

Lexical Bundles in the Discussion Section Moves of High Impact Medical Research Articles

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ABSTRACT

Findings in medical research articles (MRAs), in particular, the discussion section interest not only the discourse community but also the ordinary people. Therefore, the writing needs to be comprehensible to both experts and laymen alike. To achieve a successful writing of a MRA, the author's knowledge of lexical bundles (LBs) and rhetorical moves in MRAs are essential. Though research on rhetorical moves in RAs abounds, there is a lack of study that examines the LBs in the rhetorical moves in MRAs. This scarcity of research prompted this study to examine the LBs associated with the moves and steps in the discussion section of high impact MRAs. A total of 50 MRA discussion sections were investigated. Findings revealed that generally groups of LBs were related to the functions of the moves and steps in the discussion sections. The majority of LBs were associated with

move *Stating Research Conclusion* (31%), move *Contrasting Present and Previous Outcomes* (23%) and move *Explain Specific Research Outcomes* (22%). The findings from this study can provide informed input not only to ESP writing instructors on how to navigate the writing of the discussion section in an RA but also to novice writers on how to follow the conventions of the discussion section in writing MRAs.

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INTRODUCTION

The necessity of publishing research papers in high impact journals is mandatory in most high ranking universities. Not only the academia but postgraduate students have to publish their findings in prestigious journals such as ISI (web of science) indexed journals. Publication has become a crucial requirement for the hiring, promotion, and tenure of academic staff and also for the successful completion of postgraduate studies (Flowerdew & Forest, 2009). Therefore, knowledge of writing a well-organized research article (RA) is pivotal.

One crucial factor that plays a significant role in the acceptance of an RA for publication is a well-organized structure of its various sections (Flowerdew et al., 2005). Of particular interest to this study is the discussion section as its importance has been highlighted by several scholars (e.g., Basturkmen, 2012; Dujsik, 2013; Moyetta, 2016).

Among the IMRD (Introduction, Method, Results and Discussion) sections of an RA, it has also been documented that the discussion section is the most challenging to write for both novice and experienced writers. (Amnuai, 2017, Jaroongkhongdach et al., 2012; Swales & Feak, 1994). In the discussion section, writers need to have persuasive writing skills to convince readers of the novelty of their claims (Pojanapunya & Todd, 2011). They also need to structure their discussion section appropriately to make a powerful “closing argument” (Annesley, 2010) using various information elements, such as research purpose, main

findings, interpretations of the results, implications and limitations (Bitchener & Basturkmen, 2006). To do this successfully, a template of the various rhetorical moves and steps of the discussion section is crucial.

In addition, writers should also know the formulaic language in order to construct and structure the writing of this section. One form of formulaic language is the lexical bundles (LBs). Biber et al. (1999), defined LB as recurrent sequences of three or more words. Previous literature has proven that having knowledge of LBs is an indication of being a professional language user (Biber, 2009; Cortes, 2004; Karabacak & Qin, 2013; Yeganehjoo & Thai, 2012). With that being said, sufficient knowledge of LBs could help novice writers to expand their mental lexicon, and this will help them to formulate their ideas succinctly in the rhetorical moves of the discussion section. Hence, knowledge of LBs can facilitate the process of writing a well-structured discussion section that clearly and effectively presents its communicative functions.

The Relationship between Formulaic Expressions and Communicative Functions

Lexical bundles are seen as building units of discourse (Biber & Barbieri, 2007) and considered to have an essential role in achieving fluency in speaking and writing. Considering the importance of LBs in language teaching and learning, several studies have been done to examine the employment of LBs in academic writings (Biber et al., 2004; Hyland, 2008a;

Kashiha & Chan, 2014). In particular, the identification of LBs in the moves and steps of various RA sections can help academic writers better understand the role of lexicogrammatical features in the formulation of academic discourse, in particular, the writing of medical research articles (MRAs).

The relationship between rhetorical moves and lexical bundles is that both of these linguistics concepts have been viewed as building blocks that are used in the construction of discourse. Hyland (2008b) maintained that bundles had been increasingly considered as “important building blocks of coherent discourse and characteristic features of language use in particular settings”. Biber et al. (2007) added that move types could be considered as the “main building blocks” of a genre. Accordingly, both lexical bundles and rhetorical moves have similar features. They function as discourse frames for the expression of new information and contribute to the meaning of particular contexts of language use as well as creating a flow and rhythm in the discourse. A description of the relationship between LBs and moves in a particular register could provide evidence towards a complete picture of the tendencies used in the organizational and lexico-grammatical patterns of a successful RA discourse. This is evident in Cortes’ (2013) study where the Bundle-move connection approach was employed to examine the LBs in the rhetorical moves of Introduction sections. The study found an association between the move employment and the use of LBs.

