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INTRODUCTION

Introduction should be short and arresting and tell readers why the study has been undertaken (3). This section should be brief rather than expansive and, in essence, the structure should funnel down from a broad perspective to a specific aim of the study (1). It means that the first paragraph should be a short story of the current knowledge of the attempted research area (to state "what we know" of the problem that was investigated). This should lead directly into the next paragraph that summarises what other people have done in that field, what limitations have been encountered to date, and what questions still need to be answered (to speculate "what we don't know"). This will inevitably lead to the last paragraph, which should clearly quote what was done and why (stating the aim of the study).

The purpose of the introduction should be to supply sufficient background information to allow the reader to understand and evaluate the results of the present study without needing to refer to previous studies on the topic. However, in this section, one wouldn't review all the literature available. One must resist the temptation to impress readers by summarising everything that has gone before. They will be bored, not impressed, and will probably never make it through the present study (2). Only those references that are essential to justify the proposed study should be cited. It is important to discard the scientifically weak studies and only draw evidence from the most rigorous, most relevant, and most valid studies. It is also important not only to quote references dealing with the problem investigated in the present study and omit to cite the obtained results - the lack of information what was actually found does not help readers to put the present work in the context of what has gone before.

The most essential part of the introduction is the last paragraph, which gives details of the aim of the undertaken study, i.e. the hypothesis of the research. This is where the sentence that will dictate the content of the remainder of the paper should be found. This sentence sets up the expectations for the rest of the paper (1). Finally, this is also a good place to tell to the readers the type of the study design used to test the hypothesis.

To summarize, one must know his audience to write an effective introduction, keep it short, tell readers why he has done the study and explain why it is important, and try to hook them in the first line (2).

MATERIAL AND METHOD(S)

This section of the paper should describe, in logical sequence, how the study was designed and carried out, who the participants were, what material and method was used and how the data were analysed. This should be a simple task when the study is complete. However, if this section has been left until this stage, one may only then recognise flaws in the design that would have been detected sooner if this part had been written in as much detail as possible before the study had started (4).

The main purpose of this section is to describe precisely the experimental design and, consequently, provide enough detail so that an experiment could be repeated. Actually, this is critically important as the obtained results should be reproducible if they are to be of scientific merit (2). The study design should be stated up front because each study type has its own strengths and limitations, and usually dictates the type of statistical tests that are appropriate for analysing the data and describing the results (1). The study design can often be described in a few well chosen words as commonly used types are actually well defined (for example, "randomised controlled trial", "prospective, double-blind, cross-over study", etc). It should always be stated clearly how randomisation was done, since this is a crucial part of many clinical trials. Specific aspects, such as blocked randomisation and stratification, should also be clearly described. This part of the material and method section usually includes information on the sample size and sample characteristics. This information is of paramount significance for testing the hypothesis or fulfilling the study aims. The number of participants in any study should be large

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Original (scientific) paper - the IMRAD layout

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ABSTRACT

Certain rules on how to write original (scientific) papers are pointed out. The structure of all mandatory sections of the paper (i.e. introduction, material and methods, results and discussion), representing the IMRAD layout is described in detail. Apart from the general rules concerning the preparation of these sections, the importance of following precisely the instructions to authors published by journals is also emphasized. It is important to publish results of scientific research for many reasons. Some of the reasons are (1): giving credibility to the research, informing a broad audience of the achieved scientific results, adding credibility to one's own reputation, improving chances for personal promotion, etc. After all, if scientific results were not published and available to a wide scientific audience, it would be as if they had never existed. Today, it is regarded that original (scientific) papers are the only acceptable way of publishing scientific results. A scientific paper is a written and published report describing original research results (2). However, this definition is quite short and should be supplemented by the fact that it has to be the first announcement of scientific results, capable of being repeated. It should also be noted that it has to be written in a certain way and validly published, i.e. in a primary journal having a respectable peer-reviewing process or other primary publication, which means that it will be accessible to a broad scientific audience. Scientific papers generally follow the IMRAD layout - the acronym that stands for four basic sections of the paper: Introduction (What question was asked?), Material and method (How was it studied?), Results (What was found?) and Discussion (What do the findings mean?). The aim of this paper is to emphasize essential points of these basic sections.

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enough to provide precise estimates of effect and therefore a reliable answer to the research question being addressed (1).

In clinical trials, it is especially important to state how the participants were recruited in the study. In doing this, the sampling frame should be clearly described and the inclusion and exclusion criteria, if any, should be spelt out. As readers like to be assured that the welfare and rights of the participants in the study were placed above those of the investigator, the details of the ethical approval should be quoted.

For materials, the exact technical specifications and quantities, as well as the method of preparation, should be included. Sometimes it is even necessary to list pertinent chemical and physical properties of the reagents used. Trade names should be avoided, and generic or chemical names preferred. When registered trade names are nevertheless used, they should be capitalized to distinguish them from generic names. Experimental animals or microorganisms should be identified accurately, usually by genus, species, or strain designations. Sources should be also listed and special characteristics (age, gender, genetic and physiological status) described.

The exact form of treatment used has to be described in a way to allow replication. If the methods, devices, or techniques are widely known or can be found in standard textbooks, further information is unnecessary. Methods that are uncommon or unique should be described fully or an adequate reference to the method should be provided.

Statistical analysis is often necessary, but one should feature and discuss the data, not the statistics. The statistical method section should describe how the data were analysed, with specific details of the statistical tests and the statistical computer packages that were used. If a statistical test that is not simple or well known is used, a reference to the method and an explanation of why it is used is required.

The material and method section usually has subheadings. If so, they should "match" those to be used in the next section of the paper (results). The writing of both sections will be easier if internal consistency has been striven for, as the reader will be able to grasp quickly the relationship of a particular methodology to the related results.

