Cognitive processing biases in those experiencing frequent or chronic headaches or migraines: a meta-analysis and systematic review

This protocol was iteratively developed and agreed upon by the researchers involved.

Objectives and research Questions:

The aim of this review is to explore the role of cognitive biases in those experiencing frequent or chronic headaches and migraines (based on selection criteria outlined across studies – e.g. criteria stated in the International Classification of Headache Disorders). More specifically, we are interested in attentional, interpretation and memory biases.

Primary Questions:

1. Do those experiencing frequent or chronic headaches or migraines show greater cognitive processing biases (i.e. attentional, interpretation and memory biases) towards pain or threat information than healthy individuals (i.e. those not experiencing chronic headaches or migraines)?
2. Do people experiencing frequent or chronic headaches or migraines show cognitive processing biases (i.e. attentional, interpretation and memory biases) towards headache stimuli compared to neutral stimuli?
3. Do healthy individuals show cognitive processing biases (i.e. attentional, interpretation and memory biases) towards headache stimuli relative to neutral stimuli?

Secondary Questions:

1. Does the strength of cognitive bias (i.e. attentional, interpretation and memory biases) depend on type of task used?

2. Do cognitive processing biases (i.e. attentional, interpretation and memory biases) differ depending on the content and type of stimuli (e.g. headache, pain or threat related; and for studies measuring attentional bias, whether the stimuli are in the form of pictures or words)?
3. Do attentional biases differ depending on the duration of stimuli presentation (e.g. 300, 500 or 1250 ms)?
4. Are cognitive processing biases (i.e. attentional, interpretation and memory biases) towards pain or threat stimuli associated with increased and/or enduring headache pain, severity and disability, and psychopathology in those with frequent or chronic headaches or migraines?

Primary Outcomes:

1. Comparison (analysis of between-group studies) of cognitive processing biases towards headache or pain-related stimuli between those experiencing headaches or migraines and those not experiencing headaches or migraines (i.e. 'healthy' individuals).
2. Analysis of whether those with frequent or chronic headaches show cognitive processing biases towards headache or pain-related stimuli.
3. Analysis of whether healthy individuals show cognitive processing bias towards headache or pain-related stimuli.

The cognitive biases of interest in the present review are attentional bias, interpretation bias and memory bias. Whilst there was no restriction on the measures used to assess these biases, the following provides a description of the typical indices and measures of each bias.

Cognitive bias towards headache or pain-related stimuli are measured as one of the following:

1. Attentional bias is measured via an attentional bias index, i.e. the difference in response times to trials on which the probe follows neutral stimuli (incongruent trials) and trials on which the probe follows salient stimuli (congruent trials). This is the primary outcome for reaction-time based tasks such as the dot-probe, Stroop (usually terms an interference score), and spatial cueing task. Additionally, Eye- tracking outcomes (e.g. time to first fixation on salient stimuli, proportion of first fixations on salient stimuli and mean dwell time on salient stimuli, all compared to neutral stimuli) are also used to measure attentional bias.
2. Interpretation bias is measured as a tendency to interpret ambiguous information in a negative or pain-related manner. Tasks used to measure interpretation bias include word stem completion tasks, in which part of a word is presented with at least two possible resolutions, for which one possible solution is pain or threat-related; homograph or word association task, in which participants are presented with words that have one or more meanings or associations, and participants are asked to write down the first associated word that comes to mind; sentence generation task, in which participants are presented with a word, which they then use in a sentence; and ambiguous scenarios task, in which participants are presented in an ambiguous scenario which they then resolve in a negative or benign manner.
3. Memory bias is measured as a tendency to remember pain or health-related information more negatively, or more readily than neutral information. This can be measured with tasks such as the free recall task, in which participants are given a list of words containing pain (or threat) words and neutral words, and a memory bias is inferred where more of the pain (or threat) words are recalled.

Secondary Outcomes:

Quantitative and qualitative consideration of the influence of study design factors, including:

- Duration of stimuli presentation (i.e. 300 ms, 500 ms, 1200 ms). Do attentional bias effects differ with duration of stimuli presentation?
- Type of stimuli presentation (e.g. word or image-based stimulus; headache pain stimuli, general pain stimuli, general threat stimuli). Does one form of stimuli presentation show stronger effects than others?
- Method of measurement of cognitive processing biases (i.e. attentional, interpretation and memory bias). Within each cognitive processing bias, do certain methods show stronger effects than others? For example, attentional bias can be measured via the dot-probe task or eye-movement measurements. In cases such as these, where the resulting bias indices are not compatible (i.e. reaction time measures of attention vs. eye-tracking measures of attention), qualitative rather than quantitative comparisons will be made.

Consideration of the association between attentional biases towards pain or threat information and headache pain, severity and disability.

Study selection criteria:

Studies must:

1. Include participants experiencing frequent or chronic headaches or migraines and/or healthy individuals (i.e. those not experiencing headaches or migraines).
2. Not include headaches or migraines which are caused by trauma or medication over-use in the headache/migraine condition.
3. Report on original data (i.e. not reviews or commentaries). Where the same data is included in multiple papers, we will include that with the larger sample. If sample

sizes are the same, we will include that with the data that best addresses the research question.

4. Be peer-reviewed and accepted for publication in a journal
5. Be available in English

Studies must be headache and/or migraine-related, either in sample, or in stimuli, or in both. That is, if studies only include a healthy (non-headache) sample, then the cognitive processing bias measures must include headache pain stimuli. Timing of stimulus display (e.g. 100ms, 500ms) is not restricted. Type of salient stimuli is also not restricted, as long as it includes an element of threat (e.g. headache/migraine related, general pain, general threat). For a research outcome to be included in the effect size analysis, there must be at least three sets of data (i.e. three studies having measured that outcome, or three groups of participants). Where there are less than three studies, said research outcomes will be analysed qualitatively.

