Royal Netherlands Air Force

Optimising aircrew's helmet fit

the effect on neck load

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Introduction

- Year prevalence neck pain in helicopter pilots:
  - 43%, en 20% regular or continuous (Van den Oord et al., 2010)
- Year prevalence neck pain in loadmasters:
  - 61%, en 32% regular or continuous (Van den Oord, 2012)
- Contributing factors (Van den Oord et al., 2010) :
  - Flying hours
  - Experienced cause neck pain: NVG use

**To prevent flight-related neck pain,
there is a need for ergonomic improvements in the equipment
used by the helicopter aircrew**

Introduction

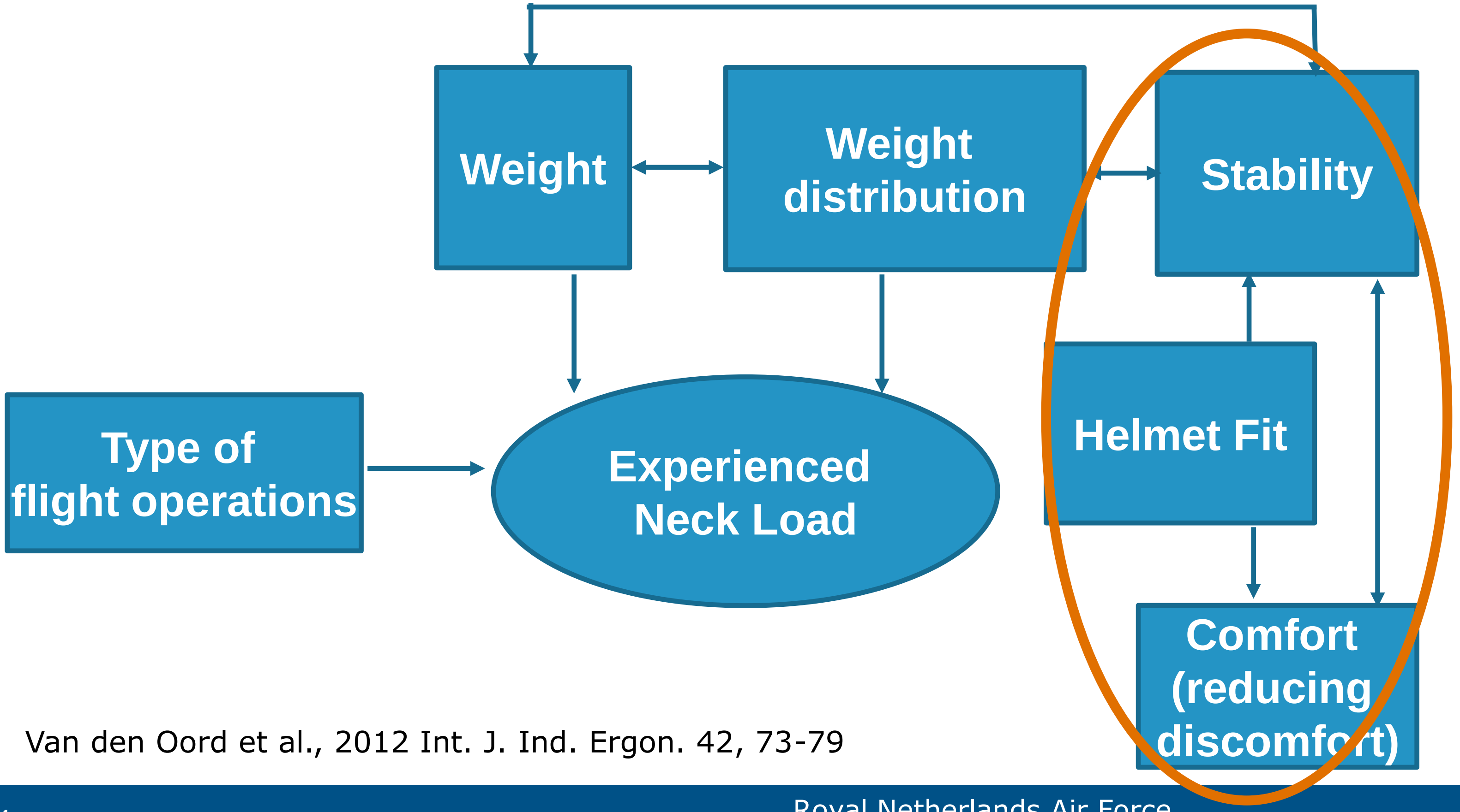
Ergonomics flight helmet + NVG :

- Weight and position NVG cause change in center of gravity
- Counter Weights (CW) available to create balance
- But flying is not a static situation
- What do helicopter aircrew prefer in flight? What's their experience?

