EMMA NEUROSCIENCE GROUP

GUIDELINE – ARTICLE WRITING

VERSION 1.0

GENERAL

1. COMPOSE A GROUP OF CORE AUTHORS

a. Manuscript drafts are usually prepared by a core group of authors, who assist the first author by formulating the aims and perspective of the article and providing feedback on drafts. The core group minimally consist out of the first author and his/her supervisors (i.e. second and last authors). Depending on the first author's experience in scientific writing, it usually takes several drafts before a manuscript draft is presented to the author group as a whole.

INTRODUCTION

1. FORMULATE THE MAIN MESSAGE

a. The introduction serves as a chain of argumentation, convincing the reader of the importance of the main study aim. In order to write a convincing introduction section, you should start with clearly formulating the main message of the introduction. The main message is the result of your interpretation of the state of the literature and warrants the investigation of the main study goal.

2. DETERMINE THE GREATER STRUCTURE

a. Most introduction sections are composed of 5-7 paragraphs, depending on the specificity and/or complexity of the main study goal. Introduction sections may be composed of fewer or a larger number of paragraphs, depending on the target journal and disciplines served by the target journal. The number of paragraphs is equal to the number of 'steps' that have to be taken in order to explain the main study goal to a colleague with a comparable background but with another expertise.

b. Paragraphs have a specific functioning in your chain of reasoning. Every introduction should have clearly recognizable paragraphs serving the following functions:

   i. Introduction of the major study concept(s), their importance and a teaser to the problem statement. Concepts may refer to disorders, aspects of functioning, theoretical frameworks, etcetera. This is a general description of the problem that gave rise to the main study goal and to which the expected results of the study would be a (potential) solution;

   ii. Critical review of the existing literature on the study concept(s), including a description of the limitations in the existing literature that gives rise to the main study goal;

   iii. Description of the main study aim, presented as a logical consequence of the state of evidence.

c. Generate the major and minor concepts of the study using a mind map. Use the main subject of the study as the central node, while adding relevant themes using branches. At first, use associations to build a rich mind map (go wild). Then, prune the map to remove irrelevant or redundant themes, and try different versions of its structure until you are satisfied with the chosen concepts and their hierarchy in the map. Themes connected to the original node would be major concepts of the study, while themes connected to other nodes would be minor concepts.

d. Create an outline for the structure of the introduction, the Skeleton Template:

   i. Determine the chain of reasoning using the limited set of keywords from the mind map. Divide the chain of reasoning in a number of steps which will pertain to the paragraphs of your introduction. Each paragraph should be described in a few keywords, typically one to three. If more than three keywords are necessary to describe a paragraph, this might indicate that the paragraph relates to more than one concept and needs to be split into two or more paragraphs;

ii. Use the Funnel 'model', meaning that the first paragraph starts with the most general concept within your scope, and each following paragraph narrows down the field within the general concept towards the main study goal.

3. ORGANIZE THE PARAGRAPHS, DESIGN THE INTRODUCTION SKELETON

a. Each paragraph has its own structure in itself:
   i. Introduction of the content of the paragraph;
   ii. Presentation of evidence, supporting the function of the paragraph (this may be an overview of the results of other studies);
   iii. A conclusion drawn from the evidence presented in the paragraph, explicitly stating the argument of the paragraph.

b. Paragraphs should work together to support a continuous chain of reasoning. This is reached by connecting the paragraphs by meaning ánd explicit wording. In other words, the introduction of each paragraph should be the natural consequence of the conclusion of the preceding paragraph. Likewise, the conclusion of a paragraph naturally bridges to the introduction of the subsequent paragraph. Refine the structure created in step 3, by extending the keywords pertaining to the three paragraph structures:
   i. Introduction: argues for the connection between the current paragraph and the preceding paragraph (does not hold for first paragraph);
   ii. Evidence: the key findings from the literature, including references;
   iii. Conclusion: the conclusion from the literature, which will naturally introduce the following paragraph (does not hold for final paragraph);

