Discussion and conclusion

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Abstract: The purpose of this article is to provide an instructional review about how to write effective discussion sections for original medical research articles. First, the basic function and aims of the discussion section are outlined. The discussion is critically linked to the introduction and results sections: it should respond and attempt to conclude the issues and motivations raised in the introduction, and it should interpret the objective data described in the results to do this. Given these roles, the writing in the discussion needs to be precise and unambiguous, but does also allow for a more subjective and personable tone when less objective, or more expansive topics are being discussed. Next, the principle functions of a discussion are reviewed; these include the statement of major findings, comparison with other literature, implications, limitations, and conclusion. Using examples, each of these functions are analyzed with reference to the common English language features, such as verb tense, common words and phrases, hedging language, etc., that are associated with each function. Important information to include in each function, along with techniques to improve coherence and readability, are also outlined. These include explicitly identifying the source of any information being referred to and clearly ordering and labelling the different points within the discussion.

Keywords: Discussion sections; conclusions; original research articles; implications; medical writing

Ultimately, all literature, scientific or otherwise, is valuable because of the meaning which it expresses. Writing without meaning is worthless, and a research article without a proper discussion is like a novel with no ending, and therefore no theme. Given this, the discussion, along with its accompanying conclusion section, is the most vital section in an original research article. In addition to its importance, the discussion section is also perhaps the most complex section and must perform several roles in order to be effective.

On the one hand, the discussion section is part of the natural progression of the medical research process, continuing from the statement of the research problem and continuing through the methodology and results section. In this sense, the discussion is critically linked to the preceding results section; it identifies the key findings and interprets their meaning in relation to how they relate to or resolve the research question. The writing for this purpose needs to be precise, unambiguous, and scientific.

On the other hand, the discussion section also acts as the response to or completion of the issues and concerns that were raised in the introduction section. In the way that the introduction has a social role of welcoming and engaging the reader, the discussion is similar in that it should provide closure, recommendations, and overall meaning to the article. This being the case, the writing of the discussion can also, when appropriate, allow for subjectivity and stylistic flourish.

Crucially, the discussion and conclusion sections offer the writer the opportunity to properly frame their work and findings and state the value and meaning of their research in more conversational English. Often, after the abstract, this will be the section that is skimmed by the interested reader (1). If the discussion is not clear and engaging, the importance of the work will be lost on the reader, and they will be unlikely to read the rest of the article or be left disappointed if they have read it. Ultimately, the accumulated material from the research process can be vast, dense, confusing, complex, technical or dull. From this potential chaos, the medical writer must forge order and meaning.

Discussion functions

As mentioned above, the discussion section can be considered the most complicated section due to the diversity and number of roles and tasks it is required to accomplish. Meeting the requirements of most, if not all these functions, is pivotal in writing a discussion section which will both accurately and honestly communicate the value of your findings, and have the reader recognize and be excited about this value.

A short description of each of the introduction functions follows. It should be noted that there are different ways of thinking about the subdivisions and organization of the discussion and conclusion sections, and the following are, for the most part, the most commonly received functions. Furthermore, each function does not necessarily have its paragraph or series of paragraphs and can be overlapped or enfolded within other functions. What matters is that their content should be addressed fully, and written with the appropriate corresponding language features.

Statement of major findings

This should be a simplified, to-the-point, and clear declaration of your most significant results. Naturally, not all studies give equally conclusive results, or are designed in the same way; thus, some interpretation is warranted as long as the author's degree of uncertainty is reflected in the language used. What constitutes the most significant finding is determined by your research problem/question, and the results most relevant to answering or clarifying the research question should be focused on first and given the most emphasis. Given the distance between your introduction—where your research question is first posed—and the discussion—where the question is resolved—it can be helpful to reiterate the research question in the discussion section (1). Generally, the writing should move away from data, and numbers, and towards words and prose.

