Tinnitus and chronic pain: The Tromsø Study

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Background

Tinnitus and pain are both frequently occurring phenomena that share many similarities. Both are subjective sensations that may turn chronic, are accompanied by hypersensitivity in their respective sensory system, and may be caused by functional changes in the central nervous system. Studies examining the empirical associations between the two conditions in the general population are lacking.

Aim

To study the relationship between tinnitus and pain in the general adult population, by examining distribution, intensity and discomfort of pain in relation to tinnitus prevalence and annoyance.

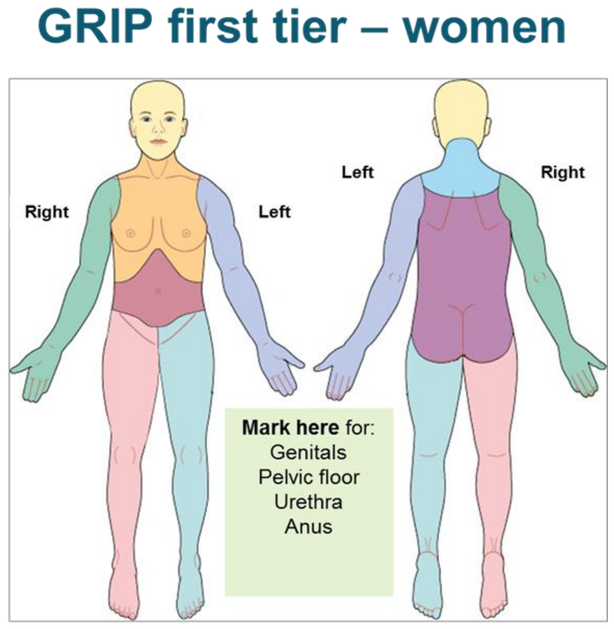
Methods

Data:

- The Tromsø Study: Tromsø 7 (2015 – 2016, n = 21 083)

Main variables:

- **Chronic pain:** reported pain in the first tier of the Graphical Index of Pain with 10 main body regions (Fig. 1)
  - Chronic pain defined as pain persisting for ≥3 months
  - Three separate pain variables were calculated:
    1. Total number of body regions with pain
    2. Maximum intensity of pain
    3. Maximum pain discomfort
- **Tinnitus:**
  1. Answered yes/no to having tinnitus lasting 5 minutes within the past 12 months
  2. If yes - Reported tinnitus annoyance
- Directed Acyclic Graphs were used to identify confounding variables to adjust for in regression models (Fig. 2)
- Participants with missing data in any of the variables in questions were excluded from analyses
- Statistical analyses:
  - Logistic and linear regression were used to analyse the relationships



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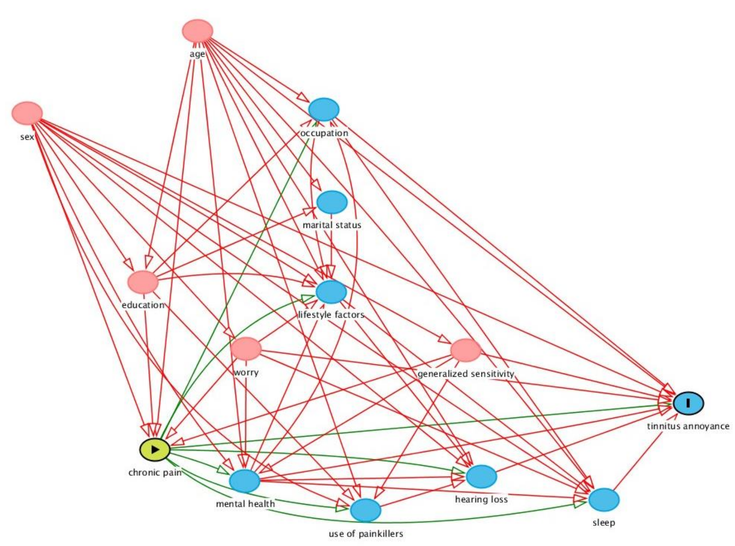


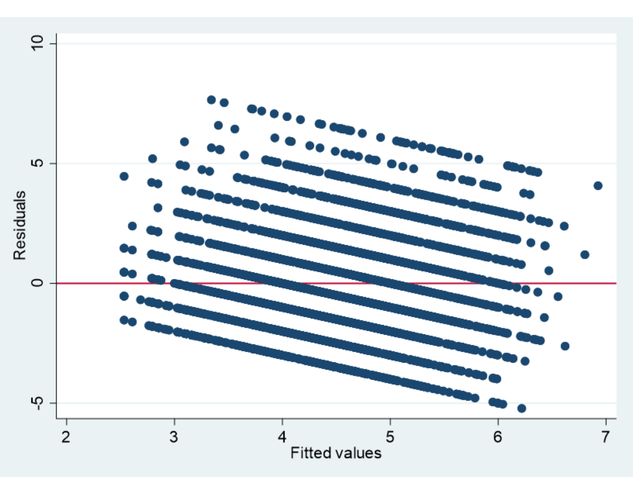
Preliminary results

Tinnitus variable	Pain variable	Female		Male	
		Age 40-69 (n = 8492)	**Age ≥70 (n = 1476)**	**Age 40-69 (n = 7721)**	**Age ≥70 (n = 1463)**
Tinnitus (yes/no) Logistic regression n=19152	Number of areas with pain	OR = 1.23 [1.19, 1.27]***	OR = 1.78 [1.60, 1.99]***	OR = 2.89 [2.62, 3.19]***	OR = 4.19 [3.63, 4.85]***
	Maximum pain intensity	OR = 1.09 [1.07, 1.11]***	OR = 1.65 [1.45, 1.87]***	OR = 2.51 [2.24, 2.80]***	OR = 3.79[3.21, 4.48]***
	Maximum pain discomfort	OR = 1.08 [1.06, 1.10]***	OR = 1.60 [1.42, 1.82]***	OR = 2.47 [2.21, 2.75]***	OR = 3.67 [3.11, 4.33]***
		Age 40-69 (n = 1355)	**Age ≥70 (n = 256)**	**Age 40-69 (n = 1917)**	**Age ≥70 (n = 468)**
Tinnitus annoyance Linear regression n=3996	Number of areas with pain	β = 0.069 [0.008, 0.131]*	β = 0.242 [0.037, 0.447]*	β = -0.124 [-0.321, 0.073]	β = 0.048 [-0.228, 0.325]
	Maximum pain intensity	β = 0.098 [0.064, 0.132]***	β = 0.386 [0.152, 0.620]**	β = -0.086 [-0.308, 0.136]	β = 0.202 [-0.112, 0.517]
	Maximum pain discomfort	β = 0.088 [0.056, 0.121]***	β = 0.344 [0.110, 0.577]**	β = -0.123 [-0.343, 0.098]	β = 0.133 [-0.180, 0.447]
Age, sex, education, generalised sensitivity and worry were adjusted for in analyses, in addition to interactions pain*age and pain*sex.					
Results for each group were found by linear combinations of effect estimates.					
* : p<0.05, ** : p<0.01, *** : p<0.001					

Methodological challenges:

- Logistic regression models: Hosmer Lemeshow tests show are significant, i.e. the model adjustments are not satisfactory
- Linear regression: Residual plots display systematic patterns

Residual plot for tinnitus annoyance vs. pain discomfort: underestimating the lower values and overestimating the higher values
The other residual plots display the same patterns



Conclusions

Preliminary results indicate associations between chronic pain and both tinnitus and tinnitus annoyance. However, the chosen models are inadequate, and it is necessary to consider other statistical methods.

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