4. ADD DETAIL

a. Only start to add detail when step 1-3 have been discussed, revised and established to with the core group of authors.

b. Transform the key messages into narrative sentences, please note:
   i. Do not reformulate or translate existing sentences; take down the conclusions of other authors to the essence of their meaning and use this essence as the basis of a new sentence. Adapt the sentence to that it fits in the context of the surrounding sentences in your introduction;
   ii. Leave out any information that does not directly contribute to the chain of reasoning, also when it is 'generally interesting' to the readership. This does not mean that you should selectively 'shop' in the available literature for evidence that supports your hypothesis. In contrast, the main study goal is the result of careful consideration of the existing literature, so the evidence presented in the chain of reasoning should logically and directly contribute to your main study goal.

5. STREAMLINE READABILITY

a. Help the reader to follow your chain of reasoning, by explicitly stating the relation between sentences using conjunctions, i.e. "*A recent study showed (…). This finding suggests that (…)*".

b. When evidence is contradictive, sparse or lacking at all, explicitly state this.

c. When evidence is presented from an adjacent field or population (i.e. evidence from a comparable disease condition or another population, i.e. adults vs. children) explicitly state the origin of the evidence, and the relevance of this finding for the population of interest in your own work. Clearly separate evidence (in space and wording) from other populations from the evidence acquired in the subpopulation of interest.
d. Minimize the number of abbreviations, only use abbreviations of major study concepts when use of the abbreviation will considerably alleviate the pressure on word count. A great number of abbreviations reduces readability. When using abbreviations, always use existing and or logical versions; be very conservative in creating your own abbreviation.
e. Please note that usually there are several alternative orderings possible in the streamline of reasoning. During the process, it may therefore become clear that the order of the reasoning (and therefore the order of the paragraphs) may need to change. Exploration of different introduction structures are frequently part of the process.

TEMPLATE – INTRODUCTION SKELETON

1. **PARAGRAPH 1**
    a. Describe the major concept (e.g. the disease condition).
    b. Describe the importance of the major concept:
        i. Incidence and/or prevalence (absolute numbers, percentages);
        ii. Major consequences and disabilities (these should also match your main goal of the study).
    c. 'Teaser' of problem statement: Describe importance of your subfield of interest (e.g. a certain outcome domain or intervention) or your subpopulation of interest (e.g. children, adolescents, etc.). Finish with a 'teaser' of the problem statement. This is a general description of the problem that gave rise to the main study goal and to which the expected results of the study would be a (potential) solution.
2. **PARAGRAPH 2**
    a. Describe the major mechanisms that give rise to the problem statement in your subfield/subpopulation of interest (use a neuroscientific model, e.g. a description of pathophysiological processes damaging the brain, in turn leading to cognitive and behavioral abnormalities).
3. **PARAGRAPH 3 (OPTIONAL)**
    a. Provide an overview of evidence in the greater context, this may involve evidence from adjacent subfields and/or subpopulations. Use this knowledge to underline the importance of studying the main study goal in the subfield/subpopulation of interest.
4. **PARAGRAPH 4**
    a. Provide an overview of evidence directly relating to your subfield/subpopulation of interest. This should be an exhaustive overview of the literature directly relating to your main study goal. The exhaustive overview of the literature may be based on individual studies or summaries of the existing literature, such as reviews. It is also important to explicitly point at inconsistencies in the literature.
    b. Summarize the limitations of the existing literature (including inconsistencies).
5. **PARAGRAPH 5**
    a. Present the main goal of the study. If well-chosen, this will automatically align with the summary of the limitations in the existing literature.
    b. Present your hypotheses, based and explicitly related to the evidence provided in paragraph 2, 3 and 4. Describe the hypothesis at the level of detail that you can support by the evidence that you provided in paragraph 4.
    c. Underline the importance of your main study goal with regard to the gaps in the literature. This should directly relate to your problem statement.
    d. Describe the potential value of your study for the scientific and/or clinical field. This should directly relate to your problem statement.