Comparison with relevant literature

This section can be seen as a response to or an elaboration of, the review of literature and identification of a "gap" in the study which began in the introduction. If there was a lack of consensus in the literature, with which hypotheses or perspectives are your findings consistent, and with which do they disagree? If there was insufficient research in a defined area, how do your results combine with other studies to give more certainty about a particular claim? If your results were unexpected, inconsistent, or conflicting, how might other

research help to clarify or explain these results? No matter how unique your study may be, it will bear some connection to other published works (2), and these connections should be explored to clarify your findings and contribute to the expansion of general knowledge.

Implications

This part should state what your findings mean in a bigger context, and can extend or summarize the ideas generated from the interpretation of findings and their comparison to the literature. This part can also be seen as a reply to the social impact or motivation for research which was described in the introduction. The implications then can explain in what way your results might be generalizable, clinically applicable, or relevant to patient care outside those conditions defined in your methodology. It can also be the opportunity to provide recommendations for specific measures or identify avenues of future study or research. No matter the topic, it is important the content here be in some way linked logically to your findings, and that the language reflects the speculative, less-than-certain, or subjective tone, that is permissible, and often necessary, for this type of content.

Limitations

This should identify the issues in your methodological design which might have reduced the validity, applicability, or generalizability of your results. Being forthright and thorough here may help pre-empt critics' or reviewers' critiques of your study design and conclusions, while being open about the potential flaws may improve your perceived credibility, rather than detract from it. These limitations naturally provide direction for how future research can strengthen, improve, expand on, or verify your findings.

Conclusions

Depending on the journal being submitted to, conclusions might be designated under a separate heading, or be the last paragraph of the discussion. Essentially, the conclusion is the final opportunity for the author to emphasize to the reader what the most important part of their study was, and impress upon them a particular recommendation, idea, or assertion. Typically, what is included in the conclusion is the reiteration of the principal findings stated in a few sentences and the most important implications of these findings. The strength, novelty, and importance of the

study, along with future research suggestions, can also be highlighted in the conclusion.

Discussion functions and related language features

Given the nature of the functions described above, we can expect to find common language features of grammar, vocabulary, and structure resulting from the communicative role these parts are performing. What follows is a description, with examples, of some of these functions and their related language features, along with some common mistakes. It is important to note that these are not strict rules about how to write these discussion functions, but rather general guidelines to follow in order to increase the likelihood that the writing is grammatically correct, lexically accurate, and communicatively effective.

Statement of major findings

Most successful discussion sections begin by stating what the major findings of the study are, repeating the research question found in the introduction (1), and attempting to answer that question directly. This accomplishes both continuity with the previous results section and reminds the reader of the overall purpose of the study. Discussion of past results and what they mean, usually leads to this function having predictable **verb tenses**, and, depending on how confident the researchers are in their conclusions, differing **degrees of certainty** in their language.

Example 1
The following example shows both a study's research question from the introduction section and the main findings from the discussion section (3):

> **Introduction (research question)**: This network meta-analysis aims to summarize the relative efficacies for maintaining graft patency when using none, one or two antiplatelet agents following CABG.
> **Discussion**: This network meta-analysis aimed to compare graft patency results at least 3 months after CABG given the use of none, one or two anti-platelet agents to give context to the application of single or DAPT by the surgeon today. Results from 16 studies and 6,667 followed-up grafts demonstrated aspirin monotherapy, aspirin + dipyridamole and DAPT (aspirin + clopidogrel, aspirin + ticagrelor) following CABG all achieved significant patency benefit compared to placebo.   (3)

In the example above, note how the first section of the discussion restates the research problem and the second sentence answers it. The main elements of the research question are all represented in corresponding elements in the discussion section's response sentence: "*network meta-analysis*" relates to the "*16 studies*"; "*graft patency*" relates to "*graft*" and "*patency*"; "*none, one or two antiplatelet agents*" relates to "*aspirin monotherapy*", "*aspirin + dipyridamole and DAPT*", and "*placebo*" respectively; and "CABG" is found in both sentences.

