Report on the deliverable 10.4 for the TASK 25 of CIMVHR Contracts

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Task #: 25
Validation of a Standardized Neck/Shoulder Exercise Program in CF Helicopter Aircrew and Its Impact on Neck Pain, Impairments and Functional Limitations/Restrictions

Report on the deliverable 10.4 Draft Study Report in MS Office format outlining; 1) innovative assessment processes to optimize the improvement and development of assessment tools for neck related injuries in CAF members; 2) the feasibility, with specific reference to the identified barriers and facilitators, of implementing a standardized and specific exercise regimen program for CAF CH-146 aircrew in a multicenter setting; and 3) the cost effectiveness of the potential implementation of such an injury prevention program no later than 27 September 2017. The report must also provide recommendations on future development of neck injury prevention on other CAF bases and wings. The SA will require no more than 10 business days to provide feedback to the Sub Contractor.

Date of Report: 27 September 2017

1. Summary of the main findings of the neck RCT

A survey of Canadian Forces (CF) Griffon helicopter aircrew indicated an 80% incidence of neck pain in that population. Preventive measures to mitigate neck pain in this population have been proposed and the Royal Canadian Air Force has made reducing the prevalence of aircrew neck pain a high priority.

Objective 1: To document the baseline profile of Canadian Forces (CF) Griffon helicopter aircrew in terms of pain, functional limitations and physical impairments (strength, endurance and range of motion [ROM]) of the cervical region and to compare the profiles between the ones that did report pain to the ones who did not.

Method: Descriptive statistics were used to describe the prevalence of neck pain during the previous week and 3 months (Nordic Musculoskeletal Questionnaire (NMQ)), as well as neck pain related impairments, limitations and restrictions (neck disability index [NDI]), cervical range of motion (ROM) (Multi Cervical Unit MCU™ and neck muscles strength (maximal voluntary isometric contraction (MVIC)) and endurance). In order to verify the potential impact of pain at baseline, two group assignations were used: a "Pain" group (PG: those who reported pain in the last three months) and a
"No pain" group (NPG). T-tests were used to assess statistical differences for each variable between the PG and NPG.

Results: Fifty-two men and two women (mean age: 36.78 +/- 7.96) were recruited at CF bases Valcartier (n=32) and Gagetown (n=22). They reported a total of 31-neck pain episodes in the past week and of those, 12 were linked to flying activities. The percentage of participants who experienced more than one pain episode in the past week or in the past 3-months were 33% and 50%, respectively. The PG reported higher duration of flight (6.30 vs 2.77h; p=0.002) and more extensive Night Vision Goggles (NVG) wearing during the day (0.38 vs 0.06h; p=0.0031) and at night (2.15 vs 0.96h; p=0.0027). The CF aircrew did not report significant physical limitations or functional restrictions (mean NDI score, PG/NPG = 5.90 ± 4.25/0.90 ± 1.67, p ≤ 0.0001). Ninety seven percent (97%) of participants had NDI scores < 10/50 from which 50% of those had NDI scores < 5/50. The cervical ROM was significantly higher in the NPG for all combined neck movements (p ≤ 0.05) but similar for the neck flexion and extension (Figure 1). Strength was significantly higher in the NPG for all MVIC performed (p ≤ 0.05)(Figure 1). No difference was found for the neck muscle endurance between the PG and NPG.

Figure 1. Cervical range of motion (ROM) and neck muscle strength at baseline between the pain group (PG) and the no pain group (NPG) for the following movements: flexion (F), extension (E), flexion in right (FRR) and left rotation (FLR), extension in right (ERR), and left rotation (ELR).
**Conclusion:** Only a few RCAF aircrews in this cohort reported some functional limitations because of their neck pain; however, a low but recurrent level of pain even over a short period of time seems to impact on their neck mobility and strength.

**Implication:** These findings reinforce our approach to focus on training military aircrew to adopt a neuromuscular strategy allowing a better use of their deep neck muscle stabilizers.