Aim: To identify the factors based on the experience of the aircrew to be important in optimizing helmet use and adjustment with respect to neck load.

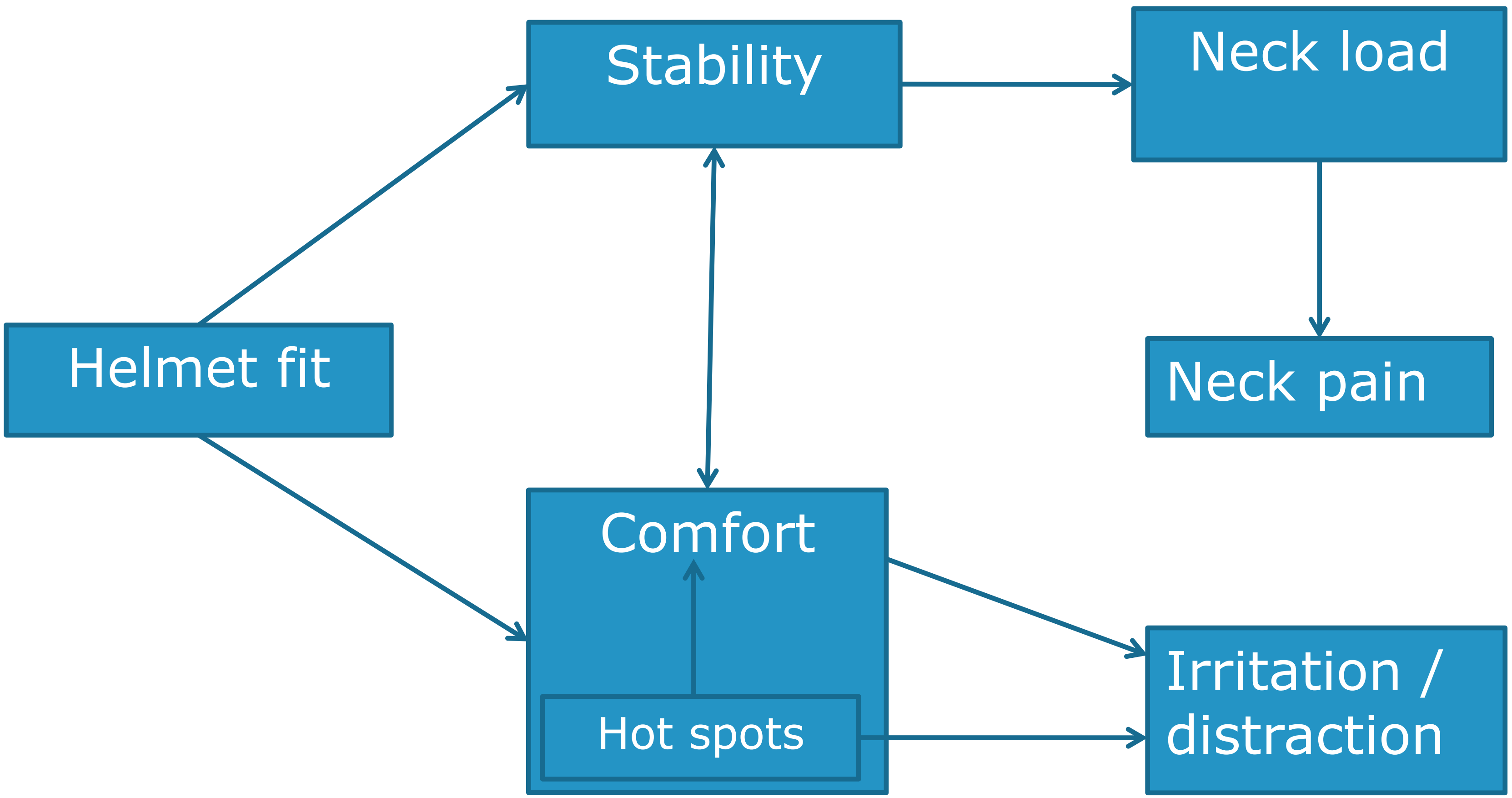
Introduction

Improvements in helmet fit(ting) and stability that take comfort issues into account should be suggested, and their impact on the experienced neck load should be evaluated.