Note the verbs in green are **simple past tense** as they refer to the finished activity of the completed results. Most references to what happened in the results should use the simple past tense.

Example 2
The following excerpt is from the beginning of its article's discussion section (4):

> The degree of the proportional tumor volume shrinkage in reference to baseline at the maximal response was greater in human subjects than in mice, and the response rate was higher in humans than in mice. The observation is notable as it indicates that a certain degree of difference is expected between mice and human cohorts, even when they harbor tumors driven by the same genomic alterations and are treated with the same anti-cancer agent.   (4)

In the above example, the verbs in green in the first sentence are in the **simple past tense** because they discuss the specific events outlined in the results. Note that in the second sentence, the tense changes to the **simple present tense** (words in yellow) as the author is now talking about what these results *mean* and how they can be understood as a general truth or accepted knowledge. The phrases "*is notable*" and "*indicates that*" are particularly useful for discussing what particular results might mean or prove. For more of these types of "discussion" verbs, see *Table 1*.

Example 3
The following example also discusses the meaning of the results (5):

> The results of the analysis suggest both MIDCAB and DES are effective strategies for revascularization of isolated LAD stenosis.   (5)

Note that the verb in blue is not only in the simple present tense to interpret the generalizability of the results but also that the word "*suggest*" gives less of a sense of certainty than for example a stronger word like "*demonstrates*" does in Example 1. We can consider this an example of **"hedging language"** in that it shows a degree of uncertainty

Table 1 Common verbs to discuss the meaning of the results or findings

Verb + that + clause (e.g., *The results show that the treatment increased overall survival*)
Show
Demonstrate
Indicate
Illustrate
Reveal
Signify
Imply
Suggest (used to show more uncertainty)
Prove (with reference to an assumption or hypothesis)
Confirm (with reference to an assumption or hypothesis)
Attest to (with reference to an assumption or hypothesis)

on the part of the author, and allows room for the researcher to be wrong about their interpretation. Hedging language is perfectly appropriate and even necessary to use if you are not completely certain about the accuracy of your statement. For some examples of hedging language see *Table 2*.

Comparison with the literature

The purpose of comparing your findings with other those found in other literature is to find similarities or contrasts with other studies, or to use other literature to expand on or confirm certain ideas in the subject generally. It is necessary, then, to make it clear to the reader when you are referring to findings in your study, and when you are referring to results from another study. Not clearly identifying where the information being discussed is from will make the reader have to work to understand its source which will reduce your article's overall readability.

Example 4

Our data agree with previous studies; for example, Sawabata *et al.* speculated that mediastinal lymph node resection may contribute to a postoperative cough (3,10).   (6)

The example (6) above shows that the author's study has **similarity** with other studies (e.g., "*previous studies*"), and specifies a single study with the mention of "*Sawabata et al.*"

as the subject of the second clause. The verb in green, "*agree with*", is a common way to show interstudy similarity or support. A list of common vocabulary to compare studies is available in *Table 3*.

Example 5

The short-term results of this study are in line with the published results of other groups reporting early mortality (0% to 4.9%), conversion rate to sternotomy (0% to 6.2%), short-term reintervention on target vessel (up to 8.9%), and overall perioperative complication rate (1.6% to 40%) (9-14).   (7)

Note again in this example (7) the phrase in green, "*are in line*", shows the similarity between the author's study and other studies ("*published results*"). Also, observe how the author clearly and concisely outline results in four different areas (yellow text) which are from five different sources. Less organized writers might use five different sentences to discuss these sources, but this author uses one. This is efficient writing.

Example 6

While the superiority of DAPT over aspirin monotherapy (or aspirin + dipyridamole) did not reach significance (including in the SVG sub-analysis), this finding contrasts with recent meta-analyses of single versus dual antiplatelet therapy which showed patency benefit of DAPT over aspirin monotherapy for saphenous vein grafts (8,9).   (3)

In this example (3), the author's result, indicated by "*this finding*", is described as different from other studies' in the literature, indicated by "*recent meta-analyses*". Again, make sure the sources of different results are clearly identified when describing specific data or information from a study. Note that the verb "*contrasts with*" is used to show differing results. A list of vocabulary showing **contrast** is also available in *Table 3*.