**Objective 2:** To evaluate the efficacy of a specific neck/shoulder exercise regimen in the prevention and reduction of neck pain in RCAF CH-146 helicopter pilots and flight engineers using a single-blind RCT design.

**Method:** The forty-three air force helicopter pilots and eleven flight engineers enrolled at baseline were eligible if they 1) were fit for flight duties, 2) had logged flying hours in the previous 3 months and were aged between 18 and 60. The exclusion criteria were: 1) Participants with previous cervical or upper thoracic spinal surgery, 2) neurological symptoms, 3) significant limitations and restrictions because of a neck problem (NDI > 34/50), 4) participation in a neck training program during the past year, 5) use of steroid anti-inflammatory medication, 6) were received treatment for neck and shoulder at recruitment period. To this, nine participants dropped out from the study due to lack of interest/time (4), posting (1), pain (3) or for personal reasons (1). Partial data were recorded for eleven participants for strength and endurance outcomes due to pain encounter during testing. Written informed consent was obtained from all participants. This study was approved by the ethics committees of the CIRRIS and DND.

**Study design**
After recruitment, eligible participants were taken place in the baseline evaluation. They had filled a series of questionnaire on sociodemographic, symptomatology and comorbidity. Measures for main outcome NDI and NMQ and secondary outcome (strength, endurance and range of motion) were taken before any more investigations. Two other evaluation sessions were planned at 8 weeks and after 6 months of intervention. At each evaluation, the main (pain) and secondary outcomes (measures of impairment) were evaluated. The Figure 2 below shows the design of the RCT that was conducted.
Figure 2: Single blind RCT design.

- Socio-demographic information
- Symptomatology, comorbidity
- Nordic MSK Questionnaire
- Neck Disability Index
- Neck range of motion, muscle strength and endurance
The exercises program
Participants who were assigned to the exercises group were instructed to do them once or twice a week in regards to their reported pain at baseline. The frequency at which the exercises were prescribed was based on the results to the NMQ. If a subject had reported pain in the last three months, he/she had to do them twice daily and, if not, with a preventive approach, they had to do them once daily. High compliance to the exercises was defined as doing the exercises 3 or more times a week. The program was including nine basic exercises based on the program presented in the study by Ang & al. (2009). Variations from this previous program and targeted muscles for each exercise are shown in the Table 1 at the end of this report. During the first eight weeks, participants in the exercises group followed a supervised program with a physiotherapist not involved in the evaluations performed at 8 weeks and 6 months. To ensure that participant performed the exercises adequately, a 15 minutes supervised session was conducted with each participant at the beginning of the program. After that session, the program was performed independently. Written instructions with pictures and videos were given to each participant of the exercises group. The dosage and progression of the exercises were adapted and adjusted for every individual by the supervising physiotherapist in the course of the first eight weeks. For those who had reported ongoing pain, the program had followed the procedure initially described by Jull and al. (2004). The progression of the exercises was from non postural to postural load situated exercises, moving from isolated low-load muscle exercises to synergy endurance-strength exercises. Guided by the physiotherapist, the progression was based on the pilot's/FEs observed progress toward neck/shoulder motor control and movement quality, rather than on a certain amount of sets and repetitions.

