
 - to forward a report to the RMA.

THE SPECIALIST MEDICAL REVIEW COUNCIL

2. The Council is a body corporate established under section 196V of the VEA, and consists of such number of members as the Minister for Veterans' Affairs determines from time to time to be necessary for the proper exercise of the function of the Council as set out in the VEA. The Minister must appoint one of the Councillors to be the Convener. When a review is undertaken the Council is constituted by 3 to 5 Councillors selected by the Convener. When appointing Councillors, the Minister is required to have regard to the branches of medical science expertise that would be necessary for deciding matters referred to the Council for review.
3. Dr Charles Guest FAFPHM was the Presiding Councillor of the Council for this review. He is President-Elect, Faculty of Public Health Medicine (Royal Australasian College of Physicians), Professor at the Australian National University Medical School, and, until May 2011, Chief Health Officer in the Australian Capital Territory.
4. The other members of the Council were:
 - (i) Associate Professor John Hart
5. Associate Professor Hart is an Orthopaedic Surgeon based in Melbourne. He was Head of the Orthopaedic Unit at the Alfred Hospital from 1980 until 2003 and is a Clinical

Associate Professor in the Department of Surgery at Monash University. He has published numerous articles relating mainly to joint replacement and joint resurfacing. He was President of the Australian Orthopaedic Association in 1998/99 and was awarded the L.O. Betts gold medal of the Association in 1997. He was Chairman of the International Girdlestone Orthopaedic Society from 1995 to 1996. He is an Honorary Member of the Australian College of Sports Physicians, the Knee Society in the USA and the North American Association for Arthroscopy.

(ii) Professor Geoffrey Littlejohn

6. Professor Littlejohn is Associate Professor of Medicine and Director of Rheumatology at Monash Medical Centre, Melbourne, and Adjunct Professor at Edith Cowan University, Perth. He completed a MD thesis on Diffuse Idiopathic Skeletal Hyperostosis in Toronto and has remained an international expert in that field. He has also published widely in other rheumatic disorders including inflammatory joint disease, chronic pain syndromes and osteoarthritis. He has published widely, and talks regularly to health professionals both nationally and internationally.

(iii) Dr David Newman

7. Dr Newman is an aviation medicine specialist, with particular expertise in the physiology of human exposure to acceleration. He spent over 12 years in the RAAF as a medical officer and aviation medicine specialist.

He holds a medical degree from Monash University, a PhD in physiology from the University of Newcastle, and a DipAvMed, from the Royal College of Physicians of London. He is an Associate Fellow of the Aerospace Medical Association, and is a member of the Editorial Board of the international journal *Aviation Space and Environmental Medicine*. He is a qualified pilot and an active researcher. He was the recipient of the Aerospace Medical Association's Arnold Tuttle Award in 2000, and the Royal Aeronautical Society's 2000 Buchanon-Barbour Prize for outstanding contributions to aviation medicine.

He consults in aviation medicine internationally, and is a consultant to the Australian Transport Safety Bureau, where he has been involved in several aircraft accident investigations. He holds several academic positions, including Head of Research in the Aviation Discipline, Faculty of Engineering and Industrial Sciences at Swinburne University, Victoria, and Head of the Aviation Medicine Unit in the Department of Epidemiology and Preventive Medicine at Monash University.

THE LEGISLATION

8. The legislative scheme for the making of Statements of Principles is set out in Parts XIA and XIB of the VEA. Statements of Principles operate as templates, which are

ultimately applied by decision-makers in determining individual claims for benefits under the VEA and the *Military Rehabilitation and Compensation Act 2004* (the MRCA)¹.

9. Fundamental to Statements of Principles is the concept of 'sound medical-scientific evidence', which is defined in section 5AB(2) of the VEA. Information about a particular kind of injury, disease or death is taken to be sound medical-scientific evidence if:
- a) the information
 - i) is consistent with material relating to medical science that has been published in a medical or scientific publication and has been, in the opinion of the Repatriation Medical Authority, subjected to a peer review process; or
 - ii) in accordance with generally accepted medical practice, would serve as the basis for the diagnosis and management of a medical condition; and
 - b) in the case of information about how that injury, disease or death may be caused meets the applicable criteria for assessing causation currently applied in the field of epidemiology².
10. The functions of the Council are set out in section 196W of the VEA. In this case, the Council was asked (under section 196Y of the VEA) by a person eligible to make a claim for a pension, to review the contents of:
- a) Statement of Principles No. 33 of 2005, in respect of cervical spondylosis and death from cervical spondylosis, being Statement of Principles determined by the RMA under section 196B(2)³ of the VEA ('the reasonable hypothesis test'); and
 - b) Statement of Principles No. 34 of 2005, in respect of cervical spondylosis and death from cervical spondylosis, being Statement of Principles determined by the RMA under section 196B(3)⁴ of the VEA ('the balance of probabilities test').

¹ See sections 120, 120A and 120B of the VEA and sections 335, 338 and 339 of the MRCA.

² This has been held to mean 'information which epidemiologists would consider appropriate to take into account' see *Repatriation Commission v Vietnam Veterans' Association of Australia NSW Branch Inc* (2000) 48 NSWLR 548 (the New South Wales Court of Appeal decision) per Spigelman CJ at paragraph 117.

³ 196 B provides;

(2) If the Authority is of the view that there is sound medical-scientific evidence that indicates that a particular kind of injury, disease or death can be related to:

- (a) operational service rendered by veterans; or
- (b) peacekeeping service rendered by members of Peacekeeping Forces; or
- (c) hazardous service rendered by members of the Forces; or
- (ca) warlike or non-warlike service rendered by members;

the Authority must determine a Statement of Principles in respect of that kind of injury, disease or death setting out:

- (d) the factors that must as a minimum exist; and
- (e) which of those factors must be related to service rendered by a person;

before it can be said that a reasonable hypothesis has been raised connecting an injury, disease or death of that kind with the circumstances of that service.

11. Specifically, the Applicant contended for a factor or factors to be included in Statements of Principles Nos. 33 and 34 of 2005 in respect of weight-bearing on the shoulders and neck.
12. In conducting its review, the Council must review all the information that was available to (before) the RMA at the time it determined, amended, or last amended the Statements of Principles (the relevant times) and is constrained to conduct its review by reference to that information only⁵.
13. Under section 196W of the VEA, the Council can only reach the view that a Statement of Principles should be amended on the basis of sound medical-scientific evidence.

BACKGROUND

Application for review by the Council

14. On 8 November 2005, the RMA under subsection 196B(2), (3) and (8) of the VEA determined the Statements of Principles being the instruments Nos. 33 & 34 of 2005, in respect of cervical spondylosis, expressed to take effect from 16 November 2005.
15. On 28 November 2005 in accordance with section 42 of the *Legislative Instruments Act 2003* the Statements of Principles were tabled in the House of Representatives and in the Senate.
16. On 10 November 2005 the Statements of Principles were registered on the Federal Register of Legislative Instruments (FRLI).
17. An application dated 1 February 2006 for review of the Statements of Principles Nos. 33 & 34 of 2005 was received by the Council on 6 February 2006. Specifically the application was concerned with the characterisation by the RMA of the factors in the Statements of Principles concerning carrying loads on the head.

⁴ 196 B provides;

(2) If the Authority is of the view that there is sound medical-scientific evidence that indicates that a particular kind of injury, disease or death can be related to:

- (a) operational service rendered by veterans; or
- (b) peacekeeping service rendered by members of Peacekeeping Forces; or
- (c) hazardous service rendered by members of the Forces; or
- (ca) warlike or non-warlike service rendered by members;

the Authority must determine a Statement of Principles in respect of that kind of injury, disease or death setting out:

- (d) the factors that must as a minimum exist; and
- (e) which of those factors must be related to service rendered by a person;

before it can be said that a reasonable hypothesis has been raised connecting an injury, disease or death of that kind with the circumstances of that service.

⁵ *Vietnam Veterans' Association (NSW Branch) Inc v Specialist Medical Review Council and Anor* (full Federal Court decision) (2002) 72 ALD 378 at paragraph 35 per Branson J.

18. Pursuant to section 196ZB of the VEA the Council published in the Gazette a notice of its intention to carry out a review of all the information available to the RMA about cervical spondylosis, and inviting persons or organisations authorised so to do to make submissions to the Council (Gazette number 23 of 2006 p. 1373). The Council gazetted three subsequent notices as to the dates by which written submissions must be received by the Council⁶.

Amendments to Statements of Principles

19. On 1 November 2007, the RMA gave notice under section 196G of the Act that, pursuant to subsection 196B(7) of the VEA that it intended to carry out an investigation in respect of the factors (and associated definitions) connecting cervical spondylosis with aircraft flight.
20. On 22 October 2008, the RMA under subsection 196B(8) of the VEA amended Statements of Principles Nos. 33 and 34 of 2005 by two instruments, each entitled Amendment Statement of Principles, being the instruments Nos. 76 and 77 of 2008 expressed to take effect from 5 November 2008.
21. By the Amendment Statements of Principles, the RMA amended Nos. 33 and 34 of 2005 by replacing the definition of high performance aircraft in clause 9:
- an aircraft capable of routinely sustaining at least two positive G forces
- with a new definition:
- an aircraft capable of routinely sustaining a positive G force of four or more.
22. The amendments affect existing factors in respect of flying in high-performance aircraft; 6(j) and 6(t) in Statement of Principles No. 33 of 2005 and 6(i) and 6(s) in the Statement of Principles No. 34 of 2005. The Amendment Statements of Principles were registered on FRLI on 5 November 2008.
23. No application was received by the Council for review of the Amendment Statements of Principles Nos. 76 and 77 of 2008.

The information sent by the RMA to the Council

24. The RMA is obliged under section 196K of the VEA to send to the Council all the information that was available to it (the RMA) at the relevant times, i.e. when it determined, amended, or last amended the Statements of Principles. That comprises all the information that was available to the RMA when it determined the first Statements of Principles in respect of cervical spondylosis in 1995, and all the information subsequently available at all times when the Statements of Principles have been

⁶ Gazette Notice 4 of 2007, p. 452 ; Gazette Notice 32 of 2007, p. 1284; and Gazette Notice 30 of 2009, p. 1960

amended, or revoked and replaced, up to and including that information which was available in 2005 when the RMA determined the Statements of Principles under review.

25. In other words, within 28 days after being notified that the Council has been asked to conduct a review, the RMA must send to the Council all the information in respect of cervical spondylosis which was in the possession of the RMA at the time it (the RMA) made the decision that triggered the Council's review.
26. By letter dated 8 June 2006 the RMA, under section 196K of the VEA, sent to the Council the information the RMA advised was available to (before) it at the relevant times.
27. By agreement between the RMA and the Council, information the RMA advised was available to (before) it at the relevant times is posted on a secure website (referred to as FILEForce) and is made accessible to the Council, the Commission, the applicant and other interested parties via confidential password.
28. By letter dated 16 June 2008 the RMA, under section 196K of the VEA, confirmed for the Council the information the RMA advised was available to (before) it at the relevant times. This information was posted on FILEForce on 28 March 2009.

Written submissions

29. The Applicant submitted two written submissions dated 18 September 2006, and 13 July 2010 referable to the review addressing the Council's proposed scope of review, but not addressing the pool of information decisions, and at the Council's meeting on 13 August 2010 made an oral submission complementing his written submissions.
30. The Repatriation Commission made one written submission dated 29 March 2010. The Repatriation Commission stated it did not wish to propose any alteration to the Council's preliminary views on the pool of information. A Medical Officer with the Department of Veterans' Affairs, representing the Repatriation Commission, made an oral submission complementing the Commission's written submissions at the Council's meeting on 13 August 2010.
31. The Council held a meeting on 13 August 2010 to hear oral submissions complementing the written submissions. At the hearing the Council provided access to all of the information.

Notification of Preliminary Decisions on Amendment Statements of Principles, Proposed Scope of Review and Proposed Pool of Information

32. The Council's preliminary decision as to the proposed pool of information included information that the Council was satisfied:
 - was sound medical-scientific evidence;

- 'touched on' (was relevant to) the review; and
 - was considered appropriate to take into account by epidemiologists.
33. By letter dated 21 July 2010 to the Commission, the Council advised that the Council was then of the opinion that the Amendment Statements of Principles did not affect its ability to review the Statements of Principles. It was explained in those letters that the information that was available to (before) the RMA at the time it made Statements of Principles Nos. 33 and 34 of 2005 was sent to the Council pursuant to section 196K and that that information did not include the information that was available to (before) the RMA at the time that it made the Amendment Statements of Principles (Nos. 76 & 77 of 2008). The information available to (before) the RMA at the time that it made the Amendment Statements of Principles was not sent to the Council by the RMA. A copy of this letter was sent to the Applicant on 26 July 2010, for his information.
34. The Council further advised the Applicant and the Commission of:
- the Council's preliminary decisions on the proposed scope of the review and proposed pool of information; and
 - invited the Applicant and the Commission to make any written comments on those preliminary decisions by 30 July 2010.