Determining LBs in the rhetorical moves and steps of the discussion section would show what language expressions are frequently employed to formulate rhetorical moves. It is pertinent then that novice writers need to have knowledge of LBs in order to initiate and construct these communicative moves. Though studies on LBs have been done, Cortes (2013) noted that “the relationship between LBs and moves needs to be further developed not only in Introductions but also in other sections of RAs.” Therefore, this research sought to investigate the patterns of occurrences of LBs and also to examine the associations of the types of LBs in the moves and steps in the discussion sections of high impact MRAs.

LITERATURE REVIEW

Many studies have been done to examine LBs across the IMRD sections of RAs. A recent research was done by Jalali and Moini (2018) who investigated the form, structure and function of LBs in the corpus of 790 MRAs discussions. They found that the most frequent bundles were *this_is_the_first*, *In_our_study_the_*, *the_present_study_we*, *In_this_study_the_*, and *In_our_study_we*. For the structural classification, clausal LBs were more frequent than phrasal LBs as they formed 49.05% of the whole corpus. Different from Jalali and Moini’s (2018) study, Mizumoto et al. (2017) examined 1000 RAs in the field of applied linguistics. They aimed to create a data-driven and theory-based practical writing support tool by connecting rhetorical moves and LBs.

They found that certain LBs were associated with specific moves. For example, LBs such as *this study investigated the* and *little is known about* were more highly associated with move *Presenting the research* and move *Introduction* in the abstract section. Also, there was a strong relationship between LBs and moves across IMRD sections. On the other hand, they found that many LBs were used in more than one section in the RAs. Bundles such as *on the other hand*, *in terms of the*, *on the basis of* were generic and therefore they could generally be found in the introduction section and the discussion section as well.

In another study, Kashiha (2015) examined LBs in the moves and steps of the conclusion sections in 200 RAs written by native and Iranian non-native writers. He focused on four-word LBs as they were more common than 5-word bundles (Hyland, 2008b). Some of the examples that were used by both native and non-native writers in the conclusion section were *findings of this study*, *On the other hand*, and *the results of the*. Kashiha (2015) found that native writers relied more on the use of LBs in writing conclusions. Additionally, Li et al. (2020) analyzed the sentence initial lexical bundles in the moves of PhD abstracts in the field of arts and humanities. They used a corpus-driven approach to examine the five-word bundles in the moves of 3,697 abstracts. They found that most of the generated LBs can be considered as move indicators. For example, the bundle "The study shows that the" was associated with move *Showing results or findings* to introduced the research findings. This is in line with findings of Abdollahpour and

Gholami (2019) who also examined LBs in abstract moves but in medical RAs. In addition, it was found that the majority of the indicated moves aligned with the moves proposed for research article abstracts in previous studies. Similar to Mizumoto et al.'s (2017) study, it was also found that some LBs could be used in different moves. For example, the bundle *'the use of'* was identified in Move *Stating the current knowledge* and Move *Indicating the main purpose*.

From the above discussion, it is clear that studies on LBs have been done in certain disciplines and in different section of RAs but, no study has been done to explore the relationship between the LBs and the communicative moves in the discussion section of MRAs. Therefore, this study attempted to do that as a successful writing of the discussion section demonstrated the writing sophistication and scholarship of the writer.

METHOD

A content analysis was employed in the study in which both the quantitative and qualitative approaches were used. The quantitative approach was used to determine the patterns of occurrences of LB word types in the moves and steps of MRAs. A qualitative approach, on the other hand, enables the analysis of LBs linguistic expressions in relation to the moves and steps.

The corpus comprised 50 MRAs with a total of 54901 words. They were collected purposively and involved two phases of sampling: (i) selection of Medical journals

and (ii) selection of MRAs. For the journal selection, only high impact factor ISI (Institute for Scientific Information) indexed journals were chosen. The chosen journals were *New England Journal of Medicine (NEJM)*, *The Lancet*, *The Journal of the American Medical Association (JAMA)*, *British Medical Journal (BMJ)*, and *Journal of Clinical Investigation (JCI)*. The selection was based on three criteria: representativity, reputation (impact factor), and accessibility (Nwogu, 1997). Furthermore, the scope of the selected journals was not limited to a specific sub-discipline. Instead, it covered a wide range of medical sub-disciplines. This criterion mirrored the criterion adopted by Wang et al. (2008) and Jalali et al. (2015), and therefore in this study, all areas of medical sciences were included.