Results
Neck pain, physical limitations and level of disability:
The two-way analysis of variance has shown no significant difference between groups or across time for the per protocol analysis. The results were slightly different for the intention-to-treat analysis for which although there were no between group differences (p=0.17), the effect of time was significant (p=0.001). This suggests that any new episode of pain is due only to time and that exercises, although not harmful, has shown no additional benefit. However, as seen on the Figure 3, when participants are classified in high (doing the exercises 3 or more times a week) and low compliance (less than 3 times a week) groups, during the intervention of 8 weeks, there is an progressive increase in the number of participants reporting no pain in the high compliance group (18.2% to 27.3%) compared to the low compliance (58.3% to 41.7%). Also, over the 6 month period, the percentage of participants reporting pain once or a few times in the last week increased from 25% to 41.7% in the low compliance group compared to a very positive decrease from 45.5% to only 18.2% in the high compliance. These later results are not statistically significant but they indicate a two-fold clear tendency: the supervised program contributes to decreasing pain and on the medium term, doing the exercises more regularly seems to have an impact on the frequency of pain.
Figure 3. Comparisons of the percentage of participants reporting no pain or pain once or a few times in the last 3 months, last month or last week between the high (H) and low (L) compliance group. The labels above each column indicate the specific percentage.
As seen on the Figure 4, for the NDI score, not surprisingly, as the scores at baseline were fairly low (3.35, exercise; 2.92, control), the scores at 6 months did not significantly change (3.74, exercise; 2.84, control). This suggests no real physical limitations and no disability, which is consistent with the low level of self-reported change that was similar for both the control and exercise group of 3.28 and 3.30, respectively. However, these later results are puzzling, as they do not seem to match the level of pain daily reported in everyday conversation by the RCAF aircrew both in terms of frequency and intensity – an observation that is supported by the results of the focus group – see Section 4.

Figure 4. Physical limitations and level of disability over the 6-month period for both cohorts.

Results

NDI interpretation IAW the original report:
0 - 4 = no disability
5 - 14 = mild
15 - 24 = moderate
25 - 34 = severe
above 34 = complete
ROM, strength and endurance

No statistical difference was observed for the neck ROM, neck muscle strength and neck muscle endurance between the exercise and control groups at baseline as well as at 8 weeks and 6 months (p-value varying between 0.052 and 0.231)(Figure 5). The results for the intention to treat analysis were similar. However, the mean values of neck muscle strength in neck flexion and extension in this CF cohort is much higher than reference values reported for civilians (Chiu 2002) but very similar to the ones reported for a military population (Salmon 2013). Also, when comparing to reference data of healthy subjects, the neck muscle strength of aircrew members in this study shows a higher ratio of neck ext to neck flex of 1.8 compared to another group of military at 1.4 and civilians at 1.3. So, what is even more interesting is the fact that, compared to reference values, the military in both our study and the one of Salmon (Salmon 2013) on a group of Griffon aircrew have much stronger neck muscles in the sagittal plan compared to healthy civilian subjects. This supports the hypothesis that neck pain in RCAF aircrew may not be the results of muscle weakness but possibly the result of an abnormal motor control or recruitment pattern. And this again, reinforces our strategy to implement a neuromuscular training program focussing on motor control recruitment of the deep paravertebral muscle rather than using and a conventional strengthening program as the pilots and FE in this study did not present neck muscle weaknesses.

Figure 5. Neck muscle strength assessed at baseline (T1), 8 weeks (T2) and 6 months (T3).
Compliance of the participants to the exercises program

Compliance to the exercises program was considered good during the 8 weeks of the supervised program conducted by a physiotherapist (so during the intervention) as the number of time the participant was doing the exercises per week ranged from 4.69 to 6.68 (Figure 6). However, the compliance dropped drastically after 8 weeks at the end of the supervised program; it was as low as 1.22 times per week, a frequency that is insufficient to modulate any significant change at the muscular level. This drop of compliance between the first 7 weeks of the program and the last 4 months of the non-supervised exercises phase was statistically significant (p-values between 0.05 to 0.001 depending on the month used for comparisons).

Figure 6. Level of absolute compliance to the prescription of exercises of the participants in the exercises group during the supervised intervention (1-8 weeks) and the follow-up period from 3 to 6 months.
2. General observations/points of discussion from the neck RCT that led to the implementation of the focus groups