Preliminary decision on Scope of Review

35. The Council's preliminary view, as advised to the Applicant and Repatriation Commission on 6 July 2010 respectively was as follows:

Without limiting the scope of the SMRC's review of the (whole of) the contents of SoPs Nos. 33 and 34 of 2005, in respect of cervical spondylosis, the SMRC presently proposes to have particular regard to whether there is sound medical-scientific evidence upon which the RMA could have relied to amend the Statements of Principles in any or all of the following ways:

(a) the possible amendment of the factor, or affirming of the factor, namely that factor referred to at 6(i) 'carrying loads of at least 15kg on the head while upright to a cumulative total of 72 000 kg within any 10 year period, before the clinical onset of cervical spondylosis' in Statement of Principles number 33 of 2005, and listed in Table 3.

(b) the possible amendment of the factor, or affirming of the factor, namely that factor referred to at 6(h) 'carrying loads of at least 25 kg on the head while upright to a cumulative total of 120 000 kg within any 10 year period, before the clinical onset of cervical spondylosis, and where such physical activity has ceased, the clinical onset of cervical spondylosis has occurred within the 25 years immediately following such activity' in Statement of Principles number 34 of 2005, and listed at Table 3.

(c) the possible amendment of an existing factor or inclusion of a new factor in respect of carrying loads on the shoulder and the resulting effect on the neck and repetitive movement whether separate to or in conjunction with loads on the head.

36. At the hearing on 13 August 2010, the Council clarified to the Applicant and the Commission's representative that in each Statement of Principles, there are two additional factors in relation to carrying loads on the head which Council proposed to include in the review. Those were the factors relating to clinical worsening, which are in identical terms to the factors notified in the letters of 6 July 2010, except that they deal with the clinical worsening of the condition. In Statement of Principles No. 33 of 2005, the additional factor is clause 6(s):

Carrying loads of at least 15 kilograms on the head while upright, to a cumulative total of at least 72,000 kilograms within any 10-year period, before the clinical worsening of cervical spondylosis.

and in Statement of Principles No. 34 of 2005, the factor is 6(r):

Carrying loads of at least 25 kilograms on the head while upright, to a cumulative total of at least 120,000 kilograms within any 10-year period, before the clinical worsening of cervical spondylosis and where the clinical worsening of cervical spondylosis occurs within the 25 years following that period.

37. The Council also considered the issue of loads on the shoulder, and the resulting effect on the neck, and made it clear to the Applicant and the Commission's representative that in considering the shoulder the Council proposed to consider the shoulder girdle, that is that part of the shoulder nearest the neck. The issue the Council therefore proposed to consider was:

Carrying loads on the shoulder girdle and the resulting effect on the neck, and repetitive movement either separate to, or in conjunction with, loads on the head.

38. The Applicant and the Commission's representative were invited to comment on those matters at the hearing or by written comment within an agreed timeframe. No comments were received.

Preliminary decision on the Pool of Information

39. As mentioned above, the RMA is obliged under section 196K of the VEA to send to the Council all the information that was available to it (the RMA) at the relevant times, i.e. when it determined, amended, or last amended the Statements of Principles. That comprises all the information that was available to the RMA when it determined the original Statements of Principles in 1995, and all the information subsequently available at all times when the Statements of Principles have been amended, or revoked and replaced, up to and including that information which was available in 2005 when the RMA determined the Statements of Principles under review.

40. In other words, within 28 days after being notified that the Council has been asked to conduct a review, the RMA must send to the Council all the information in respect of cervical spondylosis which was in the possession of the RMA at the time it (the RMA) made the decision that triggered the Council's review.

41. In determining the pool of information the Council applied the methodology it had advised the Applicant and Repatriation Commission on 6 July 2010 i.e. that the pool of information should comprise the information:

- that was available to (before) the RMA at the relevant times;
- which was sent by the RMA to the Council under section 196K of the VEA; and
- which was considered by the Council to be sound medical-scientific evidence as defined in section 5AB(2) of the VEA being information which:
 - (1) epidemiologists would consider appropriate to take into account; and
 - (2) in the Council's view 'touches on' (is relevant to);
 - carrying loads on the head; or
 - weight-bearing on the shoulders or neck and particularly in respect of the shoulder girdle; or
 - repetitive twisting or bending of the neck with or without load bearing;

and has been evaluated by the Council according to epidemiological criteria, including the Bradford Hill criteria.⁷

42. For the purposes of making its revised preliminary and then final decisions on the proposed pool of information, the Council took into account all the information identified to it by the RMA on 8 June 2006. The Council then applied the two-stage process (discussed at paragraphs 84 and 85 below) to the information within the pool, all of which was available to (before) the RMA at the relevant times.

43. Information which the RMA advised was not available to (not before) the RMA at the relevant times, was not taken into account by the Council for the purposes of the review, but was considered as 'new information'.

44. A copy of the Council's preliminary decision on the proposed pool of information is attached at **Appendix A**.

APPLICANT'S SUBMISSIONS

45. The Applicant made written submissions to the RMA and to the Council, all of which were taken into account by the Council.

46. In his application to the Council of 1 February 2006, the Applicant stated that his grounds for review were as follows:

⁷ see Bradford Hill, A (1965) 'The Environment and Disease: Association or Causation?' *Proceedings of the Royal Society of Medicine* Section of Occupational Medicine, Meeting January 14, pages 295 to 300.

that the sections in the SoPs on weight bearing 'on the head while upright' are "unreasonable, harsh, not a part of the normal working life of a civilian or a naval member".

47. Further written submissions by the Applicant dated 19 September 2006 and 13 July 2010 were received by the Council on 27 September 2006 and 16 July 2010 respectively.
48. These submissions were in addition to the Applicant's submissions to the RMA dated 16 July 2005, which were included in the information sent by the RMA to the SMRC under section 196K of the VEA.
49. As mentioned above, the Applicant also made a comprehensive oral submission complementing his written submissions⁸.
50. In summary, the Applicant's primary submission was that:
During his ten year of service in the Australian Navy the Applicant was required to carry heavy loads in excess of 25kg from the ships stores to the ships galley. He submitted that the loads were carried on the shoulders (the Council took this to be a reference to the shoulder girdle), and supported by the head, whilst climbing vertical steps in a moving and pitching ship.
51. The Applicant highlighted circumstances and conditions that he and other members of the RAN faced in 1973 which he contended were different to that of the civilian environment.
52. The Applicant contended his cervical spondylosis was caused by carrying weights in excess of 25kg - cumulatively just over one million kilograms approximately - over a period of 10 years. In the processes of storing ships with stores, including dry weights, meats and vegetables and milk churns, he manually carried weights up and down ladders of 2.7 metres in length, some of which were vertical and some inclined at 48 degrees.
53. The Applicant explained that there were no mechanical handling devices to assist the storage of supplies. He concentrated mainly on meat and vegetables and manhandled quantities of meat and boxes down the various decks to storage areas. He said that, in some cases, the only way to get the store down to the next deck, was for one person to lie over the top of the hatch with a second person braced halfway down the ladder; the first to drop the items down to the second person.
54. Boxes etc were carried in the curve of his shoulder, supported by his neck. As he is right handed, about 70 - 80% of the time he carried weights on the left shoulder, leaving the right hand free to pull himself up ladders, swapping shoulders occasionally. On ascent, he would use one hand to help get up the ladder, with the other arm supporting

⁸ The discussion of the Applicant's submissions set out in these Reasons is derived from the written submissions and the complementary oral submission here identified.

the weight on the shoulder girdle. Once he reached the top of a vertical ladder, if someone was not on the next deck to assist, he would either attempt to throw the load over, using his shoulder, or juggle it on to his head and push it over. That is the only time he ever used his head; not for carrying, but to push the load over the final step onto the next deck. When throwing the weight onto the next deck, he used the leverage of his shoulder and his head to toss the load over the side of the top of the hatch; the ladders ceasing at the edge of the hatch.

55. In the case of a pitching ship, he would use one hand to steady himself, and then travel down or up decks. The Applicant explained that if the ship was really pitching, it was a battle to maintain a hold on the load and keep moving. The force of the weight being carried while the ship was pitching was much more than the stationary weight of the load. During his service, safety shoes were not worn and slips were common.
56. On the main deck, the deck heads were low, so that sailors could not carry the weights on their shoulders. Instead loads were carried in the arms in front of the body, so that they were straining all the time, using neck, shoulder and back muscles.

Applicant's comments on the Scope of Review and Pool of Information

57. The Applicant made no comment on the Council's preliminary decisions on the scope of the review and pool of information other than to confirm his interest in carrying weights on the shoulder girdle.

REPATRIATION COMMISSION'S SUBMISSIONS

58. The Commission submitted that there is evidence within the information pertinent to the decision, that was available to the RMA on "carrying loads on the head" that:
...underpin the current factor" and adding that "...the current factor reasonably reflects that existing evidence.
59. The Commission submitted however that the studies that were available to the RMA on weight bearing and cervical spondylosis were:
... limited in both extent and quality.
60. Given the paucity of information available, the Commission submitted that the evidence does not indicate, nor establish on the balance of probabilities, that cervical spondylosis can be caused by weight bearing activities other than carrying loads on the head.

Repatriation Commission's comments on the Scope of Review and Pool of Information

61. The Commission stated its interpretation of the scope of the review to be:
...a widening of the current factors or the addition of further factors to cover circumstances where weight is borne other than on the head.

62. The Commission stated that its submission would therefore focus on the role of weight bearing (load carrying or lifting) in general in causing or worsening cervical spondylosis.
63. The Commission's representative agreed with the Council in the oral submission, that:
... the mode of activity in the current factor for carrying loads on the head, is of very little relevance to any Australian service personnel" but that there is "...not really a lot of direct evidence" to support "... load carrying ...other than directly on the head.
64. The Commissions' representative pointed out that given the shortage of medical-scientific evidence before the RMA about cervical spondylosis that further investigation of the types of activities undertaken by the applicant could be warranted. He commented that, people in the Navy doing that sort of work would make good subjects for a study that could provide some useful results.
65. The Commission concurred with the Council's preliminary decision on the proposed pool of information.
66. The Commission in its submission referred to several small studies from Africa as being the most relevant available evidence for 'carrying loads on the head'.
67. The Commission submitted however that the studies that were available to the RMA on weight bearing and cervical spondylosis:
... could be described as generally being of poor quality. Problems include small size, lack of methodological detail, potential for a range of biases, lack of adjustment for age and gender, failure to control for other potential confounders, inadequate data and poorly presented results.
68. Of the papers cited by the Commission two were singled out as providing the best evidence that was available to the RMA.
69. The first of these was Jager et al (1997) which was a small study:
based on radiological and not clinical spondylosis, it had adequate control for age and gender and it included information on cumulative load, providing some evidence of a dose-response effect. This study provided evidence that axial loading exacerbates degenerative change in the cervical spine.
70. The Commission also cited Echarri and Forriol (2005) as providing:
support for the findings of Jager et al. In this study heavy load bearers, with longer average years of work, had more cervical degenerative change than lighter load bearers, despite a younger average age.
71. The Commission concluded however that collectively the African studies:

...provide evidence that people who carry loads on the head develop degenerative changes in the cervical spine earlier and to a greater extent than people who don't carry loads on the head.

72. The Commission submitted that in addition to the African studies, a number of occupational studies add further evidence for an association between occupation and cervical spondylosis.

73. Of these studies, the Commission focussed on a review by Hagberg and Wegman (1987), and in particular their citation of two German studies that had the same lead author (Schröter G). The Commission noted that the Schröter studies provided data on cervical spondylosis in "carriers" and "meat carriers", and commented that as the original studies were not available to the RMA, it was not possible to assess Schröter's methodology thus making any meaningful interpretation of the results difficult.

74. Nevertheless, the Commission submitted that the Schröter studies:

...suggest that the meat carrying activity involved some axial loading of the cervical spine. The studies might therefore be seen as offering some further support to the findings of the African studies on head loading. In the view of the Commission, they don't provide any additional useful evidence regarding other modes of weight bearing.

75. In oral submissions, the Commission's representative submitted that in relation to circumstances where weight is borne other than on the head, analogies might be drawn from a range of literature. For example, the literature available to the RMA on aircraft flight and cervical spondylosis, might provide evidence that is analogous to the situation described by the applicant:

of carrying loads in "...a pitching ship" ... that "... is subject to unexpected movements."