Type of participants:

Participants will be adults and can be included regardless of the presence or absence of headaches or migraines. Where samples include participants younger than 18, the average age of participants must be over 18.

Participants will be grouped based upon the presence of headache or migraine to form the following two groups:

1. *Headache or migraine group*: those participants who experience frequent or chronic headaches or migraines.
2. *Healthy group*: participants not experiencing headaches or migraines

Search Methods for Identification of Studies:

Search databases/sources:

- Web of Science
- PsycINFO
- Cinahl
- Reference lists of included studies and review articles will also be searched, and authors of included studies will be contacted to reduce the chance of missing a study.

Search:

[attention* OR interpretation* OR memory OR cognitive] AND [selective OR bias*] AND [headache* or migraine*]

Search dates: No restrictions

Search restrictions: English language, human samples (no animal studies)

Unpublished studies will not be included

Selection of Studies:

The titles, abstracts and full text articles from the available literature will be screened for inclusion in the review.

Two reviewers will independently screen records for inclusion and a third reviewer will help to resolve any discrepancies.

Data Extraction:

A data extraction form will be created for this study, based on the protocol specifications. Data will be double-coded and discrepancies resolved through consensus or through consultation with a third reviewer.

If a study presents multiple types of salient stimuli (e.g. headache/migraine-related, general pain, general threat), we will preference them in the following order regarding inclusion in the main analysis: headache/migraine-related > general pain > general threat.

Reaction time measures of attention will be analysed separately to eye-tracking measures of

attention (i.e. these two measurements of attentional bias will not be meta-analytically compared).

Quality rating:

Quality Assessment (adapted from Todd, et al., 2018):

1. Description of inclusion and exclusion criteria

    1: Adequate

    0: Not adequate

A study should provide detailed information regarding the inclusion and exclusion criteria in terms of age range, sex, diagnosis or other relevant variables.

2. Description of demographics of participants

    1: Adequate

    0: Not adequate

A study should provide information regarding participants' age, gender and socioeconomic status. Often study participants are biased towards the higher educated. Inclusion of this demographic information provides valuable information for evaluating external validity.

3. Description of headache/migraine experience

    1: Adequate

    0: Not adequate

A study should provide a detailed description of the criteria for determining the presence/absence of headache/migraine experience among participants. For example, in terms of severity, type of pain and pain duration.

The control group should be identified as those not experiencing chronic headaches/migraines. Given headaches are a common experience, if 'headache/migraine free

sample' is indicated, then study must include information on a) how this was determined (e.g. excluding those reporting a history of migraines or headaches), or b) record pain measurements (e.g. specify the proportion of individuals within the control group who are currently experiencing headaches, or the average pain rating for the control group).

4. Description of recruitment procedure

1: Adequate

0: Not adequate

A study should provide information about the participant recruitment procedure. When participants are students the description should include whether they volunteered for credit points or money. When participants are patients, the description should include the recruitment procedure (advertisement, consecutive patients). When applicable, the study should describe how many patients refused participation. Of less importance are the reasons for refusal.

5. Description of the setting and/or location of the study of participants in each group

1: Adequate

0: Not adequate

The study should provide information about the setting where participants were recruited (general population, revalidation centre, medical clinic), type of students (undergraduates of university, post-graduates, etc.).

6. Description of data cleaning, and its criteria (outliers, missing values, invalid data)

1: Adequate

0: Not adequate

Studies must report how data was cleaned, how outlying participants and data were removed, and the percentages or number removed. Also, the study should report the percentage of

missing values in the final data set. It is not necessary that the study investigates the pattern of the missing values (missing completely at random, missing at random or missing not at random).

7. Relevance of Headache/migraine-related information

3: selection/check in (pilot) study, and data reported

2: selection/check in (pilot) study, but data not reported; or based upon relevant data from another study

1: based upon expertise of experimenter, or based upon previous studies that did not provide data

0: no mentioning

The study should report that the headache/migraine-related stimuli are relevant for this group of the study. This includes the word or picture stimuli used in attentional bias tasks, potential word resolutions for interpretation bias tasks, and words for recall in the memory bias tasks. Stimuli may be selected in a pilot study in which the participants are of similar characteristics to the study participants. Stimuli may be rated for relevance by the participants themselves (score 3). It is not sufficient that stimuli have been shown to be headache/migraine-relevant and valid in another study unless that study involves similar participants and context. Validity is not absolute and is often context dependent. Headache/migraine-related stimuli that are relevant for one setting and one type of participants are not necessarily valid for another setting or type of participants (score 2). A score of 2 is also given when the study reports that pain-relevance has been investigated but fails to report the data. Studies in which the pain-related stimuli are only based upon the experimenter's expertise, or in which the same stimuli are used from previous studies that did not provide data about pain relevance, are scored 1. No mentioning of an internal check is scored 0.

References

Todd, J., van Ryckeghem, D. M., Sharpe, L., & Crombez, G. (2018). Attentional bias to pain-related information: a meta-analysis of dot-probe studies. Health psychology review, 12(4), 419-436.

Crombez G, Van Ryckeghem D, Eccleston C, Van Damme S. (2013). Attentional Bias to pain-related information: A meta-analysis. Pain; 154(4): 497-510