Van den Oord et al., 2012 Int. J. Ind. Ergon. 42, 73-79

Introduction



Aims

To improve the helmet fit and evaluate its effect on the experienced

- helmet stability
- neck load
- neck pain
- hot spots
- irritation/distraction
- overall helmet comfort

during flight

To explore the assumed relations between

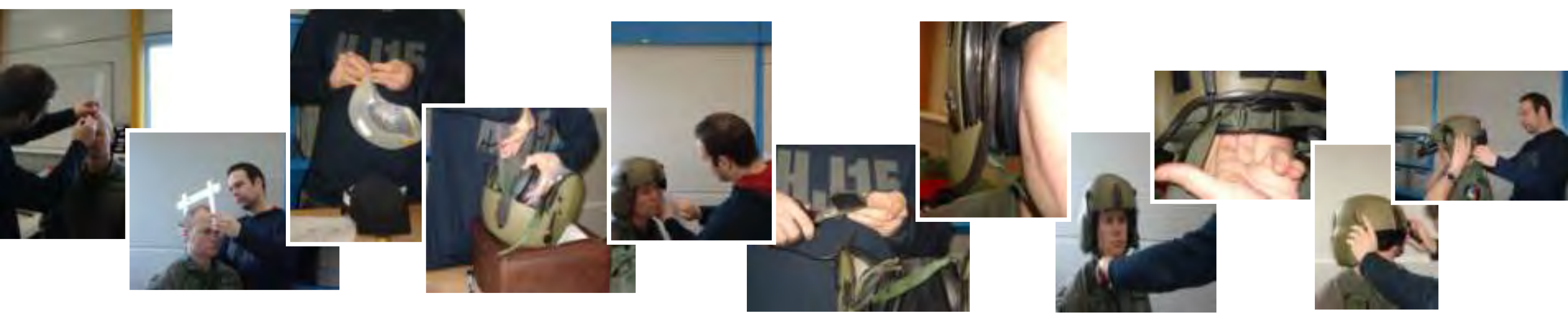
- helmet stability and neck load
- neck load and neck pain
- hot spots and comfort
- hot spots and irritation/distraction
- comfort and irritation/distraction

Methods
Participants and Interventions

Design: within-subjects, two consecutive interventions,
three measurements

Pilots and loadmasters of two squadrons,
expected to fly at least 9 night flights within a period of 3 months