In case a target journal requires a very short introduction, it could be a solution to:

a. Merge paragraphs 1 and 2;
b. Continue with paragraph 4;
c. End with paragraph 5 (sometimes, hypotheses are not provided in these cases).

If the mechanism is actually part of the main study goal, it may need some further discussion and therefore it could be another option to:

a. Begin with paragraph 1;
b. Merge paragraph 2 and 4;
c. End with paragraph 5 (sometimes, hypotheses are not provided in these cases).

METHODS

The Methods section is a more straightforward section to write as compared to the Introduction section. The Methods section contains a relatively fixed set of subheadings and content. The following items should be described in every methods section (with the exception of optional items, which may or may not apply). Please be aware that some additional items may be necessary to describe for your study specifically.

1. **STUDY DESIGN (SUBHEADING LEVEL 1)**
    a. Describe the study design;
    b. Provide a general description of the study groups;
    c. In case a special control group is used, provide the reason for this;
    d. Guidelines for reporting from the EQUATOR Network.

2. **PARTICIPANTS (SUBHEADING LEVEL 1)**
    a. Sample **(SUBHEADING LEVEL 2)**
        i. Describe the recruitment procedure, including:
            1. The recruiting centers;
            2. The recruitment period;
            3. Inclusion criteria;
            4. Exclusion criteria.
        ii. The inclusion rate,* including:
            1. The percentage of children included from the recruitment cohort;
            2. The main reasons provided for not participating.
        iii. The exclusion rate,* including:
            1. The percentage of included children that were excluded;
            2. The specific reasons for all excluded cases.
        iv. Loss to follow-up (optional for studies with longitudinal measurements).
    b. Intervention (**SUBHEADING LEVEL 2,** optional):
        i. Describe details of the intervention(s) used, including:
            1. The nature of the intervention arms;
            2. The exposure to the intervention arms (dosage, frequency, duration);
            3. The group allocation procedure and concealment procedure;
            4. The blinding procedures (investigators, patients and/or assessment);
            5. Loss to follow-up (also referred to as drop-out rate or attrition), including specific reasons for each case.
        ii. Describe how loss to follow-up was handled in the analysis:
            1. Intention to treat principle;
            2. Per protocol.

*Some journals require this information to be reported in the Results section.

3. **MEASURES (SUBHEADING LEVEL 1)**
    a. Use subheadings (level 2) for each (set of) outcome measure(s);

b. Per (set of) outcome measure(s), describe the methods used, including:
    i. The specific tests used;
    ii. The variable of interest for each construct assessed;
    iii. Evidence regarding psychometric quality (e.g. validity, reliability).

4. PROCEDURE (SUBHEADING LEVEL 1)

a. Describe the procedure of recruitment, including:
    i. The procedure for contacting potential candidates;
    ii. The procedure for informing potential candidates;
    iii. The consideration period and follow-up for the decision to participate.
b. Describe the procedure for inclusion, including:
    i. How written informed consent was obtained from parents;
    ii. How written informed consent was obtained from children (e.g. > 11 years of age).
c. Describe the procedure for outcome assessment, including;
    i. The location, duration and number of visits;
    ii. The duration of actual outcome assessment (including planned breaks);
    iii. Specific strategies applied for outcome assessment (e.g. counterbalancing of test administration order).
d. Describe the details regarding ethical approval, including:
    i. The execution of study procedures according to the Declaration of Helsinki;
    ii. Whether approval was obtained (if not, provide reasoning for this);
    iii. The bodies that performed ethical and/or scientific review of the study protocol (Names and protocol number);
    iv. The trial register in which your study has been registered, including the registration number.