76. It was contended that this might be particularly the case in relation to non-pilot passengers of aircraft who sustain neck injuries as a result of being unprepared for a sudden manoeuvre.

77. The Commission's representative, in the oral submission, added that animal studies such as the rabbit study by Wada et al (1992), may go to biological plausibility.

78. It was maintained however, that studies of sports people, such as Berge (1999) on front row rugby players, and Sortland (1982) on soccer players heading the ball, are inconclusive. The evidence in these studies:

...suggests that extreme, unusual activities involving stressors on the neck, whether it is via injury, or whether it is via overactivity, or whether it is via micro trauma, seems to be relevant. And the loads on the head evidence from the small African studies, also seems to support that.

Repatriation Commission's comments on the Applicant's submissions

79. The Commission stated that its interpretation was that the applicant is seeking a widening of the current factors or the addition of further factors to cover circumstances where weight is borne other than on the head, and focussed its submission on the role of weight bearing (load carrying or lifting) in general in causing or worsening cervical spondylosis.
80. The Commission made no comment on the Council's preliminary decision on the proposed pool of information.

REASONS FOR THE COUNCIL'S DECISION

The Council's Task

81. The fundamental and primary importance of 'the information' sent by the RMA under section 196K of the VEA to the Council cannot be overstated. The integrity of the information is absolutely critical to the Council's review role and functions.
82. The Council was very mindful of meeting its obligations under the VEA to review all and only the information that was available to (before) the RMA at the relevant times, in order to determine whether there was sufficient sound medical-scientific evidence upon which the RMA could have relied to amend (or make) the Statements of Principles.
83. Further, the Council, in taking account of the submissions made to it ensured that it did so in the correct legal context. Information which could only be considered as new information was not taken into account in making the review decision.
84. In conducting a review the Council follows a two-step process. It first identifies the pool of information, i.e. it identifies from all the information that was available to (before) the RMA at the relevant times what the Council considers to be sound medical-scientific evidence (as that term is defined in section 5AB(2) of the VEA (see paragraph [9] above)) which 'touches on' (i.e. is relevant to) whether a particular kind of injury, disease or death can be related to service.
85. The second step requires the Council to determine whether the sound medical-scientific evidence in the pool of information
 - 85.1. points to (as opposed to merely leaves open)⁹ the relevant possibility (that is, whether 'carrying loads on the head, carrying loads on the shoulder girdle and the resulting effect on the neck; and/or or repetitive twisting or bending of the neck with or without load bearing (if found to exist in a particular case) could provide a link or element in a reasonable hypothesis connecting cervical spondylosis or death from cervical spondylosis to relevant¹⁰ service¹¹). The

⁹ See full Federal Court decision at paragraph 49 per Branson J.

¹⁰ Relevant service here refers to operational, peacekeeping and hazardous service, and warlike and non-warlike service as those terms are defined in the VEA and the MRCA.

Council had to find that the hypothesis contended for is reasonable, and not one which is 'obviously fanciful, impossible, incredible or not tenable or too remote or too tenuous'¹²

- 85.2. whether carrying loads on the head, carrying loads on the shoulder girdle and the resulting effect on the neck; and/or repetitive twisting or bending of the neck with or without load bearing (if found to exist in a particular case) could provide a relevant connection between cervical spondylosis or death from cervical spondylosis and relevant service¹³ according to a standard of satisfaction 'on the balance of probabilities,' or as being 'more probable than not'.
86. In these Reasons the association for the reasonable hypothesis test (85.1) and the balance of probabilities test (85.2) are respectively referred to as the 'relevant association'.
87. It was with these tests firmly at the forefront of its collective mind that the Council considered the sound medical-scientific evidence in the pool of information and the submissions made by the Applicant and the Repatriation Commission referable to the contended factors.
88. In forming its judgement of whether the sound medical-scientific evidence pointed to (as opposed to merely leaving open) the relevant association, the Council was conscious that the reasonable hypothesis test is 'a test of possibility'¹⁴ and 'an unusually light burden'¹⁵. If the reasonable hypothesis test was found not to be satisfied, the balance of probabilities test necessarily could not be met and the Council therefore did not consider the latter.

Scope of Review

89. The Council decided to confine its attention to those matters identified in paragraph 41 above.

¹¹ See *Vietnam Veterans' Association of Australia (NSW Branch) Inc v Specialist Medical Review Council and Anor* (2002) 69 ALD 553 (Moore J decision) per Moore J at paragraph 29.

¹² See the full Federal Court decision in *Repatriation Commission v Bey* (1997) 79 FCR 364 which cited with approval these comments from Veterans' Review Board in *Stacey* (unreported 26 June 1985), all of which were in turn cited with approval in the Moore J decision at paragraph 33.

¹³ Relevant service here refers to eligible war service (other than operational service), defence service (other than hazardous service), and peacetime service as those terms are defined in the VEA and the MRCA.

¹⁴ See full Federal Court decision at paragraph 49 citing with approval Spigelman CJ in the New South Wales Court of Appeal decision at paragraph 111.

¹⁵ See full Federal Court decision at paragraph 55 per Branson J.

Pool of Information

90. The chronology of the Council's preliminary proposed decision on the pool of information, and its revised proposed decision on the pool of information are detailed in paragraphs 42-44 above.
91. The Council's final view on the pool of information was that it should comprise the sound medical-scientific evidence listed in **Appendix A**.

THE COUNCIL'S ANALYSIS OF THE INFORMATION BEFORE THE RMA

Preliminary comment on cervical spondylosis

92. The Statements of Principles describe cervical spondylosis to mean

degenerative changes affecting the cervical vertebrae or intervertebral discs, causing local pain and stiffness or symptoms and signs of cervical cord or cervical nerve root compression, but excludes diffuse idiopathic skeletal hyperostosis.
93. The Review Council recognise cervical spondylosis as a clinical diagnosis. It is a common disorder of poorly understood aetiology. Clinically, patients present with symptoms or signs, the causes of which are often difficult to determine.
94. The contribution of external factors to the development of cervical spondylosis is difficult to investigate or verify. Degenerative changes, particularly at the C5/6 level, are common and are often asymptomatic. The correlation between the radiological assessment of degeneration, with changes in structure or function, and signs or symptoms experienced by the patient is generally accepted to be loose, but where investigative imaging reveals a close relationship between them, a diagnosis of cervical spondylosis can be made.
95. It is difficult to document the postulated causal pathway, from bearing loads on the head or shoulder girdle to degenerative change affecting the intervertebral discs or other structures of the spine, by clinical symptoms or signs, or by imaging. These difficulties are reflected in gaps in the evidence that appear in the academic literature.
96. Scientific research into the pathology of the condition has predominantly focused on the objective evidence of degeneration in the spine (without the symptoms or signs which would meet the description 'cervical spondylosis' provided by the Statements of Principles) in the context of lengthy occupational exposures to various stresses with frequently inadequately documented related clinical findings. The major scientific challenge confronting this Council is to apply their collective expertise to interpret this apparently scant and patchy medical scientific evidence.
97. The Statements of Principles provide for "carrying loads on the head" as one factor causative of cervical spondylosis and the necessary doses are detailed in each

Statement of Principles. The Review Council accepted the existing loads on the heads factors in the Statements of Principles.

98. However as attested by the applicant, in his experience, Australian service personnel generally did not carry loads on the head. Service personnel were more likely to have carried loads on the shoulder girdle, whilst supporting the load with the head which therefore requires an additional focus for this review.
99. The focus of the Council's analysis was therefore on the four issues identified by the scope of this review mentioned at paragraph 37 above.
 - 99.1. Should there be an amendment to the existing 'carrying loads on the head' factor?
 - 99.2. Should there be new factors in respect of:
 - carrying loads on the shoulder girdle
 - repetitive movement in conjunction with carrying loads on the head
 - repetitive movement in conjunction with loads on the shoulder girdle?

DOES THE SOUND MEDICAL-SCIENTIFIC EVIDENCE 'POINT TO' OR 'LEAVE OPEN' THE RELEVANT ASSOCIATION

100. As mentioned above, having settled the pool of information, the second question for the Review Council to consider was whether the sound medical-scientific evidence in the pool of information 'points to' a potential factor in the scope of review as a link or element in a reasonable hypothesis connecting cervical spondylosis to relevant service, and if so, whether the relevant association exists on the balance of probabilities.
101. The only basis upon which the Council can review the contents of a Statement of Principles is by reviewing all of the information that was available to (before) the RMA at the relevant times, in order to ascertain whether there was sound medical-scientific evidence upon which the RMA could have relied to amend either or both of the Statements of Principles.
102. The Review Council considered all the articles in the pool. However, given the number of articles in the pool, the Review Council in these Reasons focused its discussion upon its analysis of those articles which it considered most pertinent to the issues before it.
103. Ultimately, matters of weight are question for the Review Council in the exercise of its expertise and scientific judgement, noting that the Councillors are appointed to a particular review because of their specialist expertise in the particular condition, and the matters within the scope of the review.

The Review Council's Analysis of the Information it considered most important as potentially referable to the contended factors

Studies – Loads on the Head (Axial loading)

104. Because carrying loads on the head is uncommon in developed countries, available studies tend to focus on those populations and countries where such activities are more routine. These studies generally describe loading along the lines of the spinal axis (axial loading), rather than non-axial loading and/or eccentric head positions.

Bremner, JM, Lawrence, JS & Miall, WE 1968, 'Degenerative joint disease in a Jamaican rural population', *Annals of Rheumatic Diseases*, vol. 27, pp. 326-32. (RMA ID 29887)

105. Bremner et al provided a general study on the prevalence of degenerative joint disease in which randomly selected subjects within Jamaican and British populations were compared using surveys and blind radiological examinations. Surveys included clinical examination, blood tests and radiological examination. The authors found that the Jamaican and British populations showed similar levels of degeneration of the lumbar spine, but both males and females in the Jamaican population were found to have more severe and widespread degeneration in the cervical spine. When compared with their British counterparts, fewer Jamaicans were found to be symptomatic for cervical degeneration, a finding that was not expected in view of the relevant exposures.

106. The authors concluded that:

The greater prevalence and severity of cervical disk degeneration in Jamaicans may be due to the practice of carrying heavy loads on the head.

107. Data were not provided for the dose and duration of load carrying.

Council's comments

108. The Council considered the authors' hypothesis attributing the greater prevalence and severity of cervical disc degeneration in Jamaicans to carrying heavy loads on the head to be of some relevance and interest. The study was suggestive of an association between carrying loads on the head and cervical spondylosis, but the Council was not persuaded that the theory was supported by data. No assistance was provided by this study in respect of any association for either loads on the shoulder girdle or repetitive movement.

109. The Council considered that the findings from this study leave open the relevant association between carrying loads on the head and cervical spondylosis and do not touch upon a relevant association between carrying loads on the shoulder girdle or repetitive movement either separate to, or in conjunction with, loads on the head and cervical spondylosis.

Echarri, JJ & Forriol, F 2002, 'Effect of axial load on the cervical spine: a study of Congolese wood bearers', *International Orthopaedics*, vol. 26, no. 3, pp. 141-4. (RMA ID 29573)

110. Echarri and Forriol reported their study of Congolese women who had carried wood on their head for an average of 12 years. The aim of the study was to compare the clinical examination of the neck and the radiology of the cervical spine of female Congolese wood bearers with those of a control group to identify consequences of an increased axial load on the head. Subjects were interviewed and examined clinically and radiologically.

111. They found amongst the wood bearers that the height of the intervertebral discs and vertebral bodies was statistically lower and listhesis more frequent, localised to the C3 and C4 vertebrae and to a lesser extent in C5 and C6. In pre-menopausal women osteophytes were seen infrequently and their presence correlated to age, short stature and the number of years working as a wood bearer. In almost half of the post-menopausal wood bearers the medullary canal was narrow and narrower in those with degenerative changes.

112. The authors found:

In the wood bearers there was a negative relationship between pain and years of work ... Pain did not correlate with degenerative signs, with a narrow canal, nor with neck stiffness. Nor was there any relationship to age, height, or weight. Pain radiating to the arms or the scapulae reported by the wood bearers was not related to radiological signs of degeneration. Women with the highest pain score were those with the least degenerative changes ...

No relationship was found between degenerative changes and wood bearing. However the proportion of degenerative changes was greater in the wood bearers ... than in the control group ... before the menopause, and similar in the older groups. The group of wood bearers with degenerative changes had been carrying wood for longer than the group of wood bearers without these changes, but the difference was not significant; nor were there differences seen in the degree of lordosis between wood bearers and controls with or without degenerative changes.