- The populations of RCAF CH-146 Griffon squadrons have a similar pain profile compared to squadrons of other countries in terms of pain frequency but not pain intensity.
- They have higher neck muscle strength but similar neck ROM compared to other healthy subjects;
- Aircrew members who experience pain have less neck muscle strength and ROM in combined neck movements. In counterpart, they logged more flight time and more time wearing NVG;
- In our CF study, the level of compliance to the exercises was about 33% at 6 months compared to 89% during the first few weeks of the study. In the study published by Ang (Ang et al. 2009) in which neck/shoulder exercises was shown to be effective in reducing neck pain among military helicopter pilots, there was a level of compliance of about 70%;
- The participants that do not have a high level of pain may not see the relevance of doing neck exercises on a regular basis. And indeed and unfortunately, the participants that were the most compliant were the ones that were already reporting a certain level of pain and the literature shows that the risk of having an episode of neck pain is significantly increased when you already had one in the past that had not been resolved;
- The dosage of the exercises is important as we observed a certain benefit on participants that completed the exercises at least 3 times per week;
- In our CF study, the exercises were given as homework and therefore they were not included/embedded within the military training, which could have had a more beneficial effect. Indeed, when the participants were supervised to do their exercises (during the 8-week program), they were more compliant and that led to a progressive increase in the number of participants reporting no pain. This observation is in agreement with findings reported by Alricsson et al. (Alricsson 2004).
3. Report on the deliverable 10.4. Item 1) innovative assessment processes to optimize the improvement and development of assessment tools for neck related injuries in CAF members;

One key issue that justified the completion of the focus groups: the lack of compliance to the exercises program developed and used in the randomized clinical trial

The 2 key prerequisites for an exercises program to be successful, assuming the program is valid, are the compliance to the exercises and the dosage (frequency and intensity of the exercises). In this research project, the dosage was adjusted and controlled by the use of a weekly visit of the participant to the physiotherapist during the 8 week-program and thereafter by the final PT’s recommendations. Compliance was tracked using a web base diary logbook filled in by the participant. As observed, compliance to the exercise program was good until the end of the training program, so until 8 weeks after the intervention at T2, the participants making their exercises on average from 6.68 to 4.69 per week)(Figure 6). After the end of the supervised program, the compliance drastically dropped to be as low as 1.22 times per week at 6 months. And the difference between the level of compliance during the first 7 weeks and the last 4 months of program is significant (p < 0.05). This finding justifies the need to conduct focus groups with the participants to find out the reasons for such a low compliance, and to make recommendations in regard to a potential future implementation of an exercises program.
4. Report on the deliverable 10.4: the feasibility, with specific reference to the identified barriers and facilitators, of implementing a standardized and specific exercise regimen program for CAF CH-146 aircrew in a multicenter setting.

The following information is a summary of the data that was extracted from the focus groups that were conducted with 21 people including the participants to the neck RCT as well as the physiotherapy staff that were involved in the study. The Annex 1 is providing the detailed guide that was used to conduct the interviews.

The interviewed people identified the following problems that provide the background from which the courses of action were recommended:

- Physically difficult nature of their work makes dosage and rest essential, but under the current system they do not feel that they have the option of dosing their flying activities
  - The chain of command has specific output expectations, without taking an interest in how the numbers are achieved; the perception of the aircrew is to the effect that their well-being is not a priority based on the following comments:
    - The workload and expected output are huge.
    - The fit flyers are used to meet the quotas, pushed to or past their maximum.
  - The fit have to cover for the unfit, and very few are fit.
  - At Flight school: they fly and repeat until the student achieves the manoeuvres, often going over time.
    - For example, FEs are forced to keep slinging, even when it is unnecessary.
    - The 2.3 hour maximal flying time (which used to be 2 hours) is rarely respected, as achieving training goals is prioritized.
  - Overall, pilots and FEs fly too frequently and for too long
- They (pilots and FEs) carry the psychological burden that they are hurting themselves with their work, and their perception is that their superiors consider them disposable
- Other problems were related to the use of the following equipment: seat positioning, armour plates, NVGs and counterweight, cockpit, vibrations, MX-15.