5. STATISTICAL ANALYSIS (SUBHEADING LEVEL 1)

a. Describe the (statistical) software used to perform the statistical analysis;
b. Describe the procedure for pre-processing of data, including:
    i. The prevalence of missing data:
        1. Frequency and ranges per variable;
        2. Reasons;
        3. Patterns (e.g. missing at random, etc.).
    ii. The prevalence of outliers:
        1. The detection algorithm used;
        2. The procedure for handling outliers (e.g. imputation, exclusion, etc.);
    iii. Data transformations:
        1. Standardization (e.g. z-score);
        2. Normalization (e.g. log transformation).
    iv. Group comparability (i.e. for group comparisons):
        1. Comparability on demographic characteristics;
        2. Comparability on major clinical variables (if applicable);
        3. Approach to exploring the confounding effect of group differences (e.g. matching procedure).

v. If the data violated test assumptions (e.g. normality):
    1. Methodology used to explore each assumption;
    2. Criteria used to identify violations of each assumption;
    3. Actions (e.g. transformation) applied to resolve violations of each assumption (if applicable).

c. Main analyses:
    i. Describe each analysis planned, including:
        1. The goal of the specific analysis
        2. The statistical tests/methods used, including:
            - Independent variables;
            - The dependent variable;
            - The covariates, including reasoning (if applicable)
            - Model parameters (if applicable);
            - Planned follow-up tests (e.g. post-hoc pairwise group comparisons);

d. If relevant, how the analyses were protected for the type-I error due to multiple comparisons (e.g. how the number of comparisons was limited, FDR-correction).

e. Calculation of effect-sizes and guidelines for the interpretation of the magnitude of effect sizes (e.g. Cohen, 1988).

f. Describe the level of alpha (.05) and the approach to statistical testing (two-sided).

RESULTS

Although the structure of the results section will be highly comparable between articles, the content will be considerably more variable because it directly depends on the analyses that were chosen. The following guidelines will help you to write a clear results section. Please be aware that some additional items may be necessary to describe for your study specifically. Always strictly adhere to a reporting guideline from the American Psychological Association (APA) or American Medical Association (AMA), depending on the journal.

1. THE GREATER STRUCTURE

a. Align the structure of the Results section with the Methods section, so that headings in the Results section relate to paragraphs in the Statistical Analysis of the Methods section, in exactly the same order.

b. Subheadings and/or paragraphs can be used to further add structure to the text. Do not use subheadings or paragraphs if they are not necessary and do not make paragraphs them overly short (i.e. at least five sentences).

2. THE STRUCTURE OF REPORTING

a. An important task while writing the Results section is to guide the reader through the large number of complex analyses. Keep in mind that the general readership may not have expertise in the subject area central in your manuscript. Therefore, the intention of analyses and the meaning of the outcome will be harder to grasp for the reader than it is for you.

   i. Repeat the aim of the analysis at the level of **constructs**:
      - *"In order to assess the impact of [X] on **intelligence**, (…)";*

   ii. Describe the analysis that was used to serve the aim at the level of the **variable(s) of interest** (e.g. FSIQ):*
      - *"(…) we compared the study groups on **FSIQ**";*

   iii. Provide the outcome of the analysis at the level of the **variable(s) of interest**, including the direction of significant effects:
      - *"The results show that the [X] group had **lower FSIQ** as compared to the control group, (…)";*

   iv. Provide the reader with a preliminary interpretation of the result on the **contruct level**:
      - *"(…) suggesting/indicating that children with [X] have impaired **intelligence**.";*

**Depending on the complexity of the results section, reiterate the specific test/analysis used.*

b. Discriminate between constructs and variables. Constructs are the concepts that you want to measure (i.e. intelligence) and variables are the chosen metrics (i.e. FSIQ) to measure the constructs of interest. Variables are used when directly describing the results of analyses, and constructs are used when translating the results to the interpretation level.

c. Be consistent in the use of terms. Varying the use of terms suggests meaningful differences in what is measured and analyzed. Choose one term for a specific concept and use it

throughout the whole article. Only use alternative terms in the text if you intent to refer to a concept that has a different meaning.

d. Always report descriptive data and available statistics associated with the statistical design:
    a. Descriptives:
        i. Mean, standard deviation and sample size for each variable in each study group.
    b. Test statistics:
        i. Appropriate statistics for the test used with degrees of freedom and p-value.
    c. Effect size:
        i. Appropriate effect size for type of relation assessed (group comparison vs. correlation) and the distribution of the variable (continuous vs. dichotomous).