113. They concluded:

Congolese women who carry large bundles of wood over long distances for many years may develop degenerative disc disease at the upper levels of the cervical spine, with an increased incidence of listhesis at a younger age...

Council's comments

114. The Council considered the findings of this study (of an increase in pre-menopausal wood-bearing women of radiographic degenerative changes in the cervical spine) only suggestive of a relevant association with cervical spondylosis.
115. The Council considered further that it was not able to attach much weight to this study, given it is somewhat speculative and inconclusive. The authors did not detail a dose-response and did not employ blind assessments in their clinical and radiographic examinations of subjects.
116. Overall the Council considered that the findings from this study leave open the relevant association between carrying loads on the head and cervical spondylosis and do not touch upon the relevant association between carrying loads on the shoulder girdle or repetitive movement either separate to, or in conjunction with, loads on the head and cervical spondylosis.

Echarri, JJ & Forriol, F 2005, 'Influence of the type of load on the cervical spine: a study on Congolese bearers', *The Spine Journal*, vol. 5, pp. 291-293. (RMA ID 35447)

117. Echarri and Forriol used a case-control study to examine the clinical changes and radiographic degenerative signs in the cervical spine of two groups of African head bearers (bearers of heavy loads - 50-60kg - over short distances and bearers of light loads - 30-35kg - over long distances) in comparison with a control group.
118. They found more prolapsed discs and disc herniations at level C6-C7 in the heavy-load bearing group than in the control group. They observed a correlation between the numbers of disc herniations with the age of subjects and concluded that load bearing on the head, particularly of heavy loads, produced more radiographic degenerative signs than in the control group, more stiffness in the neck and more reported pain than in the control group.

Council's comments

119. The Council considered the diagnoses of prolapsed discs reported in this study are questionable for the reason that the diagnostic methods described by the authors (clinical examination, functional exploration of the cervical spine and lateral radiograph) are insufficient to reach that diagnosis. Discs, being soft tissues, do not show up on X-rays. The size of the spaces between the vertebrae shown on X-rays can be examined to indicate a possibility of disc damage - a narrowed disc will show up on an X-ray as bony vertebrae being closer together than normal - but narrowing is not definitive of prolapse. Magnetic resonance imaging (MRI) or computerised tomography (CT) scan is required to diagnose a prolapsed disc.

Conclusion

120. The Council considered that the findings from this study leave open the relevant association between carrying loads on the head and cervical spondylosis and do not touch upon the relevant association between carrying loads on the shoulder girdle or repetitive movement either separate to, or in conjunction with, loads on the head and cervical spondylosis.

Jager, HJ, Gordo-Harris, L, Mehring, U-M, Goetz, GF & Mathias, KD 1997,
'Degenerative change in the cervical spine and load-carrying on the head', *Skeletal Radiology*, vol.26, pp. 475-481. (RMA ID 29588)

121. Jager et al used a case-control study to evaluate the relationship between load-carrying on the head and the development of degenerative change in the cervical spine. Their subjects were porters who routinely used head loading to transport goods, and who attended a clinic for illnesses unrelated to the cervical spine. This group was compared with a control group that had never carried loads on the head.
122. Blind radiographic readings were used to assess degenerative change.
123. The authors found that both age and the weight carried appear to be significant features in the development of degenerative changes in the study population. They found degenerative change in the cervical spine in 88.6% of the carriers in the study compared with 22.9% of the non-carriers. The incidence of degenerative change was higher and more severe at a younger age for head bearers. They concluded that the axial strain of load-carrying on the head exacerbates degenerative change in the cervical spine at all levels with more significant or marked change at higher levels.

Council's comments

124. The Council considers that this study was methodologically robust. This study evaluated radiographically demonstrated degenerative changes in the cervical spine. Excluded from the study, were load carriers with a previous history of cervical spine injury or arthritis or complaints of neck pain or stiffness.
125. The Council considers the finding that axial loading increases degenerative changes allows a reasonable hypothesis that axial loading is causative of cervical spondylosis.

Conclusion

126. The Council considered this study points to (as opposed to merely leaving open) the relevant association between carrying loads on the head and cervical spondylosis, and leaves open the relevant association between carrying loads on the shoulder girdle or repetitive movement either separate to, or in conjunction with, loads on the head and cervical spondylosis.

Joosab, M, Torode, M & Prasada Rao, PVV 1994, 'Preliminary findings on the effect of load-carrying to the structural integrity of the cervical spine', *Surg Radiol Anat*, vol 16, pp. 393-8. (RMA ID 29599)

127. Joosab et al conducted a case-control study of routinely taken diagnostic radiographs of intact cervical spines of victims of assault and road accidents in rural Zimbabwe. Those who carried loads on the head in their working life were categorized as loaders, non-loaders were those who never habitually used head loading. X-rays had been taken in cases of trauma to the head, to rule out injury to the neck and related structures.
128. The authors found a significant decrease in the angle of lordosis in loaders compared to non-loaders, no significant difference in dimensions of the spinal canal, and a significant decrease in disc height with increasing age in the 5th intervertebral disc.
129. They noted:

Loading appeared to cause a redistribution of the changes in disc height with the 1st I.V disc (i.e., between vert. 2 and 3) demonstrating the same type of disc changes as that of the 5th I.V. disc.

concluding:

In this preliminary study, the authors suggest that carrying heavy loads on the head alters the pattern of degenerative changes in the cervical spine. Improved and validated methods of measuring these parameters are currently being investigated.

Council's Comments

130. Given the study's small sample size (loaders n = 20; non-loaders n = 25) in respect of trauma victims, the Council considered the conclusions of the authors did not represent a reasonable hypothesis connecting cervical spondylosis with carrying loads on the head. The lack of supporting clinical evidence does not assist the Council's inquiry into a relevant association in respect of cervical spondylosis.

Conclusion

131. The Council considered that the findings from this study leave open the relevant association between carrying loads on the head and cervical spondylosis and do not touch upon the relevant association between carrying loads on the shoulder girdle or repetitive movement either separate to, or in conjunction with, loads on the head and cervical spondylosis.

Levy, LF 1968, 'Porter's neck', *BMJ*, vol. 2. pp.16-19 (RMA ID 29709)

132. Levy investigated Zimbabwean porters who had reported to Harare Hospital with acute serious neck injuries. Most such injuries involved the upper regions of the cervical

spine, C1 to C3-C4. The porters routinely carried sacks of meal, other grains and vegetables weighing approximately 90.7kg, for distances of up to 27 meters.

133. Levy reasoned that cervical spine injuries were infrequent amongst porters because when carrying loads on the head, the cervical spine assumes a vertical position and the discs are compressed. He concluded that neck injuries are more likely to occur if the load being carried moves from a neutral position on the head and the momentum of the load results in forced twisting, flexion or extension of the neck.
134. Levy did not provide any information on weight bearing as a causal factor in cervical spondylosis.

Council's Comments

135. The Council considered that this study was of limited value given it was confined to examination of acute injuries to the neck and does not consider a link between cervical spondylosis and head loading. It does however offer some support for increased injuries arising from non-axial loading, twisting, flexion or extension of the neck but does not provide a basis for any connection between such injuries and cervical spondylosis.

Conclusion

136. The Council considered that the findings from this study do not touch upon the relevant association between carrying loads on the head, carrying loads on the shoulder girdle or repetitive movement either separate to, or in conjunction with, loads on the head and cervical spondylosis.

Jumah, KB & Nyame, PK 1994, 'Relationship between load carrying on the head and cervical spondylosis in Ghanaians', *West Afr J Med*, vol. 13, no. 3, pp.181-2. (RMA ID 5535)

137. Jumah and Nyame used radiographic images to examine the relationship between load carrying on the head and cervical spondylosis in symptomatic Ghanaians. Cervical spondylosis was diagnosed on the basis of plain X-rays showing degenerative changes. They found that of the 305 patients studied, all of whom had neck symptoms and signs, 63.6% of the 225 who regularly carried heavy loads on their heads had cervical spondylosis compared to 36% of the 80 who did not carry loads on their heads. They concluded that:

... regular heavy load carrying on the head for a prolonged period could be an important aetiological factor for the development of cervical spondylosis. The occurrence of cervical spondylosis ... appears to be in a relatively young age group (mean age 39.9), and that cervical spondylosis is not exclusively an aging phenomenon ... Further studies involving the use of more advanced radiological tools will be necessary, to find out the other aetiological factors in the causation of cervical spondylosis...

Council's Comments

138. The Council considered it important that this study showed a significant statistical correlation between load carrying and cervical degeneration in symptomatic individuals, providing a reasonable hypothesis for the relevant association between load carrying and cervical spondylosis. The study does not quantify the amount of load as has been specified in the existing Statements of Principles.
139. The Council considered that the findings from this study point to the relevant association between carrying loads on the head and cervical spondylosis, and leave open the relevant association between carrying loads on the shoulder girdle or repetitive movement either separate to, or in conjunction with, loads on the head and cervical spondylosis.

Other Occupational Studies

Berge, J, Marque, B, Vital, JM, Sénégas, J & Caillé, JM 1999, 'Age-related changes in the cervical spines of front-line rugby players', *Am J Sports Med*, Jul-Aug, vol. 27, no. 4, pp. 422-9. (RMA ID 23370)

140. MRI scans of the cervical spine were performed on 47 rugby players and 40 age-matched control subjects to evaluate the accumulative effects of trauma to the cervical spine. All were free of symptoms at the time of examination. The aim of this study was to compare the changes in the cervical spine of players at different points in their careers. The study of cervical spine changes, including spinal curve, spinal constituents, posttraumatic deformities, and degenerative modifications, was completed by a study of cervical measurements.
141. Front-line rugby players showed greater degenerative alterations at an earlier age and at higher levels in the spine than the control subjects of the same age. The council notes the conclusion that these changes were linked to repetitive cervical trauma throughout the players' careers.

Council's Comments

142. The Council considered the study persuasive of an association between accentuated and early degenerative changes in the cervical spine and the repetitive cervical trauma experienced by the rugby players throughout their careers. The mechanism for the trauma is broadly analogous with the mechanism described by Schröter and Rademacher for meat carriers (referred to below). The actions of rugby players in the front row of a scrum are also likely to be similar to the actions of the applicant when he was carrying loads on the shoulder girdle, supported by the head.
143. As the subjects were symptom-free at the time of examination, it is not possible to draw any further assistance from the study in respect of the aetiology of cervical spondylosis.

144. The Council considered that the findings from this study leave open the relevant association between carrying loads on the head and repetitive movement, or carrying loads on the shoulder girdle, and cervical spondylosis.

Hagberg, M & Wegman, DH 1987, 'Prevalence rates and odds ratios of shoulder-neck diseases in different occupational groups', *British J Industrial Med*, vol. 44, pp. 602-610. (RMA ID 6433)

145. Hagberg and Wegman reviewed previously published studies to evaluate the prevalence of a number of shoulder-neck diseases in different occupations. Relevantly to this review, they attributed findings of degenerative changes in the cervical spine, radiographically seen as spurs or a reduction in disc height as cervical spondylosis. Symptoms of pain in the shoulder or neck in addition to tenderness over the descending part of the trapezius muscle were distinguished as 'tension neck syndrome'.
146. They concluded that by comparison with office workers and farmers, dentists had an increased odds ratio for both cervical spondylosis and for shoulder joint osteoarthritis, while meat carriers, miners¹⁶ and 'heavy workers' had significantly higher odds ratio for cervical spondylosis than referents. While the findings for meat carriers and miners were considered by the authors to be consistent with the hypothesis that a high load on the cervical spine causes cervical spondylosis, they noted that sources for a high load on the cervical spine were not described for dentists and heavy workers and a reported less cervical spondylosis among cotton workers compared with the general population was unexplained.
147. The authors concluded that, although the job descriptions in the literature reviewed were brief:
- specific exposure factors, such as highly repetitive contractions in the shoulder muscles, work at or above shoulder level, static contractions, and possibly head posture as causative factors in shoulder-neck disorders.

Council's Comments

148. Most relevantly for this review, the authors cited studies by Schröter and Rademacher (one of which is considered later in these reasons as "New Information") on meat carriers, an occupation the Council considers most closely relevant to the kind of work undertaken by the Applicant.
149. The Council considered that this review provides some evidence relating to or connecting carrying loads on the shoulder girdle and cervical spondylosis. The paper does not present primary data that would constitute a reasonable hypothesis, but identifies papers that should be considered in any future examination of these Statements of Principles.

¹⁶ Whom the Council notes are likely to have regularly worn helmets.