To mitigate neck pain in helicopter pilots and flight engineers in the RCAF, the following courses of action were suggested:

- Squadrons should implement smart scheduling in order to permit dosage of activities and limitation of the more strenuous forms of work;
- Squadrons must implement mandatory supervised physical training during working hours, endorsed by the chain of command, in a formula that:
  - Is as convenient as possible (onsite, repeated regularly as required, 15-20 minutes per session, no need to shower or change)
  - Addresses specific Neck training and full-body exercises
Considers physical training schedule to accommodate night flyers as well as those that work in the day

- There is a need to create a healthy culture right from the beginning of training for both pilots and FE: education and exercises starting at Portage (pilots) or BOR (FEs) and continued throughout the years of services
  - In that context, prevention must be viewed as part of RCAF aircrew training (to start a life style including neck-shoulder exercises before the first onset of neck pain)
- Ideally: modification of equipment and cockpit
  - Suggestions: attenuating seats in the back for the FEs, seats of varying sizes, fully articulated aircraft head

The implication of physical training during working hours may require decreasing the quota or increase of the number of people working to reach the quota. The Figure 7 below shows a detailed algorithm with several identified barriers and facilitators of implementing a standardized and specific exercise regimen program for CAF CH-146 aircrew. This Figure has also been submitted in a larger power point format.
Figure 7. Detailed algorithm illustrating the problems, causes and possible solutions that were identified from the focus groups following the neck RCT (This Figure has also been submitted in a larger power point format).
References


Table 1: Standardized exercises regimen program for RCAF CH-146 aircrew (Hébert et al.)

<table>
<thead>
<tr>
<th>Exercise</th>
<th>As in Ang et al.(2009)</th>
<th>Muscles recruited + functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- Activation of the deep neck flexor</td>
<td>X</td>
<td>Longus capitis andd longus colli: neck flexion and stabilization of the spine</td>
</tr>
<tr>
<td>2- Shoulder control</td>
<td>X</td>
<td>Rhomboids and middle trapezius: scapular retraction – provide stability to scapula during movement</td>
</tr>
<tr>
<td>3- Scapular retraction and cervical rotation</td>
<td>Modified: shoulder elevation at 45° at the same time</td>
<td>Sternocleidomastoid, rhomboids and middle trapezius: scapular retraction, cervical rotation with flexion – provide stability to scapula during movement</td>
</tr>
<tr>
<td>4- Strengthening exercises for the rotator muscles of the neck</td>
<td>X</td>
<td>Sternocleidomastoid: cervical rotation with flexion</td>
</tr>
<tr>
<td>5- Endurance exercises for the deep neck flexors</td>
<td>No pressure feedback given, participants hold position as long as they can</td>
<td>Same as exercise 1, but emphasize is made on endurance</td>
</tr>
<tr>
<td>6- Thoracic mobilization and stretching for the pectoralis and anterior musculature</td>
<td>Added to exercises program by main researcher</td>
<td>Pectoralis and deltooid muscles: Stabilize shoulder during dynamic movement, shoulder abduction and flexion</td>
</tr>
<tr>
<td>7- Exercises for the shoulder and thoracic region</td>
<td>X</td>
<td>Same as exercise 6 but work on strength muscle</td>
</tr>
</tbody>
</table>

1 The detailed program is available in both French and English in a DVD format that also includes a detailed description of each exercise.
<table>
<thead>
<tr>
<th>Exercises for the shoulder and thoracic region (during elevation)</th>
<th>8</th>
<th>No weight added and movement make in elevation</th>
<th>Same as exercise 6 but work on strength muscle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced exercises for the shoulder and thoracic region</td>
<td>9</td>
<td>Added to exercises program by main researcher</td>
<td>Same as exercise 6 but work on strength muscle</td>
</tr>
</tbody>
</table>
5. Report on the deliverable 10.4. Item 3) the cost effectiveness of the potential implementation of such an injury prevention program no later than 27 September 2017. The report must also provide recommendations on future development of neck injury prevention on other CAF bases and wings.

The implementation of an injury prevention program to mitigate neck pain in RCAF aircrew will be successful if all components are working together, such as the CFHS Gr, the RCAF chain of command and HQ, and the squadrons.

