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GENRE ANALYSIS OF ABSTRACTS OF RESEARCH ARTICLES PUBLISHED IN BIOSTATISTICS

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ABSTRACT: *Genre studies have contributed to revealing the communicative purposes and structural properties particular to specific discourse communities. Research articles (RA) have been the focus of most genre studies for the past four decades. RA abstract is important because it summarizes the work, persuades readers, and 'sells' the article locally and internationally. An emerging academic discipline that has been under studied is Biostatistics. The study aimed at exploring the move structure and lexico-grammatical features of RA abstracts published in Biostatistics. Forty (40) RA abstracts were extracted from four different Biostatistics journals. Hyland's five-move structure model was adopted to guide the analysis. Using Hüttner's classification model, the most frequent move was the Product, with a 100% occurrence. While the Introduction move was core, the Purpose, Method, Product and Conclusion moves were obligatory. It was revealed that the abstracts follow the completely linear five-move structure, i.e., M1>M2>M3>M4>M5. While the study revealed that the total number of words in an abstract is 244, the Product move had the highest textual space in the abstract. With the linguistic realisation of the moves, the past verb tense was preferred, occurring frequently in the Method move. The Introduction and Conclusion moves recorded frequent use of modal verbs. Personal pronouns were characteristic of the Method move. These linguistic realisations served to differentiate one move from the others. While the study contributes to research on RA abstracts generally, it guides the practice of abstract designing in Biostatistics. Finally, it offers insights for further research.*

KEYWORDS: Abstracts, Biostatistics, Lexico-Grammatical, Move-Structure, Research Articles

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INTRODUCTION

The upsurge in genre research is acknowledged by Afful and Gyasi (2020), Afful and Kyei (2020), and Fryer (2012); highlighting its popularity in Discourse Analysis, Applied Linguistics, and other disciplines. Genres are crucial in human interaction, given their communicative purpose (Devitt, 2004). Genres exist in several discourse communities that share communicative and structural properties. Fryer (2012) notes that genre analysis provides insights into the communicative practices of specific discourse communities. Among the plethora of discourses is the academic discourse that is charged with producing and disseminating knowledge (Curry & Lillis, 2004; Hyland, 2004). Generally, genre analysis concerns studying the move-step structure and lexico-grammatical features of texts (Afful, 2016, 2005; Agbaglo & Fiadzomor, 2021; Bhatia, 2004; Swales, 1990). Among other genre scholars, Afful (2005), Fryer (2012), Swales and Feak (2004) contend that genre analysis provides the basis for a descriptive framework in the educational context to help learners in producing, interpreting and understanding genre-specific texts. Afful and Kyei (2020) note that genre analysis offers a "unique understanding into the nature of writing in both academic and professional contexts" (p. 1). Genre studies have focused on research articles in the last four decades.

Agbaglo and Fiadzomor (2021) hint at the relative importance of research articles (hereinafter, RA) among the academic genres, given their role in disseminating novel research findings. El-Dakhs (2018) adds that being cognizant of the structure of RA in a specific discourse community motivates novice members to comply in that order. Swales (1990) points out that RAs are designed to be published which makes them more necessary in the academic world. Through RAs, scholars and professionals share knowledge and contribute to their research community.

From the 1960s, abstracts have become a core part of RA (Agbaglo & Fiadzomor, 2021). According to Hyland (2004), abstracts serve as a "selective representation rather than an attempt to give the reader exact knowledge of an article's content" (p. 64). It is a "crystallization" (Salager-Meyer, 1990, p. 367) and a "representation" (Bazerman, 1984, p. 58) of "an associated text" (Hyland, 2004, p. 64). Abstracts persuade readers that a text is worth reading (Hyland, 2000). Bhatia (1993, p. 78) purposed the abstract to be "a description or factual summary of the much longer report, and it meant to give the reader an exact and concise knowledge of the full article". Saidi and Talebi (2021) assert that the abstracts settle the fate of academic papers. This means that the acceptance, rejection or speculated motivation of a RA depends heavily on the abstract (Huckin, 2001; Ren & Li, 2011). It serves as a screening device into the RA. Given that abstracts have become obligatory in RA (Holtz, 2011), it "carries a discipline's epistemological and social assumptions" (Hyland, 2004, p. 64), focalizes authors and their work through a presentation of the summary of their research (Tanko, 2017) and provides the uniqueness of their study (Hyland, 2009). The medical discourse community is currently receiving attention in genre studies. A significant study has focused on English journals using a Systemic Functional Approach (Fryer, 2012).