- Only provide the data once, in-text or in a table/figure, not both! The place of reporting should first be made based on the readability of the text. Another reason to report data in tables/figures is the target journal's word count. Be aware that most medical journals allow for a maximum of 4 tables/figures.
    d. Clearly describe whether you report raw or transformed data (e.g. after log transformation).
    e. Always report significant and non-significant results. You may want to summarize results with comparable outcome that are presented in a table (e.g. "Comparison on demographics revealed no significant differences, suggesting that the study groups have comparable demographic characteristics (*p*s > .13)"). Refrain from varying the structure of the text to make it more 'lively', as you could do in a non-scientific text. This may seem to produce an unnatural text, but actually the structure of the text (both in terms of the order of sentences and the words chosen to bring across the message), provides predictability that supports the reader to follow the line of reasoning from the research question (via the analysis and results) to the main finding. Please be aware that although the structure of reporting should be consistent, the exact phrasing should have a certain degree of variation to avoid a bullet-wise writing style.

3. EXPLORATORY ANALYSIS

a. The findings of your study often raise research questions that you did not plan, but are highly relevant and can be answered using the data that is readily available. Therefore exploratory (unplanned) analyses are often carried out as an extension of the statistical analyses. Describe the exploratory analyses so that they are clearly recognizable as such.
    - *"We also explored the relation between intelligence and school performance using multivariate regression, using FSIQ as dependent variable and CITO arithmetic scores as independent variable. To control for the influence of demographic characteristics, age, gender, and SES were also added to the model as independent variables."*
    - *"To further understand whether the …. findings resulted from the slower reaction time that was found in group A compared to group B, exploratory … analyses were performed in which reaction time was added as a covariate."*

4. CONFOUNDING ANALYSIS

I. The study results may have identified confounders that could potentially account for group differences found in the main analyses. For example, you find a difference between groups on a demographic variable (e.g. SES) that is associated to the outcome measure (i.e. FSIQ) and may therefore account for the observes group difference on the outcome measure. Clearly describe why the confounding analyses were performed and announce the planned procedure in the methods section.

II. What the confounding analyses entails (e.g. sensitivity analysis using matching).

III. How the results change the interpretation of the relation between the variable of interest and observed difference on the outcome variable(s).

DISCUSSION

The Discussion section aims to provide an interpretation of the results, by (1) connecting the study findings to the Introduction section, (2) describe the findings in the context of existing literature (3) provide weaknesses and strengths and (4) draw conclusions while highlighting the relevance of the findings for the scientific field and clinical practice. The Discussion section should convince the reader of the value of the study finding. Also when the findings are unexpected, the discussion section should serve as an argument for the value of the study. The level of certainty with which the results are presented should align with the methodological rigor of the study for you research question. Describe findings at the interpretation level (at the level of constructs).

- Do not write: *"Our findings showed that the TBI group had a lower FSIQ than the control group."*
- Do write: *"The results of our study indicate that children with TBI have poorer intelligence as compared to healthy peers."*

1. BRIDGE THE INTRODUCTION

a. Connect the final paragraph of the Introduction section to the first paragraph of the Discussion section by using the following steps:
   i. Repeat the main study goal and the study design, in very similar wording as in the last paragraph of the introduction section;
   ii. Describe the main study finding (avoid details);
   iii. Highlight the main contribution of the study findings for the main field of interest.