Example 7

The rate of DAPT use was significantly lower compared to that reported in FREEDOM (Future Revascularization Evaluation in patients with Diabetes mellitus: Optimal management of Multivessel disease) trial, which reported 68.4% of patients being on DAPT following CABG (10). This difference may be attributed to two factors: (I) in FREEDOM trial, financial compensation was provided to participants to offset the cost of DAPT, and (II) FREEDOM trial cohort consisted of 29% of patients who presented with ACS (10), for which guidelines recommend the use of DAPT following CABG (1-3).   (8)

Table 2 Cautious or "hedging" language to express uncertainty

Type	Expression	Example
1. Verbs	Appears (that)	It _appears_ that the treatment is more effective
	Seems (that)	The treatment _seems_ more effective
	Looks like/as if	It _looks as if_ the treatment is more effective.
	Suggests (that)	The results _suggest_ that the treatment is more effective
2. Modal verbs	May	The treatment _may_ be more effective
	Might (have)	The treatment _might have been_ more effective
	Could (have)	The treatment _could_ be more effective
3. Attitude verbs	(We/the authors) think (that)	We _think_ the treatment is more effective
	(We/the authors) feel (that)	We _feel_ the treatment is more effective
	(We/the authors) believe (that)	We _believe_ the treatment is more effective
4. Adjectives of probability	(It is) possible (that)	It is _possible_ that the treatment is more effective
	(It is) probable (that)	It is _probable_ that the treatment is more effective
	(It is) likely (that)	It is _likely_ that the treatment is more effective
5. Adverbs of probability	Perhaps	The treatment is _perhaps_ more effective
	Possibly	The treatment is _possibly_ more effective
	Probably	The treatment is _probably_ more effective
6. Nouns of probability	(High/strong/good) possibility (that)	There is a _strong possibility_ that the treatment is more effective
	(Good/strong) chance (that)	There is a _good chance_ that that treatment is more effective
	(In all/good) likelihood	In all likelihood, _the treatment_ is more effective
7. Other phrases	Given X, it can be said that Y	_Given_ these findings, _it can be said that_ the treatment is more effective
	In our opinion/view	_In our opinion_, the treatment is more effective
	It is our opinion/view that	_It is our view_ that the treatment is more effective

Table 3 Common language used for comparisons with other studies

Similarity	Contrast
X are/is **similar** to Y	X are/is **in contrast to/with** Y
X are/is **in line with** Y	X are/is **not in line with** Y
X are/is **consistent with** Y	X are/is **inconsistent with** Y
X are/is **comparable to** Y	X are/is **different from** Y
X are/is **consonant with** Y	X are/is **at variance with** Y
X are/is **concurrent with** Y	X are/is **contrary to** Y
X are/is **in agreement with** Y	X are/is **in disagreement with** Y
X are/is **in accord with** Y	X are/is **in conflict with** Y
X **agrees with** Y	X **disagrees with** Y
X **accords with** Y	X **differs from** Y
X **matches** Y	X **conflicts with** Y

In the example (8) above, the phrase in green, "_was significantly lower_", indicates the difference between the author's study and another investigation. Naturally, it is likely necessary to try to understand why there might be differences across studies, and so the author then tries to explain the cause for this difference using the phrase in yellow, "may be attributed to". Note that "_may be_" is an example of hedging language. The author cannot be sure that these are the reasons, and so uses the **modal verb** "_may_". If the author simply said, "This difference is attributed to two factors…", we would understand that the author believes this explanation to be a certain truth, rather than a possibility.