The English language is used in medical RA (Fryer, 2012; Swales, 1990). Though there is considerable interest in fleshing out the characteristics and linguistic features in medical practices (Gotti & Salager-Meyer, 2006), there is a lack of genre investigation into the discipline of Biostatistics. Some studies have investigated only medical RA (MacDonald, 2002; Salager-Meyer, 1992; Skelton, 1994). The present study provides the view that genre

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studies should focus on new disciplines. In this regard, the discipline of Biostatistics is identified as one of the emerging disciplines producing robust RAs in medical discourse. Tactfully writing RA abstracts to serve its purpose as reviewed demands a lot (Flowerdew, 2008; Marefat & Mohammadzadeh, 2013). Given the pivotal role of RA abstracts, the present study aims to explore the move-structure and lexico-grammatical features of this new discipline. There are presently no genre studies conducted in Biostatistics. Knowledge of this genre contributes to building up and boosting confidence for research in the discipline (Suntara & Usaha, 2013). Following these significant revelations, the study is guided by two main research questions:

1. What is the move-structure of RA abstracts published in Biostatistics?
2. What lexico-grammatical resources characterise the rhetorical moves of RA abstracts published in Biostatistics?

LITERATURE REVIEW

This section of the study reviews the existing genre literature that relates to and helps in fleshing out the scope of the study. This portion is subcategorized into two main parts: theoretical framework and empirical review. The theoretical framework presents the theory (School of Genre) adopted for the study. The empirical review section discusses previous studies concerning the RA abstracts.

Theoretical Framework

Ghasempour and Farnia (2017) define genre analysis as an investigative approach to identify the similarities and differences associated with the purposes, forms, audience and linguistic features of texts. In the genre literature, three approaches to genre analysis (that is, English for Specific Purposes, Systemic Functional Linguistics, and New Rhetoric) has been popularized over time (Afful, 2005, 2007, 2016; Afful & Kyei, 2020; Afful & Gyasi, 2020; Bonsu, 2021; Fryer, 2012; Mwinlaaru, 2017; Nartey, 2018). Quite recently, Lin, Mwinlaaru and Tay's (2020) *Approaches to Specialized Genres* has introduced three new approaches that are Critical Genre Approach, the Corpus-Based Genre Approach and Cognitive Genre Approach. The present study dwells on the English for Specific Purposes (hereinafter, ESP) approach to genre analysis.

Swales (1990) is credited with proposing the ESP approach to genre analysis through his move analysis. Swales (1990) states that a genre is a class of communicative events purposely driven to share communicative intents through patterned structures, styles, content and audience. The communicative purpose is commonly shared among the members of the professional or academic discourse community and forms part of the genre. Huang and Chen (2018) point out that ESP analyses have grown deeper beyond a mere description of lexico-grammatical features to include communicative purposes and effects. Swales (1990) explains that this has boosted interests in assessing rhetorical purposes and accounting for syntactic and lexical choices.

With the ESP approach to genre analysis, 'moves' are significant. According to Afful (2012), 'moves' are purposeful sub-rhetorical units of a genre. Afful and Gyasi (2020) explain that 'step', as a rhetorical strategy, can be used to realise the communicative purpose of a genre.

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Swales (1990) classifies 'moves' as a sub-communicative purpose of a part of a text that helps in actualizing the overall communicative purpose. 'Moves' can be identified by the communicative purpose (Agbaglo Fiadzomor, 2021), cognitive-semantic boundary (Afful & Gyasi, 2020), or the structure of the text (Tseng, 2011). Liu (2012) asserts, "whenever a linguistic unit indicates a communicative intention subservient to the general communicative purpose of a discourse, a move can be identified" (p. 2409). The micro-structure level of genre analysis constitutes the lexico-grammatical features that add to realizing the communicative purpose of the genre. In this regard, Biber, Connor and Upton (2007) reveal that moves are identified rhetorically and linguistically. The length of a move varies from a discoursal level to a phrasal level (Huang & Chen, 2018) and can also be embedded in other moves (Pho, 2008). The essentiality of a move is a major reason for studying move analysis (Can, Karabacak, & Qin, 2016).

In ESP research, several models have been developed to study parts of a text such as the Acknowledgements (Afful, 2016), Abstracts (Hyland, 2004), Introduction (Swales, 1990), Methods (Kuo, 2011), Results (Swales & Feak, 2004), Discussion (Parkison, 2011) and Conclusion (Bunton, 2005). Swales (1990) proposed the *Create a Research Space* (CARS) model which has been used in structuring academic writing. According to Swales (1990), the CARS model is a three-move structure that focuses on establishing a territory, establishing a niche, and occupying the niche which corresponds respectively to Move 1, Move 2 and Move 3.