Aircraft Flight Studies

Hamalainen, O, Vanharanta, H & Kuusela, T 1993, 'Degeneration of cervical intervertebral disks in fighter pilots frequently exposed to high +Gz forces', *Aviation, Space, and Environmental Medicine*, vol. 64, pp. 692-696. (RMA ID 8170)

150. This study compared a group of fighter pilots with a matched set of controls, and used MRI to image their cervical spines. Degenerative changes were seen more frequently in the pilot group than the non-pilot group (to a statistically significant extent). The authors concluded that frequent exposure to high positive gravitational forces (G-forces)¹⁷ in the head-to-foot (z) axis (+Gz) forces may cause premature cervical disc degeneration.
151. The study indicated that changes occurred in the higher levels of the cervical spine for fighter pilots as opposed to the controls.
152. The study group was small and within the younger age range and therefore subjects were not affected by age-related changes in the spine.

Council's Comments

153. This paper discusses +Gz loads on the cervical spine in terms of the movements of the head and neck during high +Gz flight, while being subjected to the compressive forces involved with high +Gz (effectively a +Gz-induced weight or load-bearing situation).
154. Of relevance is the discussion about non-axial or eccentric head positions while subjected to high +Gz. The situation where a given weight is supported by the head/neck in the normal condition at +1Gz is analogous to the situation where a smaller weight is being supported at higher +Gz loads. Carrying a 15kg load on the head at +1Gz is mechanically similar to a 5kg load being subjected to +3Gz. The effective load on the head and neck in both conditions is identical. The eccentric head positioning during high +Gz flight is also somewhat analogous to supporting a weight using the shoulder girdle.
155. Although this study provides no direct evaluation of the shoulder girdle, it does show the biological plausibility of the association, given the eccentric loading of the head and neck that occurs under high +Gz.

¹⁷ Explanatory note for G - The acceleration experienced by a pilot in a manoeuvring aircraft (known as "G force") is expressed as a multiple of the normal acceleration due to the Earth's gravity, g (9.8 ms⁻²). An aircraft accelerating at 9.8 ms⁻² therefore is undergoing 1G of applied acceleration. A three-axis co-ordinate system is used by international convention to describe the direction of this applied acceleration, in either the longitudinal (head-to-foot) axis (z), the transverse axis (x) or the lateral axis (y). The acceleration is also expressed as either positive (+) or negative (-). The physiological consequences of acceleration depend on both the magnitude of the acceleration and the axis in which it is applied. The human body is particularly sensitive to acceleration in the longitudinal or z axis. Weight is altered by the level of applied +Gz, such that there is a doubling of weight at +2Gz. Exposure to high levels of applied +Gz causes considerable fluid shifts and redistribution throughout the body. The principal problem faced by the human cardiovascular system is the system's ability to maintain the required level of blood to the brain. When this does not occur, G-induced loss of consciousness (G-LOC) results.

156. The Council considered that the findings from this study point to (as opposed to merely leaving open) the relevant association between carrying loads on the head and cervical spondylosis and repetitive movement either separate to, or in conjunction with, loads on the head and cervical spondylosis, but leave open the relevant association between carrying loads on the shoulder girdle and cervical spondylosis.

Schall, DG 1989, 'Non-ejection cervical spine injuries due to +Gz high performance aircraft', *Aviation, Space, Environmental Medicine*, vol. 60, pp. 445-56. (RMA ID 12099)

157. This paper presents a number of case reports of +Gz-induced neck injury in military fighter pilots.

Council's Comments

158. Of note are comments made in the introductory section about the differences between axial load tolerance of the cervical spine and non-axial load tolerance, and in particular the comment by the author that in most cases the load applied to the cervical spine during air combat manoeuvring is of a non-axial nature. The case reports generally show sudden and/or sustained +Gz loads being applied to the head-neck complex of the pilot, coupled with either an eccentric or off-axis head position or turning of the head during the manoeuvre.
159. This study was concerned with G-force related acute injuries and as such, the Council considered that the findings did not indicate a relationship between acute injury and cervical spondylosis.

THE COUNCIL'S CONCLUSIONS

160. The Council, having closely analysed all the information in the pool, placed particular weight on the articles discussed in detail above. The critical question for the Council was whether the sound medical-scientific evidence 'points to', as opposed to merely leaves open, the possibility of the relevant association.¹⁸ If the Council decided that there was sound medical-scientific evidence that could provide a link or element in a reasonable hypothesis the Council would then go on to consider the balance of probabilities.
161. The papers by Echarri 2002, Jager, Joosab, Jumah, Berge, Hamalainen, and Schall all documented changes occurring at an earlier age and at a higher level than otherwise experienced in the populations. The Council agreed with the Commission's submission that, in combination with obvious biological plausibility, the evidence is sufficient to establish that it is more probable than not that cervical spondylosis can be caused by carrying loads on the head.
162. For the reasons discussed in detail above, the Council concluded that the sound medical-scientific evidence available to (before) the RMA at the relevant times was

¹⁸ see full Federal Court decision at paragraph 49 per Branson J, and paragraph 84 of these Reasons.

insufficient to justify amending the reasonable hypothesis Statement of Principles No. 33 of 2005 or the balance of probabilities Statement of Principles No. 34 of 2005 for carrying loads on the head.

163. The Council noted the general relevance of the medical science in respect of loads, eccentric loads and G-forces which are also experienced by personnel in the Australian Forces, particularly the RAAF and made the following findings.
- a) Although the biological plausibility of an association between carrying loads on the shoulder girdle and cervical spondylosis is obvious and is supported by the Berge article, the sound medical scientific evidence was insufficient to point to a reasonable hypothesis in respect of that factor.
 - b) Similarly, the biological plausibility of an association between repetitive twisting or bending of the neck with or without load bearing and cervical spondylosis is apparent from the occupational studies and aircraft flight studies, the evidence was insufficient to point to a reasonable hypothesis in respect of that factor.
164. The Council did find that the sound medical scientific evidence identified an association between extreme occupational stresses and cervical spondylosis at a younger age, and at higher levels, than expected from normal aging.

COUNCIL'S ANALYSIS OF THE NEW INFORMATION

165. The status of the information discussed below is 'new information', that is, it is information that was not available to (not before) the RMA. Accordingly, it has not been taken into account for the purposes of the review.
166. Rather, the Council has considered the new information to determine whether, in the Council's view, it warrants the Council making any directions or recommendations to the RMA.
167. In the Council's view any such direction or recommendation should only be made by the Council if it formed the view that the new information:
- 167.1. comprised sound medical-scientific evidence as defined in section 5AB(2) of the VEA being information which:
 - 167.2. epidemiologists would consider appropriate to take into account; and
 - 167.3. in the Council's view, 'touches on' (is relevant to) carrying weights on the shoulder girdle and has been evaluated by the Council according to epidemiological criteria, including the Bradford Hill criteria; and
 - 167.4. could potentially satisfy the reasonable hypothesis and/or balance of probabilities tests (as appropriate; see paragraphs 85.1 and 85.2 above for the relevant associations).

168. Applying the above criteria to the new information referred to the Council by the Applicant and by the Commission, the Council in these Reasons focussed its analysis on the following articles.

NEW INFORMATION

Schröter, G & Rademacher, W 1971, [in GERMAN] Schröter, G & Rademacher, W 1971, 'Die Bedeutung von Belastung und aussergewöhnlicher Haltung für das Entstehen von Verschleisschaden der HWS dargestellt an einem Kollektiv von Fleischabtragern', *Zeitschrift für die gesamte Hygiene und ihre Grenzgebiete*, vol.17, no.11, pp. 841-843.

Schröter, G & Rademacher, W 1971, [ENGLISH translation] 'Significance of stress and unusual posture in the development of degenerative changes of the cervical spine - as represented by a collective of meat porters', *Zeitschrift für die gesamte Hygiene und ihre Grenzgebiete* [Journal of All Hygiene and Related Areas], vol.17, no.11, pp. 841-843.

169. Schröter and Rademacher's paper was cited by Hagberg and Wegman (1987), and this citation was referred to by the RMA in its analysis of the medical science supporting a factor for carrying loads on the head. (RMA 2004, Carrying loads on the head and cervical spondylosis regarding gender, p2). However the paper was not before the RMA and was independently sourced by the Council during the course of the review.
170. Schröter and Rademacher examined a collective of 54 meat porters to determine whether it was possible to detect early and unusually severe changes of the cervical spine. Comparison to a control group of 100 indicated that excessive loading on the head and the neck in meat carriers resulted in significant degenerative change in the cervical spine. The location and severity of these changes differed from those found in the control group. The findings were radiographically verified.
171. The authors observed that the meat workers employed an unusual posture:

The work of meat porters requires the carrying of animal halves and quarters on the head and/or the shoulder girdle. In the process, the head is pushed forward or sideways by the load. If the meat porter wants to get his bearings while walking and carrying, he must push his head against the load, i.e. his neck muscles are in maximum tension and, in doing so, he brings his cervical spine into hyperlordosis. If the head is pushed to lateral by the load, a rotation of the cervical spine towards the load is also required, in addition to the hyperlordosis." (translation)

and they concluded that:

the combination of the factors stress and unusual posture has highly adverse effects and is especially conducive to the development and early onset of degenerative changes of the vertebral column and, in particular, of the cervical spine. (translation)

Council's Comments

172. The study demonstrated a high incidence of degenerative changes at C5 and C6 in both the controls and in the meat porters without any significant difference in incidence, although the changes were more marked in the meat porters at both levels.
173. Of particular interest however was the finding that there was a highly significant difference in the incidence of degenerative change at more proximal levels in the cervical spine, which is in keeping with the findings in papers relating to pilots who developed degenerative changes in the lower cervical spine earlier than controls and subsequently developed changes at higher levels in the cervical spine.
174. The other highly significant feature of the paper is that the meat workers carried large meat portions on their shoulder girdles, which resulted in displacement of the head in order to accommodate and balance the meat portions. This mechanism is very similar to that described by the applicant when carrying meat portions or cans of milk or vegetables on board ship.
175. The authors concluded that the combination of stress involved in supporting the meat portions and the unusual posture were conducive to the development of early onset of degenerative changes in the cervical spine.
176. Although the meat workers had to change position when carrying the meat portions, they were not subject to the unpredictable and intermittent instability situations due to sudden pitching of the vessel experienced by the applicant or to the sudden, unexpected movements experienced by aircrew.
177. The paper has significant limitations, but it does suggest that weight bearing on the shoulder girdle appeared to result in an increased incidence and severity of cervical spondylosis in meat workers compared to control group over a 10 year period.
178. The Council considered that the findings from this study point to (as opposed to merely leaving open) the relevant association between carrying loads on the shoulder girdle, and repetitive movement either separate to, or in conjunction with, loads on the head and cervical spondylosis.

Jurisdiction

179. Having considered all of the information that was available to the RMA at the time it determined the Statements of Principles, the Council reconsidered its preliminary view that the amendments to the Statements of Principles by instruments Nos. 76 and 77 of 2008 (discussed above at paragraph Number 19-23) (the amendments) did not impact on this review.
180. The Council took particular account of the following matters:
 - a) The amendments were in respect of only one issue in Statements of Principles - the definition of 'high performance aircraft'.

- b) The amendments, although potentially significant in their application to service personnel by doubling the required G-force capability of relevant aircraft, were relatively minor in the context of the whole of the Statements of Principles. Of the 22 factors identified in each Statement of Principles, the amendments affected only 2 factors - clinical onset and clinical worsening in respect of flight in high performance aircraft.
- c) The remainder of the Statements of Principles were not affected by the amendments and it could not be said that the amendments displaced the original Statements in substance or in application.
- d) The amendments bear no direct relationship in any practical way to the factors considered by the Council in this review. The circumstances of load bearing on the head or shoulder girdle are very different to the circumstances of flying in high performance aircraft.
- e) The factor contended by the applicant is the subject of medical scientific evidence that is largely separate from evidence on the effects of G-forces. Aircraft flight studies do not specifically address the direct application of non-axial loads to the shoulder girdle itself. In flight, the +Gz forces result in the head reacting to the force and the neck being required to cope with a proportionally heavier head in an off-axis position. Axially applied +Gz forces increase the loading on the structures of the neck. This is quite different to the direct application of loads to the shoulder girdle, with the neck being eccentrically positioned.

181. Taking these matters into account, the Council was of the view that directions and recommendations made by the Review Council in relation to the factors considered in this review were not pre-empted by the amendments to the Statements of Principles.

182. The Council therefore confirmed its preliminary decision that the decisions of the RMA to amend the Statements of Principles by Instruments Nos. 76 and 77 of 2008 did not undermine the purpose of this review.