The selected RAs were also published in the last 5 years (2013-2017) in order to ensure the currency of publications (Ebrahimi & Heng, 2018). Only 10 RAs were selected from each journal. The selection of the articles was done according to the criteria suggested by Cheng and Unsworth (2016). Therefore, the included

papers were written in the Introduction-Method-Results-Discussion-Conclusion (IMRDC) format. Published work such as review papers and meta-analyses were excluded. In addition, the selected articles were empirical studies because there is a clear sub-section on discussion in such study. Moreover, the RAs written by the same authors were not included. This is because more than one research article written by the same author may increase the chances of experiencing the use of similar language, structure, and style of writing, and that would be biased.

Analytical Framework of Move Analysis

Al-Shujairi et al.'s (2019) revised framework of move analysis was adopted because of its currency and appropriateness to the study. It was current because the model was taken from Al-Shujairi (2019) latest study and in their study too, they were investigating the moves and steps in Medical Research Articles. Table 1 demonstrates the model of moves and steps in the discussion section of MRAs by Al-Shujairi et al. (2019).

Table 1

Model of moves and steps in discussion section (Adopted from Al-Shujairi et al., 2019)

Moves	Steps
Move 1: Background Information	
Move 2: Highlighting Overall Research Outcome	
Move 3: Explain Specific Research Outcomes	Step 1: Stating a Specific Outcome Step 2: Interpreting the Outcome Step 3: Indicating Significance of the Outcome

Table 1 (Continued)

Moves	Steps
Move 4: Contrasting Present and Previous Outcomes	Step 1: Referring to Literature Step 2: Making a Claim
Move 5: Indicating Research Implications	
Move 6: Stating Research Conclusion	Step1: Strengths and Weaknesses of Research Step 2: Indicating Research Limitations Step 3: Promoting Further Research Step 4: Concluding the Main Results

Procedure of Analyzing Moves and Lexical Bundles

The hand-coding strategy was used for conducting the analysis. This strategy was also done by recent studies (Ansarifar et al., 2018; Lubis, 2019) as it generated more fine-grained results. Therefore, the analysis was done manually by examining the sentences of the discussion section. According to Holmes (1997), “the sentence was considered the unit of analysis implemented for examining moves, and the identifying feature was the linguistic realizations that were seen to realize the communicative functions of each move”.

Therefore in this study, the researcher identified the rhetorical function of each unit of analysis (sentence) in order to distinguish a move from a step. This stage was done by analyzing the linguistic realizations that is associated with each move and step. Some of the important linguistic realizations that were seen to realize the communicative functions were verb tense, voice, self-mention devices, modal auxiliaries, academic vocabularies and explicit phrases (Doró, 2013; Kanoksilapatham, 2005).

These linguistic devices help to express the meaning of communicative moves in a particular text (e.g., Amnuai, 2019; Suntara, 2018). For example, the finding verbs such as *find*, *show* and *reveal* were used to realize the move *Highlighting overall research outcome*. Another example was the word *limit*. Its various parts of speech such as its noun form *limitation* and verb form *limit* were used to realize the step *Indicating research limitations*. To ease the coding process, each move and step in the text was given a code. For instance, M1 means move number one, and M2S3 means step number three in move number two. Below is an account of how the moves and steps are identified.

Ex: A *limitation* of our study is that we are *unable* to (M6S2) *Further study* of the role of.... (M6S3)

After the analysis of the rhetorical moves was done, each move and step found in the analysis was moved to separate files. For example, all instances of move 1 were moved to a word file named move 1. This was done to ease the procedure of identifying

LBs in each move without any overlap. Only then, the preparation of data for the analysis of LBs by the AntConc3.2.4w computer program commenced. The LBs were identified by searching for the co-occurrences of the linguistic realization of the moves. For example, the reporting verb (find) was used to realize move 2. Therefore, it was typed in the software to look for bundles that were composed from this verb.