The Figure 7 provides a framework to the rational for implementing the specific shoulder/neck exercises program developed for the RCAF. The findings from the TASK 25 has provided a list of a few criteria that are considered mandatory for the potential implementation of such as injury prevention program:

- The efficacy of the specific neck/shoulder exercises protocol developed, as any other similar exercises regimen, is intimately linked to the acquisition of specific knowledge, and particular assessment and technical skills; therefore, the exercises prescribed and their progression need to be done under the supervision of a qualified physiotherapist;
- The exercises program to be successful should use a formula of mandatory unit PT performed at the Squadrons under the supervision of a qualified DND physiotherapist;
- This mandatory PT with emphasis on specific neck-shoulder neuromuscular/core stability exercises as the one developed by Hebert and Roy should be part of a comprehensive fitness routine including general aerobic, flexibility, and strengthening exercises;
- The use of the specific neck-shoulder neuromuscular/core stability exercises protocol is intended for physiotherapists that are qualified to proceed with a thorough neck/shoulder evaluation before prescribing the exercises that should be included in a comprehensive rehabilitation program;
- It is recommended to trial the developed exercises program (available in videos in French and English) at a few of the 1 Wing units first, then roll it out to the wider RCAF bases, when a better cost estimate and assessment of its efficiency on specific metrics would have been identified;
- It is recommended to add a few additional physiotherapy resources dedicated to the implementation of this neck injury prevention program on bases where RCAF CH-146 aircrew are trained, from the beginning to the end of their training. This will ensure that the helicopter aircrew adhere to such a prevention program early on in their training and make it as part of their lifestyle. This will ensure a continuum of care where there is a concentration of RCAF aircrew. And also, this would make feasible, at a low cost, the implementation of a universal exercises program to prevent outbreaks of neck pain in RCAF aircrew.

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Annex 1: Interview guide to the focus group with the RCAF aircrew - TASK 25

Validation of a Standardized Neck/Shoulder Exercise Program in CF Helicopter Aircrew and Its Impact on Neck Pain, Impairments and Functional Limitations/Restrictions

Introduction
Good day to all and thank you for accepting to participate in this group interview today.

My name is Luc Hébert, I’m a PT and I have a PhD in experimental medicine – I am a professor at Laval University and a Researcher at the Quebec Rehab Center. I’ve been in the CAF for almost 28 years, now attached to the 1 CDN Field Hospital Ottawa Detachment – working from Valcartier.

The aim of today’s meeting is to discuss your experience in the research project and/OR your opinions regarding the implementation of a standardized exercises program to mitigate neck pain in helicopter aircrew, a project I believe you may have participated in or not or for which you may have been involved in or not (so how many of you participated in the study, no mater if you were in the control group or in the exercises group?). OK… The information we will gather will hopefully help provide recommendations to the Canadian Armed Forces in order to prevent neck pain in helicopter aircrew.

There is no right or wrong answer – the opinion of each and every one of you is precious! My role will be to ask you a few questions. Please don’t hesitate to let me know if any of them are not clear. As you maybe know, even though I was the PI of the project, please forgive me if I miss any information or if I misunderstand anything. The discussion will be audio-recorded but the information that will be collected will be treated confidentially. Is this ok with you?

Do you have any questions or comments before we start? And before we start, could you please take a few minutes to read/sign the information sheet and consent form? - French form avail

Very well, thank you.

Brief summary:
• Prevalence of neck pain in RCAF Helicop pilots/FE the is highest in the NATO Army (between 60-80%)
• Several efforts made to attenuate vibration, improve posture, try new helmets (different cerv load, new LCD display), modify cabin ergonomics – but…. not sufficient to significantly mitigate neck P
• PT=Pilots/FE like athletes that train for a competition / We believe that the problem of recurrent/persistent neck pain lies within the recruitment pattern of neck muscle not strength
• Need to train the deep pre-vertebral muscles not the strong superficial ones easily recruited
• We designed such a program that could/should work – SEE DVD – BILINGUAL, 10 EXERCICES – VIDEOS – standardized dosage and compliance? / we conducted a RCT to verify the efficacy of the program and we are now at the stage where we need some feedback from you to help us making recommendations to successfully implement such a program, if deemed relevant by the RCAF community
• We need to have your feedback in order to make proper recommendations to the CoC
Questions – Pilots, FE Participants