Interventions:
1. New helmet fit according a new protocol

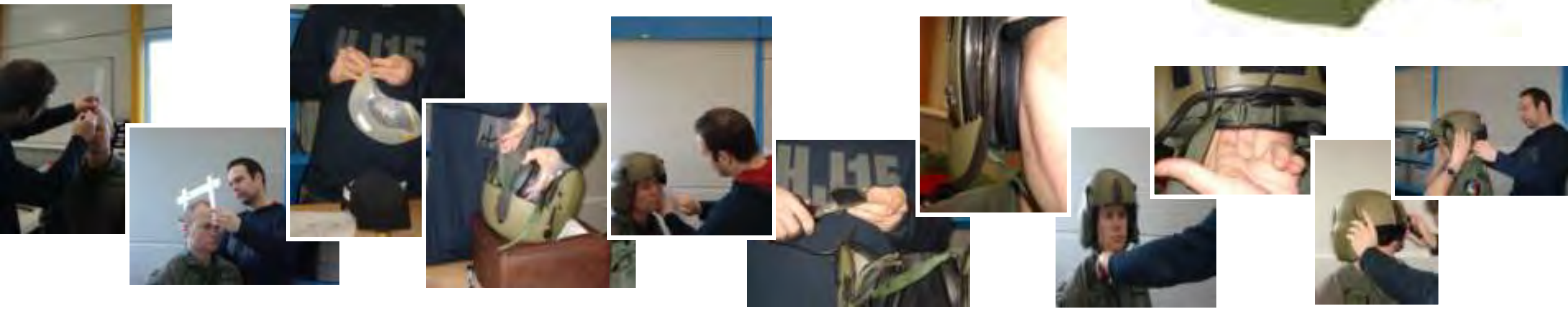


Methods
Participants and Interventions

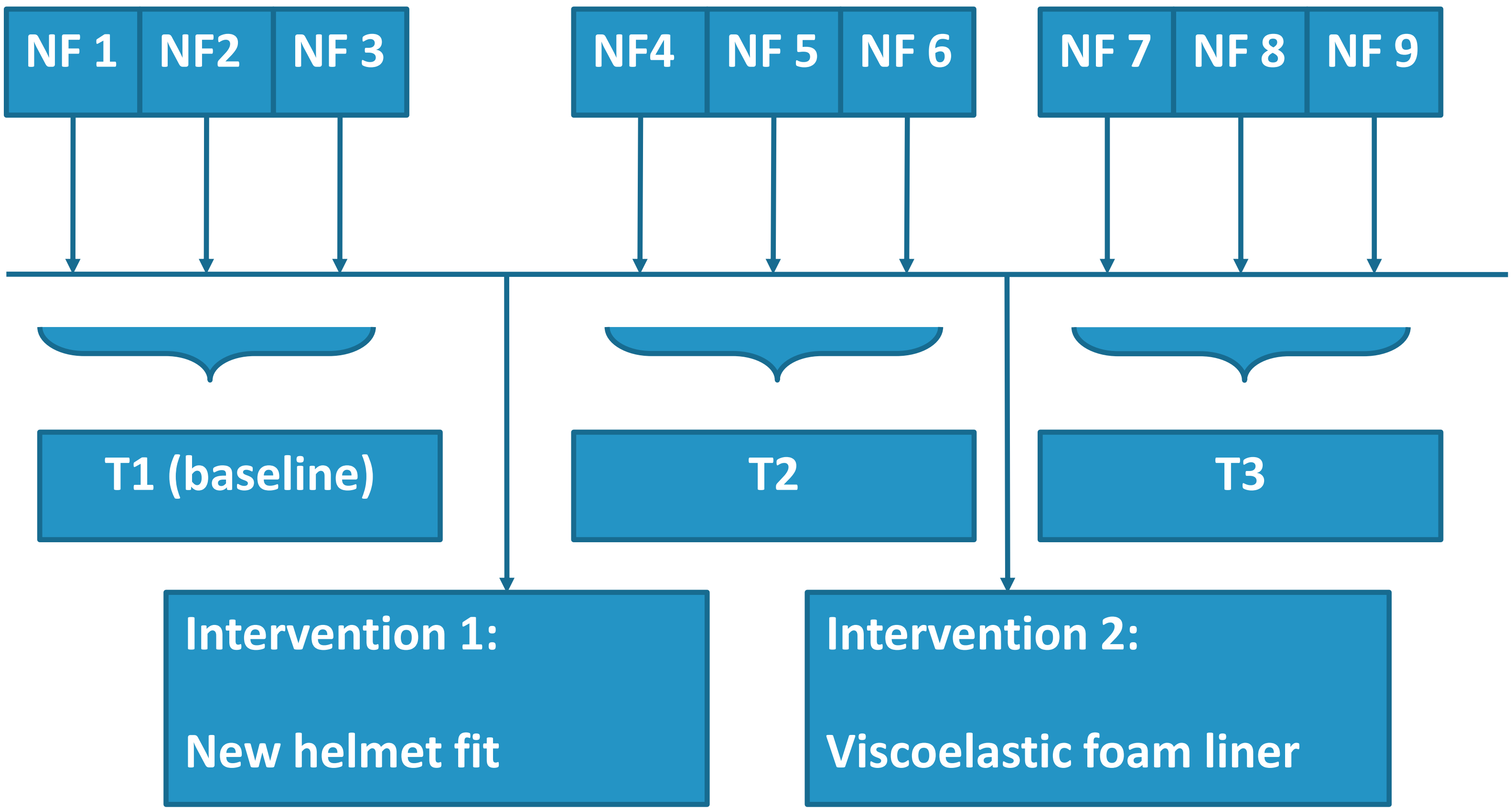
Design: within-subjects, two consecutive interventions,
three measurements

Pilots and loadmasters of two squadrons,
expected to fly at least 9 night flights within a period of 3 months

Interventions:
1. New helmet fit according a new protocol
2. Viscoelastic foam inner liner



Methods
Time Line



Methods
Measures and Analyses

Outcome measures rated using VAS (100mm):

No suffering from helmet gliding — Extreme suffering from helmet gliding

- Helmet gliding (helmet stability)
- Hot spots (pressure points)
- Neck load
- Neck pain
- Irritation/distraction
- Comfort

Analyses:
- ANOVA-repeated measures, Bonferroni post hoc test
- Pearson’s correlation coefficients