DECISION

183. The Council made the declarations summarised in **paragraph 1** above.

EVIDENCE BEFORE THE COUNCIL

Documents

184. The information considered by the Council (being the information that the RMA advised was available to (before) the RMA at the relevant times and which the RMA sent to the Council in accordance with section 196K of the VEA) is listed in **Appendix B**.

185. As mentioned above, the information upon which the Repatriation Commission relied (being information which the RMA advised was available to (before) the RMA at the

relevant times and which the RMA sent to the Council in accordance with section 196K of the VEA is listed in **Appendix C**.

186. The information to which the Repatriation Commission referred (being information which the RMA advised was new information, that is, information which was not available to (not before) the RMA at the relevant times, and so was not considered by the Council in reaching its review decision) is listed in **Appendix D**.

Articles cited in the Council's analysis

Information before the RMA:

1. Bremner, JM, Lawrence, JS & Miall, WE 1968, 'Degenerative joint disease in a Jamaican rural population', *Annals of Rheumatic Diseases*, vol. 27, pp. 326-32. (RMA ID 29887)
2. Echarri, JJ & Forriol, F 2002, 'Effect of axial load on the cervical spine: a study of Congolese wood bearers', *International Orthopaedics*, vol. 26, no. 3, pp. 141-4. (RMA ID 29573)
3. Echarri, JJ & Forriol, F 2005, 'Influence of the type of load on the cervical spine: a study on Congolese bearers', *The Spine Journal*, vol. 5, pp. 291-293. (RMA ID 35447)
4. Jager, HJ, Gordo-Harris, L, Mehring U-M, Goetz, GF & Mathias, KD 1997, 'Degenerative change in the cervical spine and load-carrying on the head', *Skeletal Radiology*, vol. 26, pp. 475-481. (RMA ID 29588)
5. Joosab, M, Torode, M & Prasada Rao, PVV 1994, 'Preliminary findings on the effect of load-carrying to the structural integrity of the cervical spine', *Surg Radiol Anat*, vol. 16, pp. 393-8. (RMA ID 29599)
6. Levy, LF 1968, 'Porter's neck', *British Medical Journal*, vol. 2, pp.16-19 (RMA ID 29709)
7. Jumah, KB & Nyame, PK 1994, 'Relationship between load carrying on the head and cervical spondylosis in Ghanaians', *West Afr J Med*; vol.13, no. 3, pp.181-2. (RMA ID 5535)
8. Berge, J, Marque, B, Vital, JM, Sénégas, J & Caillé, JM 1999, 'Age-related changes in the cervical spines of front-line rugby players. *Am J Sports Med*, Jul-Aug. vol 27, no. 4, pp.2-9. (RMA ID 11800)
9. Hagberg, M & Wegman, DH 1987, 'Prevalence rates and odds ratios of shoulder-neck diseases in different occupational groups', *British J Industrial Med*, vol. 44, pp. 602-610. (RMA ID 6433)
10. Hamalainen, O, Vanharanta, H & Kuusela, T 1993, 'Degeneration of cervical intervertebral disks in fighter pilots frequently exposed to high +Gz forces', *Aviation, Space, and Environmental Medicine*, vol. 64, pp. 692-696. (RMA ID 8170)
11. Schall, DG 1989, 'Non-ejection cervical spine injuries due to +Gz high performance aircraft', *Aviation, Space, Environmental Medicine*, vol. 60, pp. 445-56. (RMA ID 12099)

New Information; information which was not available to (not before) the RMA at the relevant times:

In German

12. Schröter, G & Rademacher, W 1971, 'Die Bedeutung von Belastung und aussergewöhnlicher Haltung für das Entstehen von Verschleisschaden der HWS dargestellt an einem Kollektiv von Fleischabtragern', *Zeitschrift für die gesamte Hygiene und ihre Grenzgebiete*, vol.17, no.11, pp. 841-843.

English translation

- 12 (a). Schröter, G & Rademacher, W 1971, 'Significance of stress and unusual posture in the development of degenerative changes of the cervical spine - as represented by a collective of meat porters', *Zeitschrift für die gesamte Hygiene und ihre Grenzgebiete* [Journal of All Hygiene and Related Areas], vol.17, no.11, pp. 841-843.

Appendices

Appendix A	Preliminary list of the proposed pool of information, as advised to the Applicant and Repatriation Commission by letters dated 6 July 2010.
Appendix B	Information that the RMA advised was available to (before) the RMA at the relevant times and which the RMA sent to the Council in accordance with section 196K of the VEA.
Appendix C	Information upon which the Repatriation Commission relied (being information which the RMA advised was available to (before) the RMA at the relevant times and which the RMA sent to the Council in accordance with section 196K of the VEA).
Appendix D	The information which the new Review Council identified (being information which the RMA advised was 'new information', that is, information which was not available to (not before) the RMA at the relevant times, and so was not considered by the new Review Council in reaching its review decision).
Appendix E	The article in German and the English translation obtained by the Council of: Schröter, G & Rademacher, W 1971, 'Die Bedeutung von Belastung und aussergewöhnlicher Haltung flir das Entstehen von Verscheisschaden der HWS dargestellt an einem Kollektiv von Fleischabtragern', <i>Zeitschrift für die gesamte Hygiene und ihre Grenzgebiete</i> , vol.17, no.11, pp. 841-843.

APPENDIX A

Preliminary list of the proposed pool of information, as advised to the Applicant and Repatriation Commission by letters dated 6 July 2010.

RMA ID	DESCRIPTION
2.1	Repatriation Commission 1995, Submission made to the Authority for consideration in the investigation which resulted in Statements of Principles Nos. 101 and 102 of 1995, including reference list, dated 16 February, pp. 1-14.
2.8	Name provided (Not included per Privacy Act 1988) 1995, 25 September submission to the RMA on a number of factors, pp.1-6.
2.13	Name provided (Not included per Privacy Act 1988) 1997, 14 October submission to the RMA on a number of factors, pp.1-9.
2.18	Department of Veterans' Affairs 1998, 12 February submission to the RMA on a number of factors, pp.1-2.
2.19	Name provided (Not included per Privacy Act 1988) 1998, 24 February submission to the RMA on a number of factors, pp.1-5.
2.21	RMA medical researcher 1998, Formal Investigation into Spondylosis, dated 10 July, pp.1-74.
2.22	Name provided (Not included per Privacy Act 1988) 1998, 22 September submission to the RMA on the definition of trauma, p.1.
2.24	Name provided (Not included per Privacy Act 1988) 1999, 26 July submission to the RMA on a number of factors, pp.1-2.
2.27	RMA medical researcher 2002, briefing paper on Cervical, Thoracic and Lumbar Spondylosis, dated 15 March, pp.1-104.
2.28	RMA medical researcher 2002, Summary of studies, dated March pp.1-23.
2.31	Name provided (Not included per Privacy Act 1988) 2002, 12 June submission to the RMA on whole body vibration and back disorders, pp.1-2.
2.32	Name provided (Not included per Privacy Act 1988) 2002, 20 June submission to the RMA on a number of factors, p.1.
2.33	Name provided (Not included per Privacy Act 1988) 2002, 26 June submission to the RMA on a number of factors, pp.1-39.
2.4	Name provided (Not included per Privacy Act 1988) 2003, 6 November submission to the RMA on a number of factors, p.1.

- 2.46 RMA medical researcher 2004, Background paper: Carrying Loads on the Head and Cervical Spondylosis Regarding Gender, dated February, pp.1-33.
- 2.47 Name provided (Not included per Privacy Act 1988) 2004, 9 March submission to the RMA in Relation to Lumbar, Doral (sic) and Cervical Spondylosis, pp.1-7.
- 2.49 Name provided (Not included per Privacy Act 1988) 2004, 2 November submission to the RMA on a number of factors, pp.1-3.
- 2.5 Name provided (Not included per Privacy Act 1988) 2005, 17 May submission to the RMA on Lifting and Carrying factors, pp.1-2.
- 2.53 Name provided (Not included per Privacy Act 1988) 2005, 16 July submission to the RMA on carrying weighs on the head factors, pp.1-24.
- 2.55 RMA medical researcher 2005, Briefing paper: Cervical, Thoracic, and Lumbar Spondylosis, dated June, pp.1-63.
- 2.56 RMA medical researcher 2005, Additional briefing paper: Manual Handling/other physical activity, Stair climbing and G-force exposure, and Osteoarthritis and Spondylosis, dated June, pp.1-56
- 12102 Andersen, HT 1988, 'Neck injury sustained during exposure to high-G forces in the F16B', *Aviation, Space, Environmental Medicine*, vol. 59, pp. 356-258.
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- 23370 Berge, J, Marque, B, Vital, JM, Senegas, J, & Caille, JM 1999, 'Age-related changes in the cervical spines of front-line rugby players', *The American Journal of Sports Medicine*, vol. 27, no. 4, pp. 422-9.
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- 12189 Gillen, MH (Major) & Raymond, D 1990, 'Progressive cervical osteoarthritis in high performance aircraft pilots', *NATO Advisory Group for Aerospace Research and Development (AGARD) Conference Proceedings*, no.471, pp. 6-1 to 6-6.
- 12188 Guill, FC & Herd, GR 1990, 'Aircrew neck injuries. A new, or existing, misunderstood phenomenon?', *NATO Advisory Group for Aerospace Research and Development (AGARD) Conference Proceedings*, no.471, pp. 9-1 to 9-12.
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- 6433 Hagberg, M & Wegman, DH 1987, 'Prevalence rates and odds ratios of shoulder-neck diseases in different occupational groups', *British J Industrial Med*, vol. 44, pp. 602-610.
- 11496 Hamalainen, O 1993, 'Flight Helmet weight, +Gz Forces, and neck muscle strain', *Aviation, Space and Environmental Medicine*, vol. 64 pp. 55-57.
- 23337 Hamalainen, O, Toivakka-Hamalainen, SA & Kuronen, P 1999, '+Gz associated stenosis of the cervical spinal canal in fighter pilots', *Aviation Space and Environmental Medicine*, vol. 70, no. 4, pp. 330-334.
- 8170 Hamalainen, O, Vanharanta, H and Kuusela, T 1993, 'Degeneration of cervical intervertebral disks in fighter pilots frequently exposed to high +Gz forces', *Aviation, Space, and Environmental Medicine*, vol. 64, pp. 692-696.
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- 29588 Jager, HJ, Gordon-Harris, L, Mehring, U-M, Goetz GF & Mathias, KD 1997, 'Degenerative change in the cervical spine and load-carrying on the head', *Skeletal Radiology*, vol. 26, pp. 475-481.

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APPENDIX B

Information that the RMA advised was available to (before) the RMA at the relevant times and which the RMA sent to the Council in accordance with section 196K of the VEA.

RMA ID	DESCRIPTION
	Specialist Medical Review Council 2009, Information List – Cervical Spondylosis, pp. 1-20.
	Repatriation Medical Authority 2006, Registrar's 27 April covering letter to the information, p.1.
	Repatriation Medical Authority 2006, Reference List for investigation #78-4, pp.1-11.
	Repatriation Medical Authority 2008, Registrar's 16 June letter confirming information available to the RMA at the time it determined the Statements of Principles, 16 June pp.1-2.
2.1	Repatriation Commission 1995, Submission made to the Authority for consideration in the investigation which resulted in Statements of Principles Nos. 101 and 102 of 1995, including reference list, dated 16 February, pp. 1-14.
2.2	Name Provided (and removed under s196I of the VEA) 1995, 23 February submission to the RMA on a number of factors, pp. 1-6.
2.3	Name Provided (and removed under s196I of the VEA) 1995, 17 March submission to the RMA on a number of factors, pp.1-14.
2.4	Name Provided (and removed under s196I of the VEA), 1995, 28 March submission to the RMA on a number of factors, pp.1-52.
2.5	Name Provided (and removed under s196I of the VEA) 1995, submission to the RMA on a number of factors, 10 April, pp.1-4.
2.6	Name Provided (and removed under s196I of the VEA) 1995, Preliminary Investigation - Microtrauma and Osteoarthritis dated 20 April, Division of Orthopaedic Surgery University of Queensland, pp. 1-28.
2.7	Name Provided (and removed under s196I of the VEA) 1995, 29 August submission to the RMA on a nu Name Provided (and removed under s196I of the VEA) mber of factors, pp.1-3.
2.8	Name Provided (and removed under s196I of the VEA) 1995, 25 September submission to the RMA on a number of factors, pp.1-6.