Example 8

We found that low PNI was an indicator for shorter OS in lung cancer, especially among NSCLC patients. Recent studies also reported that low PNI was an unfavorable marker for prognosis in several solid tumors. Nakatani and his colleagues found esophageal cancer patients undergoing neoadjuvant chemotherapy in low preoperative PNI status had a higher risk of recurrence and poorer survival (10). Kang and colleagues reported in renal cell carcinoma that monitoring of dynamics change of pre/postoperative PNI helped predict postoperative complications and long-term survival rate (7). Moreover, two recent meta-analyses explored the prognostic value of PNI in gastric and colorectal cancer, respectively. It turned out both of the two studies concluded low PNI suggested poor OS in the above two tumor types (33,34). (9)

In the example (9) above, the author discusses a particular relationship between two factors: PNI and overall survival (OS). The rest of the paragraph shows this relationship repeat in several other studies. The author is able to make this a *coherent paragraph*—that is, the author properly connects the elements and sentences in the paragraph—by using two methods.

First, the author restates, in some way, the two main items of the relationship, *PNI* and *OS*, in each of the following sentences. This way, the reader knows the basis for comparison in the mentioned articles, and that each sentence is discussing the same topic. Second, the author uses transition words like "*also*" and "*moreover*" to further show that similar ideas or points are being repeated. The use of these transition words adds to the coherence between different sentences.

Implications

The implications of your research findings should begin to move away from the specific results found from completing your methodology towards more general truths or conclusions that can be drawn logically from your findings and those findings from other literature. Ultimately, the purpose of any medical study is to improve the understanding of clinical practice (2), and it is important to state the relevance in this section. Recommendations and suggestions for future research are also appropriate here.

Example 9

This example contains within one sentence what should be done throughout the discussion of the implications: using your original research combined with comparisons to other studies to make stronger claims about appropriate clinical practice (10).

Results of those two studies and a high rate of LNM revealed in our study indicate, that EGC which exceeds expanded criteria for ER should be treated with gastrectomy and appropriate lymphadenectomy. (10)

The identification of other literature, "*results of those two studies*", and the author's result, "*a high rate of LNM revealed in our study*", is clear and distinct. Again, a discussion verb in green, "*indicate*", introduces the greater meaning derived from these studies. Also, this implication, or interpretation of results, uses **simple present tense** ("*exceeds*") to express its general applicability. Finally, the authors provide a recommendation using the **modal verb** "*should*" to give recommendations about appropriate clinical practice in light of their new research.

Example 10

We acknowledge that IABP offers only a partial cardiac support, however, in our cases it was enough to allow a progressive adaptation of the left ventricle. We believe that this option can be applied in selected cases as an alternative strategy to venous-arterial ECMO after LTx, reserving the latter for the most critical patients. (11)

The example (11) also discusses both the specific results of the original study, using the **simple past tense** "was" in yellow; in the next sentence, the **modal verb** in blue, "*can be applied*", is used to talk about the author's incomplete certainty about a conclusion based on the results. Note also the phrases in green, "*we acknowledge*", and "*we believe*", use the **first person**. This informs the reader that information is coming from a certain perspective, the author's, and is honest about the perhaps subjective nature of these assertions.

Example 11

Despite this, it will not be inappropriate to suggest that each case should be treated on their individual merits, and the information about significant excess of repeat TVR with DES strategy must feature in the informed consent. (5)

It is important to remember (12) that the purpose of using **hedging language** is to show uncertainty as to the accuracy of the statement you are making and to reserve the possibility to be wrong. It should not be confused with trying to show how humble you are, or to conform to a code of formality. In the above example, the phrase in blue,

"it will not be inappropriate", is unnecessarily wordy and difficult to understand due to the use of a double negative construction ("not" and "in-"). Write directly and honestly about how certain you are. In this case, "*we suggest*", would be enough to show that they believe their suggestion is reasonable while acknowledging it is coming from their own potentially flawed perspective.