Results
Participants and Flight information

- 18 aircrew: 9 pilots and 9 loadmasters

	Mean	SD
Age (yr)	31	10
Heigth (cm)	183	8
Weight (kg)	80	8
Flying hours (hrs)	1192	1085
NVG-hours (hrs)	215	259

- Mean flight duration:

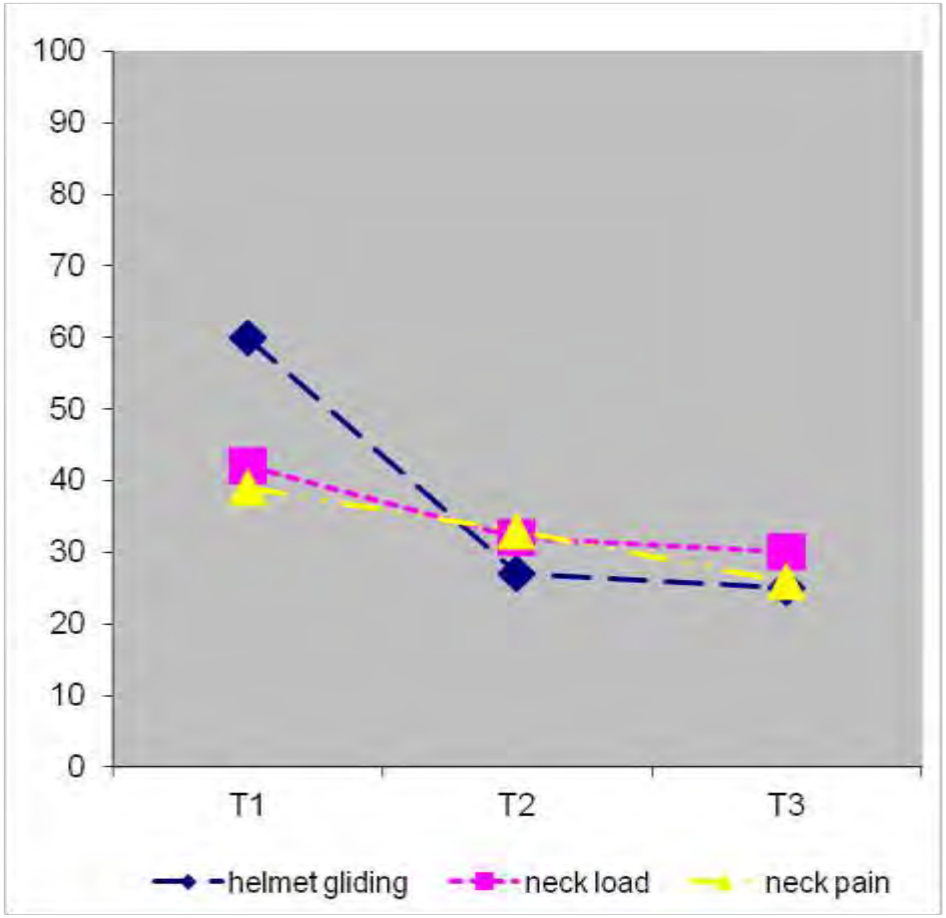
	T1	T2	T3
duration (hrs)	2.4 (±0.7)	2.1 (±0.5)	2.7 (±0.6)*