- 2.9 Name Provided (and removed under s196I of the VEA) 1995, 21 November, submission to the RMA on a number of factors, pp.1-27.
- 2.1 Repatriation Commission 1996, 26 June letter to the RMA, referring to a letter dated dated 12 June 1996 (attached) from Mr P C Anderson on a number of factors, pp.1-2.
- 2.11 Name Provided (and removed under s196I of the VEA) 1997, 26 August submission to the RMA on a number of factors, pp.1-2.
- 2.12 Name Provided (and removed under s196I of the VEA) 1997, 3 September submission to the RMA on a number of factors, pp.1-9.
- 2.13 Name Provided (and removed under s196I of the VEA) 1997, 14 October submission to the RMA on a number of factors, pp.1-9.
- 2.14 Name Provided (and removed under s196I of the VEA) 1997, 10 November submission to the RMA on a number of factors, pp.1-9.
- 2.15 Name Provided (and removed under s196I of the VEA) 1997, 25 November submission to the RMA on a number of factors, pp.1-44.
- 2.16 Name Provided (and removed under s196I of the VEA) 1997, 4 December submission to the RMA on a number of factors, pp.1-2.
- 2.17 Name Provided (and removed under s196I of the VEA) 1998, submission to the RMA on a number of factors, 16 January pp.1-54.
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APPENDIX C

Information upon which the Repatriation Commission relied (being information which the RMA advised was available to (before) the RMA at the relevant times and which the RMA sent to the Council in accordance with section 196K of the VEA).

RMA ID	DESCRIPTION
23491	Battie, MC, Videman, T, Gibbons, LE, Fisher, LD, Manninen, H & Gill, K 1995, 'Determinants of lumbar disc degeneration. A study relating lifetime exposures and magnetic resonance imaging findings in identical twins', <i>Spine</i> , vol. 20, no. 24, pp. 2601-12.
29887	Bremner, JM, Lawrence, JS & Miall, WE 1968, 'Degenerative joint disease in a Jamaican rural population', <i>Annals of Rheumatic Diseases</i> , vol. 27, pp. 326-32.
29613	Bolm-Audroff, U 1992, 'Intervertebral disc disorders due to lifting and carrying heavy weights', <i>Med. Orth. Tech</i> , 112:293-6
29573	Echarri, JJ & Forriol, F 2002, 'Effect of axial load on the cervical spine: a study of Congolese wood bearers', <i>International Orthopaedics</i> , vol. 26, no. 3, pp. 141-4.
35447	Echarri, JJ & Forriol, F 2005, 'Influence of the type of load on the cervical spine: a study on Congolese bearers', <i>The Spine Journal</i> , vol. 5, pp. 291-293.
6433	Hagberg, M & Wegman, DH 1987, 'Prevalence rates and odds ratios of shoulder-neck diseases in different occupational groups', <i>British J Industrial Med</i> , vol. 44, pp. 602-610. (RMA ID 6433)
12979	Hettinger, T 1985, 'Occupational hazards associated with diseases of the skeletal system', <i>Ergonomics</i> , vol. 28, no. 1, pp. 69-75.
12293	Hult, L 1954, 'Cervical, dorsal and lumbar spinal syndromes: A field investigation of a non-selected material of 1200 workers in different occupations with special reference to disc degeneration and so-called muscular rheumatism', <i>Acta Orthopaedica Scandinavica</i> , Supplementum vol.17, pp. 7-102.
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APPENDIX D

The information which the new Review Council identified (being information which the RMA advised was 'new information', that is, information which was not available to (not before) the RMA at the relevant times, and so was not considered by the new Review Council in reaching its review decision).

In German

Schröter, G & Rademacher, W 1971, 'Die Bedeutung von Belastung und aussergewöhnlicher Haltung für das Entstehen von Verschleisschaden der HWS dargestellt an einem Kollektiv von Fleischabtragern', *Zeitschrift für die gesamte Hygiene und ihre Grenzgebiete*, vol.17, no.11, pp. 841-843.

English translation

Schröter, G & Rademacher, W 1971, 'Significance of stress and unusual posture in the development of degenerative changes of the cervical spine - as represented by a collective of meat porters', *Zeitschrift für die gesamte Hygiene und ihre Grenzgebiete* [Journal of All Hygiene and Related Areas], vol.17, no.11, pp. 841-843.

Spondylosis deformans
Halswirbelsäule
Berufskrankheit

Aus dem Deutschen Zentralinstitut für Arbeitsmedizin Berlin-Lichtenberg
(Direktor: OMR Dr. med. H.-C. Häublein)

Die Bedeutung von Belastung und außergewöhnlicher Haltung für das Entstehen von Verschleißschäden der HWS - dargestellt an einem Kollektiv von Fleischabträgern

Von G. SCHRÖTER und W. RADEMACHER

Zusammenfassung

Ein Kollektiv von 54 Fleischabträgern wurde daraufhin untersucht, ob sich vorzeitige und über das übliche Maß hinausgehende Verschleißerscheinungen der Halswirbelsäule nachweisen lassen. Im Vergleich zu einer Kontrollgruppe von 100 Probanden konnte statistisch gesichert werden, daß die Arbeit der Fleischabträger, die durch statische Belastung und von der Norm abweichende Haltung der Halswirbelsäule charakterisiert ist, Verschleißerscheinungen setzt, die, was Lokalisation und Ausmaß der Veränderungen betrifft, sich deutlich von denen der Durchschnittsbevölkerung unterscheiden und als entschädigungspflichtige Berufskrankheit anzusprechen sind, sofern sie die weiteren Voraussetzungen der Verordnung über Melde- und Entschädigungspflicht bei Berufskrankheiten erfüllen.

Die Einschätzung der Ursachen der Überlastungsschäden der Wirbelsäule und Gelenke hat sich in den letzten 30 Jahren sehr gewandelt. Bis dahin maß man den endogenen Ursachen, der minderwertigen Gewebsanlage, die überwiegende Bedeutung zu. Der Begriff „Bindegewebsschwächling“ beherrschte das Feld und verhinderte die Suche nach anderen Schadfaktoren.

Baetzner (3) machte zuerst auf Wirbelsäulen- und Gelenkschäden bei Hochleistungssportlern aufmerksam und wendete die gewonnenen Erkenntnisse auch für die Bewertung der körperlichen Arbeit in Industrie und Handwerk an.

Jetzt ist zwar anerkannt, daß es Abnutzungsschäden durch Überlastung gibt, aber die Meinungen sind noch immer gegensätzlich. Einerseits wird die Bedeutung des „Bindegewebsschwächlings“ zu sehr betont, und andererseits werden die Wirkungen der äußeren Einflüsse überschätzt. Es hat sich noch zu wenig durchgesetzt, daß beide Faktoren von etwa gleichrangiger Bedeutung für das Entstehen von Überlastungsschäden sind. Eindrucksvoll zeigt sich das am Preflüftwerkzeugschaden, an dem trotz gleicher Belastung nur ein kleiner Teil der Preflüftwerkzeugarbeiter erkrankt.

Durch die grundlegenden Arbeiten von Schmorl und Junghanns (10), Töndury (14) u. a. wissen wir, daß die Gewebsalterung der bradytrophischen Gewebe schon am Ende des 2. Jahrzehnts einsetzt. Diese Frage, natürliche Gewebsalterung von arbeitsbedingtem Verschleiß abzugrenzen, läßt sich nur durch vergleichende Reihen-

Резюме

Значение нагрузки и необычной осанки для возникновения повреждений, связанных с износом шейного отдела позвоночника, — представлено на примере коллектива разносчиков мяса

Коллектив из 54 разносчиков мяса исследовался относительно того, возможно ли установить у них преждевременные и выходящие за рамки обычного масштаба явления износа шейного отдела позвоночника. По сравнению с контрольной группой, состоящей из 100 лиц, возможно было статистически доказать, что труд разносчиков мяса, характеризующийся статической нагрузкой и отклоняющимся от нормы положением шейного отдела позвоночника, обуславливает явления износа, которые явно отличаются от таковых явлений у среднего населения в отношении локализации и масштабов изменений и которые следует рассматривать как обязательное к возмещению профессиональное заболевание, если они отвечают дальнейшим предпосылкам постановления об обязательных регистрации и возмещения при профессиональных заболеваниях.

untersuchungen an Berufsgruppen mit unterschiedlicher Belastung des Stütz- und Bewegungssystems beantwortet; Tierversuche können hierbei nicht weiterhelfen.

Wir selbst haben Reihenuntersuchungen an Schwerlastträgern und Bergleuten einerseits und Büroangestellten andererseits durchgeführt (Schlomka und Schröter [9], Schröter [11, 12, 13]).

Entsprechende Untersuchungen stammen von Junghanns, Häublein (6), Cantenberg (5) und Lindemann und Kuhlendahl (7). Lindemann und Kuhlendahl haben ihren Untersuchungen 2,8 Millionen pflichtversicherte Arbeiter und Angestellte der AOK Düsseldorf, der Betriebskrankenkasse der Bundesbahn und der Reichsknappschaft zugrunde gelegt. Auf Grund der gemachten Untersuchungen kann gesagt werden, daß schwere körperliche Arbeit in der Lage ist, die Verschleißschäden der Brust- und Lendenwirbelsäule zumindest in ihrem Ablauf zu beschleunigen.

Die Frage, ob die berufliche Belastung Bedeutung für das Entstehen oder das Fortschreiten der Osteochondrose und Spondylose der Halswirbelsäule hat, drängt sich bei den zahlreichen Fällen von Schmerzen und Ermüdungserscheinungen im Bereiche des Schultergürtels, z. B. bei Stenotypistinnen und verwandten Berufen immer wieder auf. Es besteht kein Zweifel darüber, daß die Abnutzungserscheinungen der Halswirbelsäule einer der maßgebenden ursächlichen Faktoren für das Entstehen von Schmerz- und Ermüdungszuständen im Bereich des Schultergürtels und der oberen Extremitäten

sind. Auch in dieser Frage sind die Meinungen darüber ob die „endogenen“ oder „exogenen“ Faktoren im Vordergrund stehen, geteilt. Die umfangreiche Literatur über die Verschleißerscheinungen der Wirbelsäule befaßt sich fast ausschließlich mit der Brust- und Lendenwirbelsäule. Auch die grundlegenden Arbeiten von *Schmorl* (10) und seinen Schülern lassen die Halswirbelsäule unberücksichtigt. Nur spärlich finden sich Hinweise darauf, daß die Körperhaltung Einfluß auf das Entstehen von Verschleißerscheinungen der Halswirbelsäule hat. *Exner* (4) berichtet, daß in vornübergebeugter Haltung arbeitende Personen vorzugsweise an zervikaler Osteochondrose erkranken. Er hat seine Meinung durch Versuche an Ratten mit operativen Eingriffen an den Dornfortsätzen zu belegen versucht. Die nachgewiesenen Degenerationserscheinungen der betreffenden Bandscheiben legten natürlich den Schluß nahe, daß statisch mechanische Einflüsse die Zermürbung der Zwischenwirbelscheiben der Halswirbelsäule begünstigen, obwohl bei der relativen Schwere des operativen Eingriffs auch neurotrophische Abbauprozesse eine Rolle spielen könnten. Außer *Exner* hat *Fenz* noch darauf hingewiesen, daß Angehörige gewisser Berufe, die gewohnheitsmäßig dauernd eine Beugehaltung des Kopfes einnehmen, ganz besonders zur Osteochondrose der Halswirbelsäule neigen. Als gefährdete Berufe nennt er Strickerinnen, Stenotypistinnen, Zeichner usw.

Bei einer früheren Reihenuntersuchung über die Häufigkeit der Spondylose der Halswirbelsäule an Schwerlastträgern, Bergleuten, Büroangestellten und Zahnärzten konnten wir nachweisen, daß die Gruppe der Schwerlastträger bei den Durchschnittswerten aller Gruppen lag, daß die Bergleute und Büroarbeiter sich

nicht signifikant von den Schwerlastträgern unterscheiden, daß die Gruppe der Zahnärzte jedoch sich in der Schwere der Befunde mit weniger als 0,1 % Irrtumswahrscheinlichkeit sowohl von der Gruppe der Schwerlastträger als auch der der Bergleute und Büroarbeiter unterschied. Dieser Befund hat umso größere Bedeutung, da die Gruppe der Zahnärzte ein um 6 Jahre niedrigeres Durchschnittsalter als die anderen Gruppen hatte.