2. INTERPRET THE STUDY FINDINGS IN THE CONTEXT OF LITERATURE

a. The following paragraphs (guideline: 2-3) describe the study findings in more detail. The description of findings should be grouped by study aims, discussing each aim in a separate paragraph. The order of reporting in this section is often identical to the order in de Results section. If it is not possible to group findings per study aim, then select an alternative grouping style. For example use the type of finding as a grouping factor and make sure that the order of reporting is reasonable and structured. These paragraphs should each contain the following elements:
   i. Description of the study findings in the context of the research question and/or hypothesis.
   ii. Evaluation of the study findings (both positive and negative findings) in the context of existing literature. Describe which findings are in line with existing literature (i.e. replicating findings). Avoid over-emphasizing convergence with previous studies, because of the risk of devaluating your own work. Describe which findings extend the existing literature (i.e. providing new knowledge to the field). Describe conflicts between study findings and the existing literature, including potential accounts for conflicting results (i.e. methodological differences or alternative explanations). This section is suitable to display scientific creativity: try to capture the findings in an existing theoretical model,

and if necessary, propose adaptations of the model according to your study findings. Explanations for unexpected findings should be plausible. If there is no plausible explanation, then accept this and describe this uncertainty rather than providing an unlikely explanation.

b. As in the Introduction and Methods section, order the discussion of study findings using the Funnel model, i.e. from more general to specific findings.

3. LIMITATIONS AND STRENGTHS

a. Use <u>one paragraph</u> for the discussion of limitations (first) and strengths (second);

b. Focus on the consequences of weaknesses and strengths for the study findings. Shortly describe for each item why it is a limitation or a strength. This also allows you to nuance (neutralize) the influence of weaknesses on study findings, or highlight the strengths for the quality of the evidence. For example "*The study groups were not matched for demographic characteristics. Nevertheless, we found no group differences in age, gender or socio-economic status between the study group, indicating that demographic differences do not account for the observed group differences in outcome measures*." Describe the limitations and strengths at the level of:

   i. Methodological aspects (sample size, design, bias and analysis);
   ii. Potential confounders;
   iii. Uniqueness in the literature;

c. With regard to the limitations, do not be too harsh on your own study (others will). Remember that your aim is to defend the right of your data to be published.
Play with the order of presentation, by following-up each limitation by an argument that supports the value of your study.

4. CONTRIBUTION TO THE FIELD

a. Provide the value of the study findings using a translation to the broader clinical field. Provide suggestions for consequences of study findings.
   - If your study reveals direct evidence, use a conclusion approach (i.e. "This study shows/indicates that …")
   - If your study reveals indirect evidence, use a suggestion approach (i.e. "The findings from this study suggest that … ").

b. Present the research agenda

5. CONCLUSION

a. Optional: Summarize the most important study findings

b. Provide a short description of the study's main conclusion(s), following from (a)

c. Highlight the importance of your findings and the value for the clinical field.

TEMPLATE – DISCUSSION SKELETON

6. **PARAGRAPH 1: INTRODUCTION OF THE DISCUSSION**
    a. Describe the main aim and hallmark features of the study (avoid details)
    b. Describe the main study finding (avoid details)
    c. Describe the main contribution to the field (avoid details)

7. **PARAGRAPH 2-3(/4): DISCUSSION OF GROUPED FINDINGS**
    a. Describe the findings from general to more detailed (avoid mentioning variables, use the interpretation level)
    b. Shortly mention whether the findings are in line with other studies
    c. Highlight in what way the findings contribute to the literature, and how this changes our view on the field
    d. Provide plausible explanations for unexpected and/or inconsistent findings

8. **PARAGRAPH 4: LIMITATIONS & STRENGTHS**
    a. Describe the most clear weakness of the study
    b. Try to soften the supposed impact of the weakness using sound reasoning, possibly by describing a strength of the study
    c. Repeat the above until the major weaknesses and strengths have been described (use three weaknesses and strengths as a guideline)

9. **PARAGRAPH 5: CONTRIBUTION TO THE FIELD AND RESEARCH AGENDA (OPTIONAL, OTHERWISE INTEGRATE IN CONCLUSION)**
    a. Describe the value of your findings for clinical care, both directly and indirectly
    b. Describe the value of your findings for research, both directly and indirectly
    c. Present suggestions for the scope and/or methodology of future studies to be performed based on your findings and the state of the literature

10. **PARAGRAPH 6: CONCLUSION**
    a. Summarize the main finding
    b. Highlight the most important contribution to the field