Bhatia (1993) proposed the four-move structure: introducing purpose (Move 1); describing methodology (Move 2); summarizing the results (Move 3); presenting conclusions (Move 4). This was later termed the IMRD model i.e., Introduction, Method, Results, and Discussion (Ventola, 2004). Lorés (2004) expands the purposes of each of the parts. The last model developed in the ESP research is Hyland's (2000) five-move model which is adopted in this study. The 'moves' are classified as Introduction (M1), Purpose(M2), Methodology(M3), Product(M4), and Conclusion(M5).

In Hyland's (2000) study of abstracts, he proposed a five-move model which is highly commended by El-Dakhs (2018) given the study's comprehensiveness, verifiability, reliability and easy-to-apply approach. His model has been a leading one in analysing RA abstracts (Agbaglo & Fiadzomor, 2021; Lee, 2017; Putri, Hermawan & Muniroh, 2020; Saidi & Talebi, 2021; Sukhapabsuk, 2021). Following Hyland's proposition, there have been major developments incorporating six and seven units of RA. Nonetheless, Hyland's (2000) model has proven to be instrumental over the decades.

Empirical Review

Several studies exist on RA abstracts in the genre literature (Agbaglo & Fiadzomor, 2021; Darabad, 2016; Lee, 2017; Saidi & Talebi, 2021; Sukhapabsuk, 2021; Tanko, 2017). Most of the existing studies are in the disciplines of tourism (Ahmed, 2015), law (Ghasempour & Farnia, 2017), marketing (Li & Pramoolsook, 2015), medicine (Fryer, 2012; Huang, 2014), and applied linguistics (Agbaglo & Fiadzomor, 2021; Darabad, 2016; El-Dakhs, 2018).

In the field of Applied Linguistics, Agbaglo and Fiadzomor (2021) analysed the abstracts of empirical RA published in *TESOL Quarterly*. Given the huge amount of research articles in the area, the researchers used 100 RA abstracts as the data for the study. Adopting Hyland's

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(2000) five-move model, Agbaglo and Fiadzomor revealed a five-move structure pertinent to RA published in *TESOL Quarterly*. They identified the Purpose and Product as obligatory, while the Introduction, Methodology and Conclusion were core. Tense, voice, and grammatical subject roles were characteristic of each of the rhetorical moves. While Agbaglo and Fiadzomor (2021) report a frequent sequence of M1>M2>M3>M4>M5, Suntara and Usaha (2013) report a four-move sequence with M2>M3>M4>M5. They analysed 200 RA abstracts published between 2009-2012 using Hyland's (2000) five-move model as the analytical framework. Contrastively, they report Purpose, Methodology, and Product as the obligatory moves. Consistent with the study of Suntara and Usaha (2013), using Hyland's (2000) five-move model, El-Dakhs (2018) reports a frequent pattern of four-move structure, that is M2>M3>M4>M5. El-Dakhs (2018) hints that the Methodology and Product are the frequently used moves in the abstracts. Sukhapabsuk (2021) reports the results of the analysis of 100 RA abstracts, using Hyland's model. The RA was chosen between 2010-2017. He reports that M2>M3>M4 were frequently adopted in the RA abstracts. Likewise, Saidi and Talebi (2021) explore the moves and move pattern of 171 RA abstracts published between 2019 and 2020 in two journals. They adopted Hyland's (2000) five-move analytical model. From their analysis, while the abstracts included the conventional five-moves, the purpose, method and product moves were the frequent moves. Gustina (2020) used Hyland's model to analyze rhetorical move patterns and linguistic features of RA abstracts. From the analysis, the results show similarities and differences in the moves, steps, and lexico-grammatical features.

In the medical context, Fryer (2012) examined the generic features of experimental medical RA, using the systemic functional and structural moves approach. Four main journals were selected to retrieve the sixteen (16) RA from their archives within the years of 2004-2006. He identified ten (10) moves in the abstracts each with step(s). Modality, personal pronouns, interpersonal epithets, and mental clauses were dominant among the lexico-grammatical features in the abstracts of the medical RA. Nwogu (1997) identified 11 rhetorical moves in 15 RA corpora published in 1985-1987 in *British Medical Journal* (BMJ), Journal of the *American Medical Association* (JAMA), *Lancet* (LAN), *New England Journal of Medicine* (NEJM), and the *Journal of Clinical Research* (JCR), 7 of which were mandatory. Similarly, Skelton (1994) analyzed a corpus of 50 RA abstracts published in the *British Journal of General Practice* (BJGP) from 1989-1993, indicating 15 rhetorical actions, 7 of which were mandatory.