Example 12

This example discusses future research suggestions:

> These unexpected findings, together with the fact that GC incidence in Eastern Europe is significantly higher compared to the rest of Western world, perfectly illustrates heterogenicity of the disease between different regions and different populations. Therefore, multicenter studies with large sample sizes from different racial and ethnical populations are needed to understand the risk of nodal involvement in EGC better. Only new and high-quality evidence will let us establish accurate and reliable clinical practice guidelines for EGC management.   (10)

This example (10) includes three elements which fully address a discussion of a particular recommendation of future study. The first sentence uses findings from the present study in combination with other literature to establish a problem, the second sentence describes the characteristics of a study which could solve this problem, and the third sentence justifies why this future research would be beneficial clinically.

Note how the problem sentence (1st sentence) is connected with the description of the future research sentence (2nd sentence) using the transition word in green, "therefore". The **passive voice** verb in red, "are needed", is usually used to recommend further research as the subject of the sentence is the research itself.

Example 13

> The time to maximal tumor response was about 2.5 times longer in humans than in mice (15.7 weeks *vs.* 6.0 weeks, respectively), which provides some insights about the choice of optimal time points, at least for the specific cohorts with ALK-rearranged NSCLC. Future co-clinical trials should be designed to allow identification and testing of corresponding landmark time points in mice and humans, which may be specific to tumor types and therapies.   (4)

Here is another example (4) of future research

suggestions being justified by referring to *specific results*, rather than generic methodological shortcomings. Notice how the verb in green, "was", is in simple past tense to discuss completed results; the verb in yellow, "provides", is in simple present tense to discuss the results' meaning; and the verb in red, "should be designed", is a **passive modal verb** to give suggestions about the future research design.

Limitations

The limitations will usually be a single paragraph or even have its own section, and will occur right before the conclusion. Limitations will discuss the potential flaws which might have occurred in the methodology. Complete limitation sections will also explain how these flaws potentially affect the validity and generalizability of your results, and suggest future research based on these problems or needs.

Example 14

> The main limitation of our study is that no follow-up data were available to compare the groups with respect to the cause of death (cardiac versus non-cardiac), recurrence of angina, need for repeated revascularization, and graft patency. Therefore, we can only speculate about the mechanism beyond the equipoise between MIDCAB and isolated LAD grafting through full sternotomy on long-term survival.   (7)

As with nearly all limitation sections (7), the authors introduce the paragraph with either an indirect or direct mention of the limitations. No matter what language is used, it is important to make sure the first sentence makes it clear that the topic of the paragraph is about the studies potential weaknesses. Note how the first sentence details an issue with the results using the simple past tense ("were"), and explains why this issue specifically restricts the certainty of the author's conclusions in the second sentence using the simple present tense ("we can only speculate"). The relationship between these sentences is made clear with the use of the transition word "therefore". Too often writers do not include an explanation outlining in detail the effect of a certain limitation, which can leave the reader uninformed or unclear about the limitations specific importance.

Example 15

The following example is an entire limitation paragraph (11):

> <u>Several limitations</u> must be noticed in this meta-analysis. <u>First</u>, significant heterogeneity was found when investigating the effect of PNI in OS, which can be caused by different cancer types, sample sizes, cut off values and so on. However, association between PNI and OS obtained the same results after subgroup analyses were carried out, and removal of any single study did not significantly affect the pooled HR in sensitivity analysis, all indicating that the results were quite reliable. <u>Second</u>, the majority of included studies were from Asian countries, suggesting the result was more suitable for Asian patients; whether it can be applied to other population remains unknown. <u>Third</u>, considering that studies with negative results may tend to have less chance to be published, potential selection bias can still exist. Thus, large-scale, multicenter and well-designed studies <mark>are required</mark> to verify and expand on our conclusion.   (11)

In this extensive example, the limitations are introduced in the first sentence, and three different limitations are explained in detail. The reader can easily follow where one point ends and the next begins because the author has used the ordering words "first", "second", and "third". While this may seem simplistic, this obvious outlining is much more readable than limitation paragraphs where sentences follow each other with no clear signal that the topic is changing. Finally, the last sentence describes the characteristics of a future research possibility, once again, using a passive verb (in green), "are required".