The analysis of LBs involved the assessment of frequency and distribution, as well as factors such as overlapping bundles. Overlapping bundles were merged in order to avoid overestimating the number of occurrences of these bundles (Cooper, 2016). In this, some 3-word bundles are parts of 4-word bundles, which are parts of 5-word bundles. In this case, the largest bundle sequence was taken into consideration. For example, the bundle *studies have shown* is part of a larger bundle *studies have shown that* which is part of larger bundle *these studies have shown that*. The largest bundle sequence, which is the 5-word bundle, was considered in the analysis to avoid overlapping findings.

Regarding the frequency, the cut-off points are arbitrary depending on the scope of each study. Scholars and researchers have proposed various cut-off points. The cut-off frequency range for large corpora is from 20 to 40 times per million words (Biber et al., 2004; Cortes, 2004; Hyland, 2008a, 2008b), whereas the raw cutoff frequency range for small corpora is from 2 to 10 times in the corpus (Altenberg, 2001). The frequency

of the occurrences of a bundle in a small corpus was calculated to check whether its normed rate met the specified cut-off point set for the study or not. As the corpus of the present research is 54,901 words, an occurrence of two times in the corpus would consider a lexical bundle. According to Biber and Barbieri (2007), when counting the occurrences of a lexical bundle, the restrictions on the distribution of different texts are also taken into consideration to reduce the inflated rates. A lexical bundle must occur in a range of 2-5 samples (Biber & Barbieri, 2007; Cortes, 2004) or 10% of the samples (Hyland, 2008b) to avoid the repeated style of individual writers or speakers. In other words, a bundle must recur in at least 2-5 different samples to be considered as a lexical bundle. Any bundles that do not meet this requirement were discarded.

Reliability of the Moves Identification

An inter-rater reliability measure took place to demonstrate that the moves and steps can be coded and identified at a sufficient level of agreement. The Kappa value was calculated against three coders' agreement including the researcher in order to check its acceptability. The Cohen's Kappa value was 0.606, which falls between 0.61- 0.80 and thus considered as substantial (Lim, 2010).

RESULTS

A total of 106 LBs were found in the moves and steps of MRAs discussion. The found LBs were 3, 4, and 5 words bundles.

Figure 1 demonstrates the distribution of 3-5 words LBs in each move and step of the discussion section.

Overall, the Figure 1 shows that 4-word LBs were the most common type of bundles. It indicates that 4-word bundles were the dominant type of LBs. The number of 4-word bundles exceeded the number of 3 and 5 words bundles in most moves and steps except for move 4 step 1 (Referring to literature) where 3-words LBs were more common. According to Hyland (2008b), four-word LBs are more common than 5-word bundles in academic register and they have a clearer range of structure and function than 3-word sequences.

On the other hand, 5-word LBs were the least occurred bundles except for move 2

(Highlighting overall research outcome) and move 6 step 2 (Indicating research outcome) where 5-word bundles exceeded 3-word bundles. 5-word bundles were also found less common in past studies (e.g., Esfandiari & Barbary, 2017; Hyland, 2008b). The results of low frequency of 5-word bundles could be explained by the complexity of their production as it takes writers more effort and time to produce a 5-word bundle than 3 or 4 – word bundles. It is important to mention that no bundle was associated with move 6 step 4 (Concluding the Main Results). Instead, two-word phrases such as in summary and in conclusion were seen to be associated with this step. In addition, the analysis demonstrated that only 2 cases of 4-word LBs were associated with move 4 step 2 (Making a Claim).