Cavalieri (2014) opines that medical abstracts tend to emphasize a more empirical research perspective, whereas applied linguistics abstracts seem to place more emphasis on issues relating to theory and method. Martínez (2005) notes that in the 1 million-word biological RA corpus, personal pronouns appeared most frequently in Results and Discussions, and the fewest instances in Methods. This difference may be due to different materials and may reflect fundamental differences between the types of RA (medical and biological) studied. Darabad's (2016) study focused on the fields of Applied Linguistics, Applied Mathematics, and Applied Chemistry, revealing significant similarities and differences in the schematic structures of abstracts. Other related studies compare Applied Linguistics and English as a Second Language (e.g., Al-Shujairi, Ya'u, and Buba, 2016), Law and Business (e.g., Hatzitheodorou, 2014), Linguistics and Chemistry (Li, 2011). In terms of linguistic resources, Kearttikul and Wimonkasem (2017) analysed the tense and voice of RA abstracts published in Applied Linguistics and Linguistics. Çakır (2016) analysed the use of stance adverbs, Salager-Meyer (1992) examined tense and modality, Juan and Tao (2013) identified the dominant use of

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passive voice by Chinese writers, and Sarfo-Adu (2015) analysed nominalization in the abstracts.

In response to what other researchers have reported, the present study aims to explore the move structure and linguistic resources used in abstracts of RA published in the Biostatistics discipline. With the move structure, the paper focuses on the frequency of moves, sequencing of moves, and textual space. Tense, modality and personal pronouns are discussed as the linguistic realisations of the data set.

METHODOLOGY

Source of Data

The data set for the study comprised forty (40) RA abstracts. The data were selected from four (4) different journals with each providing ten (10) articles. They were selected from the archives of the *International Journal of Clinical Biostatistics and Biometrics* (IJCBB), the *Journal of Biostatistics and Epidemiology* (JBE), *Biostatistics* (BS), and *Journal of Clinical Epidemiology* (JCE). These journals are highly ranked journals with a frequent publication rate in the discipline. The RAs in these journals have undergone rigorous review and have been selected as eligible for publication. The RAs were randomly chosen in the journals. To limit the data set, the RAs were selected from 2019 to 2022 publication dates. The currency in the data set is suitable, given the contemporariness of the discipline in the world today.

Analytical Framework

The analysis of the obtained data was carried out on the schematic structure and the lexico-grammatical features of the moves. With the schematic structure, the issues of (i) frequency of the moves, (ii) sequencing the moves, and (iii) textual space were considered. The cognitive-semantic boundary (Afful & Gyasi, 2020; Afful, 2016) served as the main criterion in identifying the moves in the abstracts. This was achieved by associating structures with identifiable semantic implications. While this criterion was met by limitations, the functional criterion (which identifies grammatical structures that perform the same function) as proposed by Eggins (2004) was used to complement the cognitive-semantic criterion.

The frequency of the moves is determined by the guidelines provided by Hüttner (2010) which, based on the frequency of occurrence, comprises obligatory, core, ambiguous, and optional moves. The percentage of the occurrence is presented in Table 1.

Table 1: Determining the Status of Moves

Percentage of Occurrence	Status
90% - 100%	Obligatory
50% - 89%	Core
30% - 49%	Ambiguous
1% - 29%	Optional

Source: Hüttner (2010)

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As has been expressed, the analysis of the move structure is complemented by the lexico-grammatical features of the moves. This is because, given the uniqueness of each sub-rhetorical structure, each move stands to constitute different linguistic resources in their realisation. The main lexico-grammatical features taken into consideration are tense, modality and personal pronouns.

As stated in the theoretical framework, the study used Hyland's (2000) five-move analytical model to analyse the schematic structure of the articles. The framework is illustrated in Table 2.