Example 16

The example below is an excerpt from a limitation paragraph in an *ex vivo* study (12):

> It is of course difficult to draw conclusions for clinical practice. Human lungs may react differently from pig lungs. In vivo tissue per se will perhaps lead to different results. <u>Nevertheless</u>, our study adds some evidence to the growing field of minimally invasive laser resections. <u>As a next step</u>, *in vivo* experiments could help to further expand data finally leading to clinical studies.   (12)

In this example, the author notes the limitations of using *ex vivo* studies and pig models in generating relevant conclusions for human clinical practice. Importantly, the author still is able to state the worth of the research in the second sentence, introducing the value of the findings using the transition word "*nevertheless*"; this acknowledges the limitation but still affirms the overall value of research. In

the final sentence, the author suggests future research that is based on the previously mentioned limitation, and does so using the phrase "as a next step".

Conclusions

Whether it is in its own section or simply a paragraph at the end of the discussion, the conclusion will be where the reader expects you to explain the most important parts of your study. If you wanted the reader to remember only one or two things from your article, what would these things be? Put these in your conclusion. These could be the most significant findings, their implications, clinical recommendations, future study suggestions, or a mixture of all these items. Whatever is included, make sure your statements are in some way supported by data (13), and make sure your writing here is concise and to the point.

Example 17

> The use of DAPT in patients with diabetes post-CABG in this cohort <mark>was</mark> low. Compared with aspirin monotherapy, no associated differences <mark>were observed</mark> in cardiovascular outcomes, <mark>suggesting</mark> that routine use of DAPT in diabetics with SIHD after CABG <mark>may not be</mark> clinically warranted.   (8)

The above example (8) is the entire conclusion section of the article. It is short, clear, and direct. The authors chose to restate their most important findings in the first sentence and the first part of the second sentence, with the simple past tense verbs in green, "*was*" and "*were observed*", respectively. The second part of the second sentence states the clinical implications based on the findings; note that hedging language like "*suggesting*" and "*may not be*" in blue is used to convey the more speculative tone here.

Example 18

> The present network meta-analysis showed clear evidence for improved patency compared to placebo at follow-up beyond three months exists for aspirin monotherapy and dual antiplatelet therapies with aspirin. The results also demonstrated that <u>while DAPT may confer some patency benefit over aspirin</u> monotherapy, this was not statistically significant. Results from further randomized controlled trials <mark>are required</mark> to evaluate the <u>relative benefit of DAPT over aspirin</u> monotherapy.   (3)

The conclusion above (3) begins with two clear statements concerning the study's findings and its major implications. The final sentence once again uses a passive construction, "*are required*" (in green), to detail the

recommended further research. Notice that this research is directly related to the principal findings through the repeated mention of therapy type.

Summary

Discussions sections both act as an interpretation of the results section and a response to the introduction's research question. This section should outline the scientific and clinical value of your research and help the reader understand the importance of your findings. It should also provide a sense of completion and meaning to the article as a whole. Comprehensive results section include the following language functions and related features.

Statement of major findings

- ❖ Clearly and concisely state the major findings from the results section.
- ❖ Can be in the form of an answer to the research question from the introduction which can be repeated to remind the reader of the study's purpose.
- ❖ Use **simple past tense** to describe results, **simple present tense** to discuss the meaning of the results, and **hedging language** to express different degrees of certainty about the results meaning.

Comparison with literature

- ❖ Use references to other literature to better explain your results, or add to the general knowledge in your field.
- ❖ Clearly identify when your study is being discussed and when a study from the literature is being discussed.
- ❖ When referencing other studies, summarize them concisely, organize them efficiently, and mark them clearly, in order to increase the readability and shorten the length of the writing
- ❖ Use **comparative language** to identify when your study is similar to or different from other studies.
- ❖ Attempt to explain surprising results or discrepancies with other studies.