post hoc analyses: * $p<0.05$ compared to T2

- Counterweights varied from 150 gram to 400 gram between participants

Results

First aim



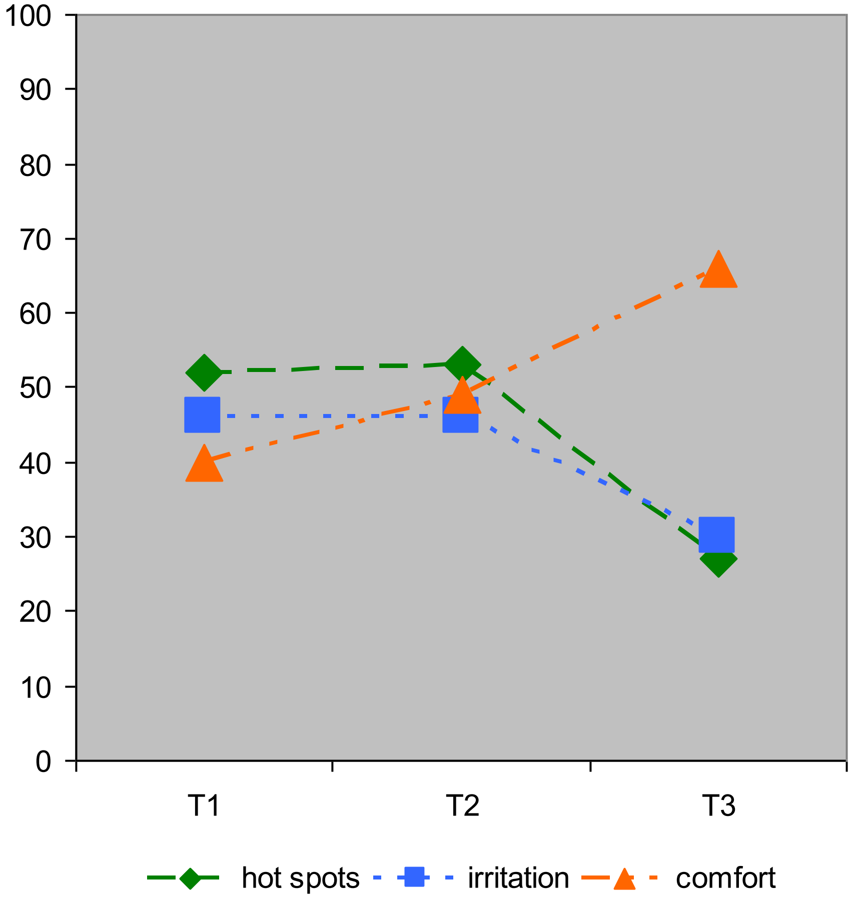
p< 0.000 p=0.02 p=0.058

	T1 mean (± SD)	T2 mean (± SD)	T3 mean (± SD)
Helmet gliding	60 (16)	27 (21)*	25 (23)*
Neck load	42 (22)	32 (21)	30 (23)*
Neck pain	39 (24)	33 (23)	26 (21)

Post hoc analyses were performed for helmet gliding and neck load.
*p<0.05 compared to T1

Results

First aim



p=0.001 p=0.057 p<0.000

	T1 Mean (± SD)	T2 mean (± SD)	T3 Mean (± SD)
Hot spots	52 (22)	53 (27)	27 (21)* †
Irritation	46 (22)	46 (29)	30 (23)
Comfort	40 (15)	49 (24)	66 (20)* †

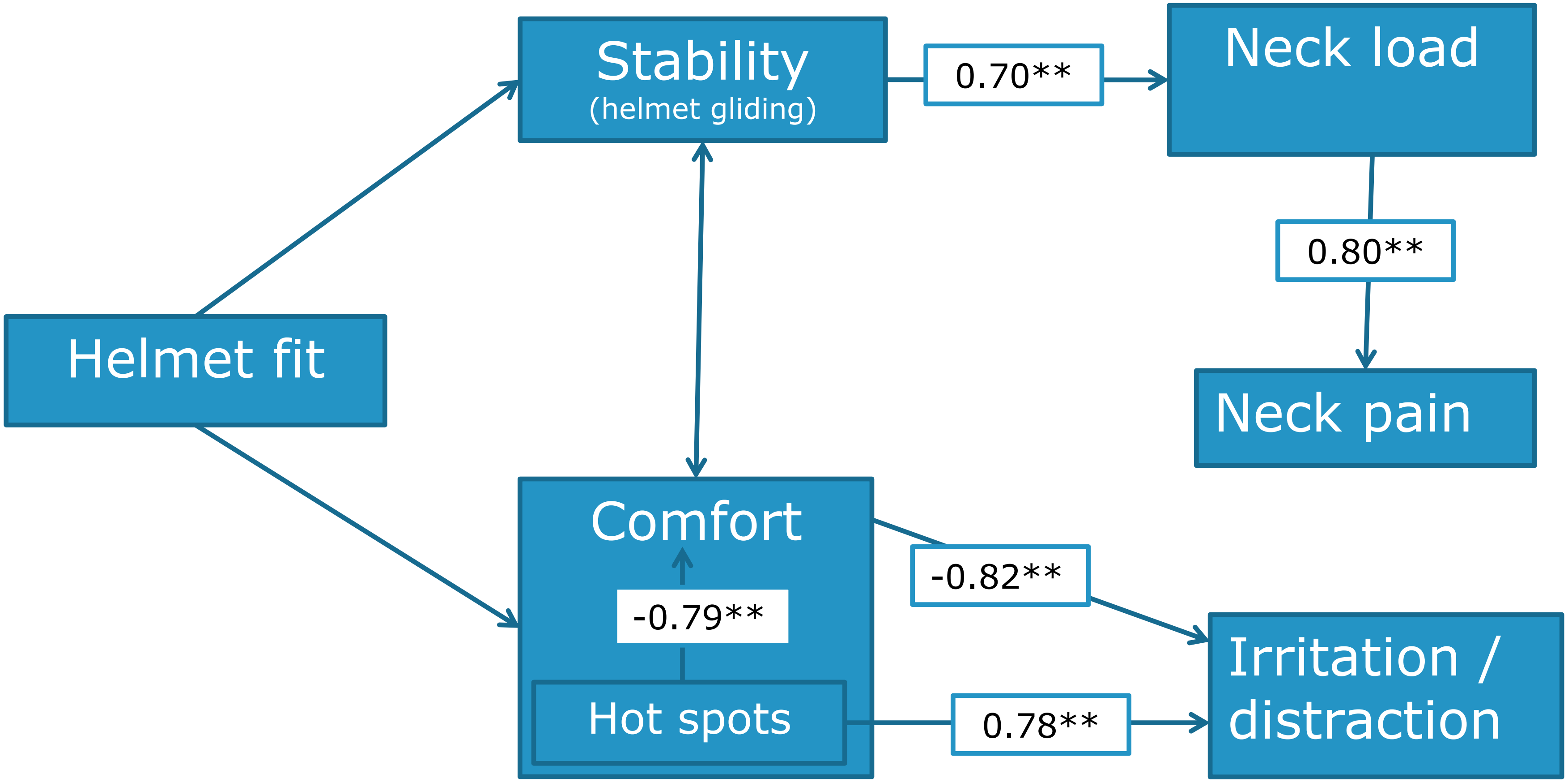
Post hoc analyses were performed for hot spots and comfort.