RESULTS

It has been asserted for a long time in the past that this section is the most important part of the scientific paper (5) because of its function to provide answers to questions that are posed in the introduction (6). The answers will most likely be the ones that are expected; however, even if they refute the original idea, they have to be reported.

There is a strong belief that this section should be the easiest to write (1). However, there are several possible traps waiting for inexperienced authors. One of the very first is to start the section with the sentence: "The results are presented in Tables 1-5 and in the figures ...". This does not guide the readers into discovering what the author wanted them to find but actively encourages them to find things the author might not think important (6). In fact, the readers should be led to follow the author's thoughts by using a suitable mixture of text, tables and illustrations.

The results section could begin with characteristics of the study sample. To describe the baseline characteristics of the participants in any type of study, a table should always be used and never a figure. In many studies the comparability of the study groups at baseline needs to be demonstrated. The baseline characteristics also define the ability to generalise the results (1). Thus, one needs to describe comparability of the control and the study groups, as well as to show the distribution of the variable in each group.

The next part(s) of the section is related to answers. It should start with a text to be followed by readers as a story, and go on logically from the beginning to the end. Tables should be used to present the essence of the results and to establish the statistical validity of the conclusions. Illustrations should be used for emphasis of the important points (6). It is important that both the tables and the illustrations should be capable of standing alone. This means

that there must be sufficient information associated with them for the reader not to have to refer back to the text. It is also important to realize that results and data are not the same thing. Numbers already presented in a table (or in a figure) should not be repeated in the text! A good practice is to describe in the text what was found, and then back it up with the data that are shown in a table or a figure. That is the easiest way to convey to readers the message that can be derived from a table or figure, and not to leave them to interpret the data themselves.

It is possible to show a vast amount of data in the tables. The key is to make each table deal with a specific problem and give details of the answers. Each table needs a title that tells the reader how to interpret the data. Generally, the results should be presented in columns where the changes run from the left-most column (6). Often, it helps to present results as percentage changes from the initial value. Finally, the way of presenting data in the tables should match the statistical analysis that was performed (it is annoying to present results in the tables as means and standard deviations if a non-parametric test was used).

Good illustrations will display the data and lead the reader to think about the substance of the answers provided; they will get the message across clearly. Different types of illustrations, i.e. graphics, drawings, photographs or micrographs, should be adjusted in accordance to instructions to authors of the journal to which the paper has been assigned. In addition, photographs must include measures to protect the anonymity of patients and micrographs need measures of scale; both need professional production. Generally, regardless the type of illustration, their technical quality should be as high as possible because they have to go through a number of processes before appearing in print. Similarly to table titles, any illustration should be followed by an appropriate legend with clearly defined possible abbreviations or symbols.

To conclude, the results section is not difficult to write if the text tells the story fluently, the tables summarise the evidence, and the illustrations highlight the points.

DISCUSSION

This section is possibly the hardest section to write; it is even difficult to define it simply. The true meaning of the data, even though the data of the paper might be both valid and interesting, may be completely obscured by the clumsy interpretation presented in the discussion, especially when it becomes needlessly long and verbose. It is necessary to confine attention only to substantial research in the area instead of a long and detailed critique of "every paper ever written on the subject" (7).

This section is really an exercise in logic and skill. It is difficult to set some rules how to write the discussion section as it depends on several circumstances. Usually, it starts with a brief summary what was really found and why it is important. The aim of the study may be restated in more general terms, but the results should not be repeated exactly as in the results section. So, the first paragraph could focus on the general picture of what the results of the study are really all about. If possible, it would be helpful to explain how the findings can add to current knowledge, change health care, or so.

The next paragraph could address the strengths and limitations of the study design and methods (1). It would be honest to comment how chance or bias might have influenced the results, how it was minimised, and how the presented research is better than other that has been done before. It should be continued by explaining how the results agree or disagree with other studies or related theories. Of course, it is interesting to point out findings that relate only to other scientifically valid studies! If conclusions differ to those reached by other researchers who have conducted similar studies, one should try to explain why this has happened.

The last paragraph should be an exciting summary of scientific implications of the findings. The "so what?" of the research needs to be very clear here. Reflections can slightly extend, without overstating the significance. However, it is strongly suggested not to finish the discussion with "Further studies are

needed..." or a similar boring presumption to readers what they should do next.

TO CONCLUDE

In brief, the IMRAD layout enables adequate and full presentation of scientific research. It enables authors to present: what is known what is not known, and why the study was done (Introduction); who the participants were, how the research was carried out, and how the results were evaluated (Material and Method); what was found (Results), and what the study means for the general appraisal of the topic (Discussion).

There are certain rules of writing scientific papers, which refer to the proper use of tense (8). This convention derives from scientific ethics and requires that the present tense be used to quote previously published work as a sign of respect for established knowledge. When referring to one's own present work, the past tense should be used, as this work is not presumed to be established knowledge until after it has been published (2). Respectively, the Material and Methods and Results should be in the past tense. On the other hand, much of the Introduction and Discussion should be in the present tense. But, as always, there are exceptions to rules. It is also correct to write, "The author demonstrated that resin based composites tended to stabilise within one month" in the Discussion, or "Table 4 shows ..." in the Results.

The IMRAD layout is a fundamental system that is the basis of all scientific papers, i.e. the relevant sections representing the acronym are their unavoidable parts, although there are some others, which are mandatory (title, summary - abstract, references), or optional (conclusion, acknowledgements). They are also important and their proper preparation will contribute to the possibility of accepting the manuscript for publication. However, a strict conformity to Instructions to authors, which every journal publishes, has to be acknowledged by those who wish to publish scientific papers in respective journals.

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