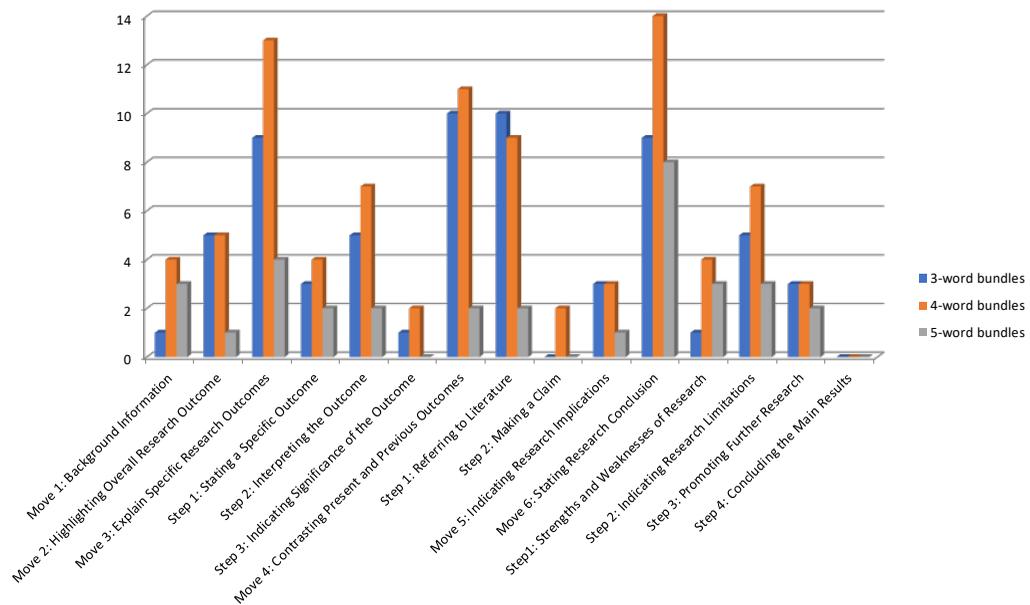


Figure 1. The frequency of 3-5 words LBs in the Moves and Steps of MRAs discussion

To address the second research question, further discussion of the LBs that appear in each move and step is presented below.

Lexical Bundles in Move 1 (Background Information)

The analysis revealed that 7.54 % of the LBs were associated with move 1 (Background information) of the discussion section. These bundles were 3 to 5 words LBs. These bundles were employed to realize the functions of move 1 which is to state the research purpose and to describe the method. The occurrence of most of the bundles in this move was twice in the discussion corpus except for one bundle (our study was) which occurred 3 times in this move. The examples below show the employment of some of the LBs in move 1 (Background information) in the discussion of MRAs.

3 word LB

Ex1: *Our study was* randomized and based on high-quality baseline imaging.... (RA17/2015/JAMA)

4 word LB

Ex2: *We studied a large* UK based community volunteer sample...(RA2/2016/BMJ)

5 word LB

Ex3: The intent in *the current study was to* replicate the post...(RA3/2014/BMJ)

Lexical Bundles in Move 2 (Highlighting Overall Research Outcome)

Move 2 (Highlighting Overall Research Outcome) comprised 10.37% of the total LBs found in the corpus. The most frequent 3-word bundles in this move were *we found*

that (7 times), *we found no* (4 times), and *the rate of* (4 times). The most frequent 4-word bundle was *our study shows that* (3 times) while the rest of the bundles occurred twice in the corpus. Only one case of 5-word LBs was tagged in this move out of 11. Examples of types 3, 4, and 5 words LBs which were taken from the corpus are illustrated below.

3 word LB

Ex1: *We found no* differences between groups in quality of life....(RA4/2014/BMJ)

4 word LB

Ex2: *Our study shows that* the combination of an anti-CD20 antibody with...(RA50/2014/NEJM)

5 word LB

Ex3: *We found no evidence of* a learning curve for high-volume operators when...(RA45/2014/NEJM)

As shown in the examples, these LBs initiate move 2 (Highlighting Overall Research Outcome). Also, the 4-word bundles in move 2 mostly commenced with either the first person plural exclusive pronoun *we* or its possessive *our*. Research authors in the field of medicine tend to use these pronouns to explicitly show their voice and their claim for their findings.

Lexical Bundles in Move 3 (Explain Specific Research Outcomes)

Among the most LBs occurrences in a single move, move 3 (Explain Specific Research Outcomes) comprised 24.52% of the LBs. This amount was distributed between the three steps: Stating a Specific Outcome,

Interpreting the Outcome and Indicating Significance of the Outcome.

Lexical Bundles in Step 1 (Stating a Specific Outcome). This step comprised 8.49% of the total LBs. The 4-word bundles were the most dominant type of LBs. All bundles in this step occurred twice in the corpus except for two bundles. The 3-word LBs *the increase in* and *was associated with* frequently occurred between 3 and 7 times respectively. The example below shows the 3-word bundle (the increase in) in the context.

3 word LB

Ex1: *The increase in* mortality for heart failure and...(RA12/2017/JAMA)

It is interesting to note that most LBs in this step start with verb *to be* in its past form such as *were common in the* and *was no difference in the*. Despite the similarity in function between move 2 (Highlight overall research outcome) and move 3 step 1 (Stating a Specific Outcome), the LBs employed in them were quite different. While the bundles in move 2 commenced with a subject and were located at the beginning of the sentence that carries the function of the move, LBs in step 1 of move 3 started with verb (be) and they were embedded in the sentence. This finding is important as it provides a clue to differentiate between move 2 and move 3 step 1.