* $p < 0.05$ compared to T1

† $p < 0.05$ compared to T2

Results

Second aim



**p < 0.01

Conclusions

- An optimised helmet fit
  - increases helmet stability
  - reduces neck load
  - reduces hot spots
  - increases overall helmet comfort

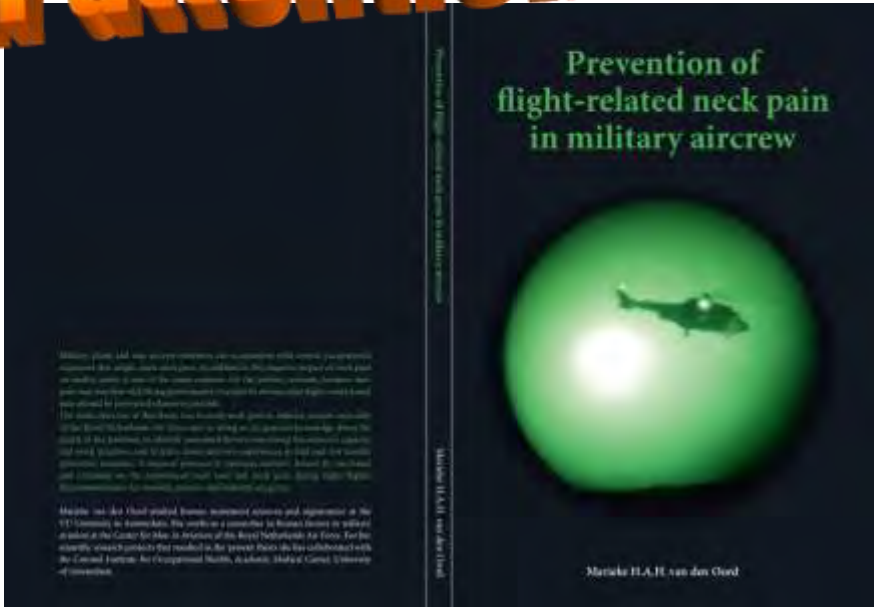
during helicopter flights

- Neck pain perceived with an optimised helmet fit is highly associated with the neck load experienced during flight

- Both the experienced hot spots and the overall helmet comfort are highly associated with irritation/distraction during flight

- An optimised helmet fit might have implications for both health and safety concerns

Thank you for your attention



The effect of an optimised helmet fit on neck load and neck pain during helicopter flights

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