Implications

- ❖ Synthesize the interpretation of your findings with other relevant literature to make claims about clinical practice or medical knowledge.
- ❖ Use **simple past tense** to describe results, and connect

them directly and logically with the conclusion you are making.
- ❖ Use **hedging language** to express the different **degrees of certainty** about the claims you are making.
- ❖ Use of the **first person** is both appropriate and recommended to convey the potentially subjective nature of your claims.
- ❖ If recommending future research, connect the type of research directly to your findings, and use the **passive voice** if the research is the subject of the sentence.

Limitations

- ❖ Make a clear and separate paragraph to discuss the limitations.
- ❖ Discuss aspects of your methodology using the **simple past tense** and clearly explain how or why they might be problematic to your study's validity or generalizability.
- ❖ Clearly separate different limitations and clearly signal when a new limitation is being discussed.
- ❖ It is possible to emphasize the remaining value or strengths of your research using specific **transition words** (e.g., "nevertheless", "despite this", etc.).
- ❖ It is possible to introduce specific requirements for future research based on the limitations outlined.

Conclusions

- ❖ Clearly and concisely state the one or two most important aspects of your study.
- ❖ No matter what kind of information is stated, ensure that all claims have some basis in your findings, the literature, or a synthesis of both.
- ❖ Use **simple past tense** to discuss your major findings, use the **simple present tense** to discuss their possible implications, and use **hedging language** to express your degree of uncertainty.

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Footnote

external peer review.

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References

1. Annesley TM. The discussion section: your closing argument. Clin Chem 2010;56:1671-4.
2. Hess DR. How to write an effective discussion. Respir Care 2004;49:1238-41.
3. Chakos A, Jbara D, Singh K, et al. Network meta-analysis of antiplatelet therapy following coronary artery bypass grafting (CABG): none versus one versus two antiplatelet agents. Ann Cardiothorac Surg 2018;7:577-85.
4. Nishino M, Sacher AG, Gandhi L, et al. Co-clinical quantitative tumor volume imaging in ALK-rearranged NSCLC treated with crizotinib. Eur J Radiol 2017;88:15-20.
5. Raja SG, Uzzaman M, Garg S, et al. Comparison of minimally invasive direct coronary artery bypass and drug-eluting stents for management of isolated left anterior descending artery disease: a systematic review and meta-analysis of 7,710 patients. Ann Cardiothorac Surg 2018;7:567-76.
6. Lin R, Che G. Risk factors of cough in non-small cell lung cancer patients after video-assisted thoracoscopic surgery. J Thorac Dis 2018;10:5368-75.
7. Raja SG, Garg S, Rochon M, et al. Short-term clinical outcomes and long-term survival of minimally invasive direct coronary artery bypass grafting. Ann Cardiothorac Surg 2018;7:621-7.
8. Mori M, Shioda K, Bin Mahmood SU, et al. Dual antiplatelet therapy versus aspirin monotherapy in diabetics with stable ischemic heart disease undergoing coronary artery bypass grafting. Ann Cardiothorac Surg 2018;7:628-35.
9. Li D, Yuan X, Liu J, et al. Prognostic value of prognostic nutritional index in lung cancer: a meta-analysis. J Thorac Dis 2018;10:5298-307.
10. Bausys R, Bausys A, Maneikis K, et al. Safety of expanded criteria for endoscopic resection of early gastric cancer in a Western cohort. BMC Surg 2018;18:79.
11. Boffini M, Simonato E, Ricci D, et al. Extracorporeal membrane oxygenation after lung transplantation: risk factors and outcomes analysis. Ann Cardiothorac Surg 2019;8:54-61.
12. Kirschbaum A, Surowiec TM, Pehl A, et al. Suturing of the laser resection area is recommended over a depth of 2 cm in an experimental porcine lung model. J Thorac Dis 2018;10:5339-45.
13. Uniform requirements for manuscripts submitted to biomedical journals: Writing and editing for biomedical publication. J Pharmacol Pharmacother 2010;1:42-58.