4 word LB

Ex2: Grade 3 or 4 adverse events *were common in the* two study groups, which was an expected finding...(RA48/2014/NEJM)

5 word LB

Ex3: There *was no difference in the* rates of hepatic resection between groups...(RA17/2014/JAMA)

Lexical Bundles in Step 2 (Interpreting the Outcome). The step comprised 13.20% of the total LBs. 4-word bundles were the most dominant in this step followed by 3-word bundles and 5-word bundles. The most common LB in this step is *the effect of* (4 times). Most LBs bundles in this step had model verbs (*might, may, could*) which are devices used to employ the hedging strategy. Hedging strategy is important in explaining the results as the writers need to mitigate the claims made by giving reasons and elaborations. Examples of LBs with model verbs were *this may explain, this might be because, and may be due to the*. Examples of the three types of LBs in the context of step 2 (*Interpreting the outcome*) are presented below. It can be noticed that LBs in this step do not only come as sentence initiatives but also embedded in the middle of the sentences.

3 word LB

Ex1: *The effect of* oral contraceptives on mental health, including...(RA6/2014/BMJ)

4 word LB

Ex2: However, given that there were only 20 SIDS deaths of mothers with obesity grade 2-3, the association between maternal BMI and SIDS *could be due to* chance. (RA10/2014/BMJ)

5 word LB

Ex3: Rapid and profound B-cell depletion

by obinutuzumab *might be the reason for* the greater frequency and intensity of... (RA50/2014/NEJM)

Lexical Bundles in Step 3 (Indicating Significance of the Outcome). Only 2.83% of the LBs were found to be associated with this step (Indicating significance of the outcome). Those bundles were of types 3-word and 4-word. The most frequent bundle is *the importance of* with 3 times occurrence in the corpus. As shown in the examples below, words such as *important* and *significant* are the main elements of these LBs. They reflect the function of this step (Indicating significance of the outcome), which is to show the importance of results. According to Salazar (2014) who examined biology and biochemistry theses, *significance* and *importance* are the keywords of identifying these LBs and such bundles (the significance of, the importance of) function as descriptors.

3 word LB

Ex1: The findings of no significant difference in weight loss in genotype-matched vs mismatched groups in the current study highlights *the importance of* conducting large, appropriately powered trails. (RA11/2017/JAMA)

4 word LB

Ex2: *Our study adds important* new information about the increased risk of... (RA8/2015/BMJ)

Lexical Bundles in Move 4 (Contrasting Present and Previous Outcomes)

It was found that 21.69% of the LBs were associated with this move. The LBs were found in step 1 (Referring to Literature) and step 2 (Making a Claim).

Lexical Bundles in Step 1 (Referring to Literature). The analysis revealed that 19.81% of the total found bundles were associated with step (Referring to literature). Most of the bundles (20) were 3 to 4 words bundle types while only two were 5-word bundles. These LBs were utilized as devices to compare and contrast the findings of a study to findings of past studies. The following examples illustrate the occurrences of LBs types that were associated with step 1 of move 4 in the MRAs discussion.

3 word LB

Ex1: Our findings *are consistent with* those of the University of Michigan. (RA49/2014/NEJM)

4 word LB

Ex2: This finding is potentially *consistent with previous studies* suggesting that antibiotic prescriptions for...(RA1/2017/BMJ)

5 word LB

Ex3: Increased deaths from breast cancer with longer durations of use, which *is in line with the* most recent meta-analysis... (RA6/2014/BMJ)

Lexical Bundles in Step 2 (Making a Claim). Overall, only 1.88% of the bundles were associated with this step (Making a claim). This could be due to the low occurrence of this step in the corpus analyzed. Hedging such as modal verbs was the central component of the LBs in this step (Making a claim). This is not surprising as when making a claim, the convention of academic writing warrants the authors to hedge their claim and be cautious about their generalizations.