1. Is neck pain a problem for helicopter pilots and flight engineers? To what extent?
   (If needed) A: Is neck pain a part of your life?
   a. (If needed) A: How does neck pain have an impact in your life?
2. According to you, why do helicopter aircrew have neck pain?
3. For the ones that participated in the research project aiming to evaluate the efficacy of a
   standardized exercise program to reduce neck pain in helicopter aircrew. Can you tell me about your
   experience? / and for the ones who did not, have you heard about this program, and what can you
tell me about it?
4. According to you, could regularly carrying out an exercise program help reduce neck pain in
   helicopter aircrew?
5. Again, for the ones who did participate, to what extent did you find the program useful?
   a. What aspects of the program did you prefer or find the most useful?
   b. What aspects of the program did you least appreciate or find the least useful?
   c. And for the ones who did not participate, from what you know and from your own
      experience, what kind of exercises program would be useful or that you would appreciate?
6. Are there certain aspects of the program that you found more difficult? Which ones? And for the
   ones who did not participate, what kind of program would you like to be implemented?
   a. (If needed) How did you find:
      o The exercise? (Nature/type, Frequency, Time to do)
      o Periodic assessments in person?
      o Tools that were used:
         ▪ Online questionnaire
         ▪ DvD
      o Other?
7. The research team found that compliance with the exercise program was much less than what was
   expected, can you tell me why you think compliance with a regular exercises program may be
   difficult for pilots and FE?
8. According to you, what are the aspects that could/would negatively impact on the realization of
   such a project / to implement a standardized exercises program to mitigate neck pain in pilots and
   FE in the CAF?
9. According to you,, what are the aspects that could/would positively impact on the realization of such
   a project / to implement a standardized exercises program to mitigate neck pain in pilots and FE in
   the CAF?
10. ONLY ASK IF WE HAVE TIME. For the ones of you that did participate; what did your colleagues from
    the unit think about your participation in the exercises program? / and for the others, what have you
    heard about the colleagues from the unit that did participate in the exercises program?
11. According to you, what could be done to facilitate your participation in such an exercise program in
    the future, for instance regarding :
    • Nature of the program (type of exercises)
    • Time you could dedicate to exercise
    • Length of time: sporadic vs continuous
    • Timing:
o during your work hours, during mandatory physical activity, on your own time
o ASA you are recruited/tag as pilot or FE vs following the completion of all your phases of training
  • Location: home vs. base, physio clinic vs elsewhere
  • Supervision: medical personnel required?
  • Your superiors’ orders: mandatory vs. optional
  • Anything else?
a. ONLY ASK IF WE HAVE TIME. What would be the roles of ?:
  • PTs and medical team?
  • Commanders and administrators?
  • The pilots and flight engineers?
  • Others?
b. To what extend would you be motivated to participate in such a program in the future?

12. Other than an exercise program, are there other things that could reduce neck pain in helicopter pilots and flight engineers according to you? What EXACTLY?

Conclusion
You really provided interesting answers and I thank you. Are there other aspects that I did not bring up and that you would like to mention? Any last comments? Any questions?

Would you accept that I contact you if needed to validate some information obtained during the interview? Yes____ No____

On behalf of the research team, I sincerely thank you for your time and for helping us in carrying out this research project.
Questions - Headquarter participants