Es war nun von Interesse, die Bedeutung der Kombination von Belastung und außergewöhnlicher Haltung der HWS zu untersuchen; denn im Laufe unserer früheren Reihenuntersuchungen hatten wir zunehmend den Eindruck gewonnen, daß die Verschleißschäden der Wirbelsäule dann besonders auftreten, wenn zwei Faktoren, nämlich statische Belastung und abnorme Haltung der Wirbelsäule, zusammentreffen. Der Arbeitsvorgang beim Fleischabträger beinhaltet erhebliche statische Belastung und gleichzeitige abnorme Haltung der HWS. Er erfüllt also die gewünschten Voraussetzungen ideal, und somit ist die Reihenuntersuchung der Fleischabträger von grundsätzlicher Bedeutung.

Die Arbeit der Fleischabträger erfordert das Tragen von Tierhälften oder -vierteln mit dem Kopf bzw. dem Schultergürtel. Dabei wird der Kopf durch die Last nach vorn oder seitwärts gedrückt. Wenn der Fleischabträger sich beim Laufen und Tragen orientieren will, muß er den Kopf gegen die Last andrücken, d. h. er spannt seine Nackenmuskulatur maximal an und bringt seine HWS damit in Hyperlordosierung. Wird der Kopf durch die Last seitwärts gedrückt, wird neben der Hyperlordosierung auch eine Drehung der HWS zur Seite der Last hin erforderlich (siehe Abb. 1-3).



Abb. 1



Abb. 2



Abb. 5

Bei allen Fleischabträgern konnten wir schwere und z. T. groteske Verschleißerscheinungen im Sinne der Osteochondrose und Spondylose der Halswirbelsäule feststellen, und zwar fanden sich die Abnutzungserscheinungen nicht nur an den Segmenten C₅-C₇, wie das im allgemeinen in der Durchschnittsbevölkerung der Fall ist, sondern sie reichten höher hinauf bis C₂.

Stellt man die Fleischabträger einer Vergleichsgruppe von Handwerkern und Fabrikarbeitern gegenüber, so sind ganz eindeutige Befunde zu erheben.

Die Gruppe der Fleischabträger umfaßte 54 Mann mit einem Durchschnittsalter von 40,2 Jahren und einer durchschnittlichen Berufszeit von 10 Jahren. Die Kontrollgruppe umfaßte 100 Mann mit einem Durchschnittsalter von 43,0 Jahren und einer durchschnittlichen Berufszeit von 12 Jahren.

Vor allem ist interessant, die Häufigkeit des Verschleißes an den einzelnen Segmenten der Halswirbelsäule miteinander zu vergleichen. Bei der Kontrollgruppe finden sich am Segment C₂ in 1% Abnutzungserscheinungen, bei den Fleischträgern bei 61%, davon bei

Tabelle Abnutzungschäden der Halswirbelsäule an den einzelnen Segmenten (in %)

Segment	Kontrollgruppe N = 100				Fleischabträger N = 54			
	mit Befund				mit Befund			
	ohne Befund	erkennbar	erheblich	aufsergewöhnlich	ohne Befund	erkennbar	erheblich	aufsergewöhnlich
C 2	99	1	0	0	39	57	4	0
C 3	95	5	0	0	2	57	39	2
C 4	70	24	6	0	4	45	49	2
C 5	34	46	20	0	9	42	49	0
C 6	35	41	24	0	14	42	44	0
C 7	65	17	18	0	28	44	28	0

4% erhebliche Veränderungen. An den übrigen Segmenten sind die Befunde folgendermaßen (siehe Tabelle 1).

Da die Zahl der Fleischabträger relativ klein war, sich aber nicht beliebig erhöhen ließ, haben wir die Ergebnisse statistisch überprüfen lassen.¹ Es wurde die Prüfung zweier Stichproben mittels des Chi-Quadrat-Testes vorgenommen. Die Prüfung erfolgte in einer Anordnung der Werte in einer 2 × 2 Tafel mit 1 Freiheitsgrad.

Bei den Wirbeln C₂-C₅ sowie C₇ ergeben sich statistisch sehr stark gesicherte Unterschiede (P = 0,1% Irrtumswahrscheinlichkeit) in den Vergleichsbefunden der Halswirbelsäule zwischen der Kontrollgruppe und den Fleischabträgern. Beim Wirbel C₆ ergeben sich keine signifikanten Unterschiede zwischen den beiden Gruppen.

Aus den erhobenen Befunden und der statistischen Sicherung derselben kann man ableiten, daß die Arbeit der Fleischabträger der entscheidende Faktor für das Entstehen, zumindest aber für die richtunggebende Verschlimmerung der Abnutzungserscheinungen der HWS ist. Wir sind der Meinung, daß das Zusammenreffen der Faktoren Belastung und außergewöhnliche Haltung ausgesprochen ungünstig ist und die Verschleißerscheinungen der WS und insbesondere der HWS in ihrer Entstehung und im vorzeitigen Ablauf besonders fördert.

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Anschrift der Verfasser: MR Dr. G. Schröter und Dr. W. Rademacher, 1134 Berlin, Nöldnerstraße 40-42

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Spondylosis
Cervical spine
Occupational disease

From the German Central Institute of Occupational Medicine Berlin-Lichtenberg [former East Germany]
(Director: OMR Dr. med. *H.-G. Haublein*)

Significance of stress and unusual posture in the development of degenerative changes of the cervical spine - as represented by a collective of meat porters

G. SCHRÖTER and W. RADEMACHER

Abstract

A collective of 54 meat porters was examined with regard to whether it was possible to detect early and unusually severe changes of the cervical spine. Comparison to a control group of 100 subjects produced statistical certainty that the work of the meat porters, which is characterised by static stresses and an abnormal posture, leads to degenerative changes. As regards their localisation and severity, such changes clearly differ from those of the average population and - provided they also meet the other criteria of the regulations concerning reporting and compensation requirements for occupational diseases - must be dealt with as an occupational disease liable for compensation.

Over the last 30 years, there has been a considerable transformation in the assessment of the causes of stress-related degenerative changes of the spine and joints. Until then, predominant importance was given to endogenous causes, i.e. inferior tissue structure. The issue was dominated by the term 'connective tissue weakling' which prevented the search for other factors causing the damage.

Baatzner (3) was the first to draw attention to spinal and joint problems in high-performance athletes, and also applied his findings to the assessment of physical work in industry and the trades.

While stress-related wear and tear has now become an accepted fact, there are still diverging opinions on the matter. On the one hand, the significance of the 'connective tissue weakling' is overemphasised, while the effects of external influences are overestimated on the other. There is still no sufficient recognition that both factors are of approximately equal importance in the development of stress-related damage. This is impressively demonstrated in the case of pneumatic

tool disease where only a small number of the people working with such tools falls ill, despite being exposed to the same stresses.

As we know from the pioneering studies of *Schmorl* and *Junghanns* (10), *Töndury* (14) et al., tissue ageing of the bradytrophic tissue begins as early as the end of the second decade. The question of how to distinguish between natural tissue ageing and work-related degenerative changes can only be answered by comparative screenings of occupational groups with different stresses to the musculoskeletal system. Animal experiments are of no use here.

We have ourselves conducted screenings of both heavy-load porters and miners on the one hand, and office workers on the other (*Schlomka* and *Schröter* [9], *Schröter* [11, 12, 13]).

Similar investigations were undertaken by *Junghanns*, *Haublein* (6), *Gantenberg* (5) and *Lindemann* and *Kuhlendahl* (7). *Lindemann* and *Kuhlendahl* based their studies on 2.8 million blue collar workers and salaried employees who had statutory insurance cover with the Düsseldorf AOK health fund, the company health fund of the German Federal Railways and with

* Translator's note: Lit. translation; term is just as derogatory in German.

the National Miners' Insurance. On the basis of these studies one can say that hard physical labour has the ability to accelerate degenerative changes of the thoracic and lumbar spine, at least as to their course.

In view of the numerous cases of pain and fatigue in the shoulder girdle area, e.g. with stenotypists and related professions, one cannot help but ask whether occupational stress plays a part in the onset or development of osteochondrosis and spondylosis of the cervical spine. There is no doubt that the degenerative symptoms of the cervical spine are one of the decisive causal factors for the development of pain and fatigue conditions in the area of the shoulder girdle and upper extremities. Once again, opinion is divided on whether the determining factors are of an 'endogenic' or 'exogenic' nature. The extensive literature on the degenerative changes of the spine focuses nearly exclusively on the thoracic and lumbar spine. Even the fundamental studies by *Schmorl* (10) and his students do not take the cervical spine into consideration. Only sparse references can be found that the posture has an effect on the development of degenerative changes of the cervical spine. *Exner* (4) reports that people working in a forward bending posture predominantly fall ill with cervical osteochondrosis. He attempted to substantiate his opinions through experiments on rats, with surgical procedures on the spinous processes. Obviously, the degenerative symptoms of the affected spinal discs lead one to conclude that the wearing down of the intervertebral discs was advanced by static mechanical influences, even if - in view of the relative severity of the surgical intervention - neurotrophic reduction processes may also have played a part. In addition to *Exner*, *Fenz* also pointed out that members of certain occupations, who habitually assume a permanently tilted posture of the head, have a very strong propensity towards osteochondrosis of the cervical spine. Among the professions at risks, he names knitters, stenotypists, draughtsmen etc.

In an earlier survey on the frequency of spondylosis of the cervical spine in heavy-load porters, miners, office workers and dentists we were able to show as follows: The heavy-load porter group was around the mean values of all groups. Miners and office workers did not significantly differ from the heavy-load porters. However, regarding the severity of their diagnoses, the dentists' group varied from both the heavy-load porter group and that of the miners and office workers, with a probability of error of less than 0.1%. This finding has an even greater significance since the average age of the dentists' group was 6 years lower than that of the other groups.

What became of interest now, was to investigate the significance of the combination of stress and unusual posture of the cervical spine. This was due to the fact that, in the course of our earlier screenings, we had increasingly formed the impression that the degenerative changes in the vertebral column occurred in particular where two factors, namely static stress and

unusual posture of the spine, coincided. The work process of the meat porters involves significant static stress and a simultaneous unusual posture of the cervical spine. It is therefore a perfect match for the desired requirements and, as a consequence, the study of meat porters is of fundamental relevance.

The work of meat porters requires the carrying of animal halves and quarters on the head and/or the shoulder girdle. In the process, the head is pushed forward or sideways by the load. If the meat porter wants to get his bearings while walking and carrying, he must push his head against the load, i.e. his neck muscles are in maximum tension and, in doing so, he brings his cervical spine into hyperlordosis. If the head is pushed to lateral by the load, a rotation of the cervical spine towards the load is also required, in addition to the hyperlordosis (see ill. 1-3).

We were able to detect severe and, at times, grotesque degenerative changes in terms of osteochondrosis and spondylosis of the cervical spine in all the meat porters. In fact, signs of wear were not only found in segments C5-C7, as would generally be the case in the average population, but extended further up to C2.

If the meat porters are juxtaposed with a comparison group made up of tradesmen and factory workers, very clear diagnoses can be established.

The meat porter group was comprised of 54 males at an average age of 40.2 years who, on average, had been in the profession for 10 years. The control group was made up of 100 males at an average age of 43.0 years, with an average time in their occupation of 12 years.

Of particular interest was a comparison of the frequency of degenerative changes in individual segments of the cervical spine. In the control group, 1% showed signs of wear on segment C2. Among the meat porters, this number was 61%, of which 4% were significant changes. For the other segments, the findings are as follows (see table 1).

Since the number of meat porters was relatively small, but could not be increased at will, we had the results statistically checked.¹ The checking of two samples was performed using the chi-square test. The check took place in a configuration of the values in a 2 X 2 table with 1 degree of freedom.

For the vertebrae C2-C5 as well as C7, there were statistically very strongly secured differences ($P = 0.1\%$ probability of error) in the comparative diagnoses of the cervical spine between the control group and the meat porters. For vertebra C6, there were no significant differences between the two groups.

Based on the established findings and their statistical confirmation, it may be deduced that it is the work of the meat porters which is the decisive factor in the

¹ We thank Dr Oehmsch for the calculations and statistical checks he performed.

development, or at least the directional aggravation of the degenerative symptoms of the cervical spine. We are of the opinion that the combination of the factors stress and unusual posture has highly adverse effects

and is especially conducive to the development and early onset of degenerative changes of the vertebral column and, in particular, of the cervical spine.

Table 1 Degenerative damage of the cervical spine in individual segments (in %)

segment	control group N = 100				meat porters N = 54			
	no abnormal findings	identifiable	significant	extreme	no abnormal findings	identifiable	significant	extreme
C2	99	1	0	0	39	57	4	0
C3	95	5	0	0	2	57	39	2
C4	70	24	6	0	4	45	49	2
C5	34	46	20	0	9	42	49	0
C6	35	41	24	0	14	42	44	0
C7	65	17	18	0	28	44	28	0