4 word LB

Ex1: In agreement with this conclusion, *our results indicate that* neither magnitude of expansion nor the...(RA22/2017/JCI)

Lexical Bundles in Move 5 (Indicating Research Implications)

Only 7 (6.60%) LBs were found to be associated with this move. Four of these bundles began with the plural possessive pronoun “our” such as *our study provides a* and *our study has important implications*. This can be attributed to the discipline under investigation, which is medical science. Authors in the field of medicine tend to explicitly show their voice through the use of first-person pronoun “we” and its possessive “our”. The pronoun “we” was followed by a verb that is illustrated in the present time or future aspect. This makes sense as the function of this move is to provide future implications. Besides, these bundles commonly initiate the sentences that carry the function of the said move (see examples 1, 2 and 3 below).

3 word LB

Ex1: *Our study will* also help to elucidate molecular processes of...(RA24/2017/JCI)

4 word LB

Ex2: *Our study provides a* mechanism to TGF- β pathway activation in PC through FOXA1 downregulation...(RA26/2017/JCI)

5 word LB

Ex3: *Our study has important implications* for the management of all...(RA8/2014/BMJ)

Lexical Bundles in Move 6 (Stating Research Conclusion)

The highest number (29.24%) of LBs was shown to be associated with this move. This move has 4 steps namely; Step1 (Strengths and Weaknesses of a Research), Step 2 (Indicating Research Limitations), Step 3 (Promoting Further Research), and Step 4 (Concluding the Main Results).

Lexical Bundles in Step 1 (Strengths and Weaknesses of a Research). In this step, 7.54% of LBs were found typical. Words such as strength and weakness are the main construct of the bundles in this step. This clearly reflects the communicative purpose of this particular step, which is to state the strengths and weaknesses of research. These LBs usually initiate the sentences that carry the function of move 6 step 1. Examples below show the different types of LBs in step 1 of move 6.

3 word LB

Ex1: *A key strength* of the PARACHUTE trial was that it was...(RA3/2017/BMJ)

4 word LB

Ex2: *Strengths of our study* include a small proportion of patients lost to...(RA20/2015/JAMA)

5 word LB

Ex3: *Our study had several strengths.* (RA6/2014/BMJ)

Lexical Bundles in Step 2 (Indicating Research Limitations). This step comprised 14.15% of the total bundles. The most frequent bundle occurred was the 3-word bundle *we did not*. This bundle occurred 8 times in the corpus. The rest of bundles tagged twice in the corpus. It can be noticed that the word *limitation* is the core element in most of the found bundles. This is in line with the communicative function of this particular step, which is to indicate the limitations of research. Thus, these bundles are typical to step 2 of move 6. Again, the constructed bundles were seen to be initials of the sentences that carry the function of this step.

3 word LB

Ex1: *We did not* assess the efficacy of first-line treatment with...(RA44/2014/NEJM)

4 word LB

Ex2: *Our study has limitations.* (RA8/2015/BMJ)

5 word LB

Ex3: *This study has several limitations.* (RA47/2017/NEJM)

Lexical Bundles in Step 3 (Promoting Further Research). Similar to step 1, 7.54% of the bundles were associated with

this step. Future indicator words such as *further* and *future* were seen in most of the LBs in this step. This is not surprising because the main function of move 6 step 3 is to indicate a recommendation for further research. The LBs in this step were also characterized by the use of the modal verb “will” to suggest an action will be done in the future (see examples below).

3 word LB

Ex1: Further follow-up *is needed to* assess whether idelalisib is safe for long-term use. (RA48/2014/NEJM)

4 word LB

Ex2: *Additional studies will be* necessary to define the most effective use of these new agents....(RA48/2014/NEJM)

5 word LB

Ex3: *More work is needed to* confirm p.C282Y homozygous associations with... (RA2/2017/BMJ)

Lexical Bundles in Step 4 (Concluding the Main Results). It is important to note that no lexical bundles were associated with move 6 step 4 (Concluding the Main Results). Instead, phrases such as *in summary* and *in conclusion* were the central construct of this step. These phrases usually initiated the sentences that carry the communicative function of this step.

Ex1: *In conclusion*, we observed an increasing incidence of... (RA48/2014/NEJM)

Ex2: *In summary*, we reported a class of anti-CTLA4 Ab whose...(RA30/2017/JCI)

To summarize the above results, a list of 3-5 words lexical bundles in the respective moves and steps is shown in the appendix.