1. Is neck pain reported by helicopter pilots and flight engineers a real problem from your perspective as HQ staff? In what way/to what extent?
   - Productivity, absence from work/number of light duties days, higher risk for some exercises/tasking/missions, quality of life...
2. To what extent is reducing neck pain in helicopter pilots and flight engineers a priority currently for you and for the Canadian Armed Forces?
3. According to you, why do helicopter aircrew have neck pain?
   - Intrinsic nature of work, level of physical demand, ergonomics of equipment, tempo of operations, physical fitness, stress...
4. As you know, our team led a research project aiming to evaluate the efficacy of a standardized exercise program to reduce neck pain in helicopter aircrew. Can you tell me about your overall appreciation of the project? Of the program?
5. According to you, could regularly carrying out an exercise program help reduce neck pain in helicopter aircrew? Why?
6. To your knowledge, what are the aspects that negatively impacted/could impact on the realization of such a project?
7. To your knowledge, what are the aspects that positively impacted/could impact on the realization of such a project?
8. The research team found that compliance with the exercise program by the aircrew personnel was less than hoped for, can you tell me why you think compliance with the program may have been difficult?
9. To what extent would you be motivated to promote/encourage the RCAF aircrew to participate in such a program in the future?
10. According to you, what could be done to facilitate the participation of helicopter pilots and flight engineers in an exercise program in the future, for instance regarding:
    - Nature of the program (type of exercises)
    - Time you could dedicate to exercise
    - Length of time: sporadic vs continuous
    - Timing:
      - during your work hours, during mandatory physical activity, on your own time
      - ASA you are recruited/tag as pilot or FE vs following the completion of all your phases of training
    - Location: home vs. base, physio clinic vs elsewhere
    - Supervision: medical personnel required?
    - ‘Your superiors’ orders: mandatory vs. optional
    - Anything else?

b. (If needed) What would be the roles of the following persons?
   - PTs and medical team?
   - Commanding officers and managers/administrators?
   - Les pilots and flight engineers?
• Others?

13. Other than an exercise program, are there other things that could reduce neck pain in helicopter pilots and flight engineers? Any suggestion?

Conclusion
You really provided interesting answers and I think you. Are there other aspects that I did not bring up and that you would like to mention? Any last comments? Any questions?

Would you accept that I contact you if needed to validate some information obtained during the interview? Yes____ No___

On behalf of the research team, I sincerely thank you for your time and for helping us in carrying out this research project.
5. Report on the deliverable 10.4. Item 3) the cost effectiveness of the potential implementation of such an injury prevention program no later than 27 September 2017. The report must also provide recommendations on future development of neck injury prevention on other CAF bases and wings.

The implementation of an injury prevention program to mitigate neck pain in RCAF aircrew will be successful if all components are working together, such as the CFHS Gr, the RCAF chain of command and HQ, and the squadrons.

The Figure 7 provides a framework to the rational for implementing the specific shoulder/neck exercises program developed for the RCAF. The findings from the TASK 25 has provided a list of a few criteria that are considered mandatory for the potential implementation of such as injury prevention program:

- The efficacy of the specific neck/shoulder exercises protocol developed, as any other similar exercises regimen, is intimately linked to the acquisition of specific knowledge, and particular assessment and technical skills; therefore, the exercises prescribed and their progression need to be done under the supervision of a qualified physiotherapist;
- The exercises program to be successful should use a formula of mandatory unit PT performed at the Squadrons under the supervision of a qualified DND physiotherapist;
- This mandatory PT with emphasis on specific neck-shoulder neuromuscular/core stability exercises as the one developed by Hebert and Roy should be part of a comprehensive fitness routine including general aerobic, flexibility, and strengthening exercises;
- The use of the specific neck-shoulder neuromuscular/core stability exercises protocol is intended for physiotherapists that are qualified to proceed with a thorough neck/shoulder evaluation before prescribing the exercises that should be included in a comprehensive rehabilitation program;
- It is recommended to trial the developed exercises program (available in videos in French and English) at a few of the 1 Wing units first, then roll it out to the wider RCAF bases, when a better cost estimate and assessment of its efficiency on specific metrics would have been identified;
- It is recommended to add a few additional physiotherapy resources dedicated to the implementation of this neck injury prevention program on bases where RCAF CH-146 aircrew are trained, from the beginning to the end of their training. This will ensure that the helicopter aircrew adhere to such a prevention program early on in their training and make it as part of their lifestyle. This will ensure a continuum of care where there is a concentration of RCAF aircrew, which would make feasible at a low cost to implement a universal exercises program to prevent outbreaks of neck pain in RCAF aircrew.

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