DISCUSSION

The current research paper examined the association between the lexical bundles and the rhetorical moves and steps in the discussion section of MRAs. The analysis showed that among 3-5 word bundles, 4-word bundles seem to be more frequently used in all moves of the discussion section. The analysis indicated that the tagged LBs could be put into groups to play the role of typicality for the rhetorical moves and steps of MRAs discussion. In other words, groups of 3-5 words LBs were found to convey the functions of the moves and steps in the discussion. This finding is consistent with the findings of the studies done by Mizumoto et al. (2017) and Wongwiwat (2016) that examined the moves and LBs across IMRD sections and conference abstracts and found that some LBs were strongly associated with certain rhetorical moves. For example, bundles such as *results showed that* and *the results showed* addressed the research results. The most rational reason behind such findings is that LBs are formulaic expressions that can serve as a building block and therefore; can be crucial in forming the communicative functions of a research article. Moreover, most of the found bundles were employed as initiatives in that they were employed at the beginning of the sentences. Such bundles (i.e., *our study shows that*, *Future studies to assess*) trigger the communicative moves.

This was also noted by Kashiha (2015) who analyzed the LBs in the conclusion moves of RAs. Considering the findings of this study and the past studies, it can be claimed that the use of certain LBs is closely linked to the rhetorical moves in the various sections of an RA.

Although few 5-word LBs were found in the present study, the finding is an asset to the existing literature of LBs. Previous studies (i.e., Cortes, 2013; Kashiha, 2015) mostly examined 4-word LBs as they did not identify 5-word LBs. The finding of 4-word bundles was in contrast with most previous research (i.e., Alamri, 2017; Cortes, 2013; Hyland, 2012; Mizumoto et al., 2017). The difference in the results could be due to the 4-word bundles in the field of medicine which initiated a move. As explained earlier, first-person plural pronoun “we” and its possessive “our” initiated a large amount of 4-word bundles. This could be that unlike other disciplines, using first-person plural pronoun is common among medical authors due to the multi-authorship of their published work (Kafes, 2017). It can be argued that the found 4-word bundles in the present study were also in contrast with the finding of Jalali et al. (2015), who also examined MRAs. This contradicted finding can be rationalized by the investigated section of RAs. While the present paper analyzed the discussion section, Jalali et al.’s (2015) focused on the introduction section. Therefore, LBs such as *our study showed that* and *we have found that* were not expected to be found in the introduction section; instead, these

bundles are more aligned to the results and discussion sections.

Finally, the findings of 3-word bundles such as *the rate of* and *we found that* were in line with the findings of past studies such as Jalali and Moini (2014), Mbodj-Diop (2016), and Salazar (2014). A number of 3-words bundles (i.e., further studies are, our results showed) was shown to be similar to the study conducted by Jalali and Moini (2014) who also examined medicine RAs. Three word bundles are the shortest type of LBs and their employment could be noticed in any discipline of sciences. Thus, the result of 3-word bundles were similar not only to studies done in the field of medicine such as Jalali and Moini (2014) but to other field of sciences such as food science and technology RAs (Esfandiari & Moein, 2016), economic, education, history, and sociology RAs (Bal, 2010). Additionally, according to Biber et al. (2004), bundles like *we found that* and *our results suggest* are commonly employed in the results and discussion sections of RAs irrespective of the discipline.

Although this study has yielded some interesting results, it is not without any limitations. First, this paper investigated only a particular discipline of science, which is the medical science. Further studies could look at various disciplines not done in past studies such as Computer science and Engineering. Second, the present sample was collected from one specific type of journals which was high impact ISI (recently, Thomson Reuters) indexed journals. Perhaps, future studies can

investigate other types of journals such as Scopus indexed and compare and contrast between two types of journal databases. Such effort will enrich the existing literature on LBs in scientific writings.

CONCLUSION

To conclude, the results obtained in this study are significant as they have several important implications. The list of lexical bundles with their associated rhetorical moves (see the appendix) is a contribution to the field of academic writing. The list could serve as a guide in their writing particularly the discussion section of RAs. Postgraduate and novice writers in the field of medicine could also benefit from the said list. These LBs can help them to initiate and construct meaningful and persuasive discussion section in their RAs. Furthermore, unlike most past studies, the findings of the present research managed to reveal the inter-connectedness between the communicative moves and lexical bundles in the discussion section of MRAs. The study had also examined not only 4-word bundles (like in the study of Kashiha (2015) and Jalali and Moini (2018) but also 3 and 5 words LBs. Although, 4-word bundles were found to be dominant, the occurrences of shorter string (3-word) and longer string (5-word) were noticeable in the moves and steps of RAs discussion section in the field of medicine.

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