Table 2: Hyland's Framework for Analysing Abstracts

Move	Function
1. Introduction	Establishes the context of the paper and motivates the research or discussion
2. Purpose	Indicates the purpose, thesis or hypothesis, outlines the intention behind the paper
3. Methodology	Provides information on design, procedures, assumptions, approach, data, etc.
4. Product	States main findings or results, the argument, or what was accomplished
5. Conclusion	Interprets and extends results beyond scope of the paper, draws inferences, points to applications or wider implications

Source: Adapted from Sukhapabsuk (2021)

Saidi and Talebi (2021), Ghasempour and Farnia (2017), and El-Dakhs (2018) commend the comprehensiveness and focus of the model in identifying the unique sub-rhetorical units (moves) in the RA. From the model, each of the moves performs a distinct communicative purpose. The 'top-down' approach is considered for the analysis of the content of the abstracts.

Data Analysis Procedure

Each of the abstracts was named after the journals and numbers were attached for convenience and ease of reference. For instance, RA abstracts in SB were tagged as SB1, SB2, SB3, up to SB10. Forums, notes on contributors and information other than the abstracts were excluded. The qualitative textual analysis focused on the move analysis, tense analysis, modality and personal pronouns. The moves were identified within the abstracts and named as M1, M2, M3, M4, and M5 depending on each presence in the abstracts. In calculating for the textual space, each move in all the abstracts was calculated and the percentage was determined against the total number of words of the extracted abstracts. The average number of words in a single move for one abstract was also calculated using the frequency of the moves against the textual space (the results are approximated to the nearest whole number).

With the tense analysis, the study focused on the lexical items such as developed, showed, and report. The auxiliary be-forms, do-forms, and have-forms were excluded. The aspect forms such as the perfectives, gerund and infinitives were excluded as well. All kinds of modal finite verbs were given a space for the analysis except modal adjuncts. Finally, the analysis of the

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personal pronouns focused on the subjective forms, whether plural or singular. The results are calculated in frequencies and percentages.

RESULTS AND DISCUSSION

Using Hyland's (2000) model and Hüttner's (2010), the present study explores the move structure and lexico-grammatical features of forty (40) RA abstracts in Biostatistics. The results and discussion follow the frequency of moves, sequence of moves, textual space, and lexico-grammatical features (i.e., tense, modality and personal pronouns).

Frequency of Moves

This portion of the study focused on the frequency of moves in the abstracts analysed. A total of forty (40) RA abstracts were used in the study. The results of the frequency of occurrence of the moves are presented in Table 3.

Table 3: Frequency of Moves

Moves	Frequency (Percentage)	Status of Move
M1	31 (77.5%)	Core
M2	36 (90%)	Obligatory
M3	37 (92.5%)	Obligatory
M4	40 (100%)	Obligatory
M5	36 (90%)	Obligatory

Source: Four Biostatistics Journals

As presented in Table 3, M4 (Product) was the most frequent move followed by M2 (Purpose), M3 (Method) and M5 (Conclusion). M1 (Introduction) had the least frequency of occurrence in the abstracts. This reveals that RA abstracts in Biostatistics do not follow the conventional structure of abstracts (Hyland, 2004, 2015), as they do not focus on the introductory move. The study revealed a five-move structure (Introduction-Purpose-Method-Product-Conclusion). Such move structure has been reported in the studies of Hyland (2000), Ahmed (2015), Santos (1996), Suntara and Usaha (2013), and Agbaglo and Fiadzomor (2021). Extracts of each of the moves are presented and discussed.

Move 1: Introduction

The 'Introduction' move establishes the context of the research and reveals gaps that need to be filled (Hyland, 2000, 2004; Swales, 1990) and discusses issues related to the field. From the forty (40) abstracts, there were only 77.5% (31 occurrences). Per Hüttner's (2010) determination of the status of moves, M1 is classified as a core move. Extracts 1 and 2 exemplify the occurrence of the move.

Extract 1

Phase I dose-finding trials are essential in drug development. By finding the maximum tolerated dose (MTD) of a new drug or treatment, a Phase I trial establishes the recommended

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doses for later-phase testing. The primary toxicity endpoint of interest is often a binary variable, to describe the event of a patient who experiences a dose-limiting toxicity. However, there is a growing interest in dose-finding studies involving non-binary outcomes, defined by either the weighted sum of rates of various toxicity grades or a continuous outcome. Although several novel methods have been proposed in the literature, it still lacks accessible software to implement these methods. (IJCBB 1)

Extract 2

Unplanned pregnancy is a public health problem that affects maternal and child health, including maternal death, abortion, and low birth weight. Consequently, the government established family planning for action to prevent and reduce the health problems for most disadvantaged women. (JBE 2)

This move is employed to contextualize the scope of the research. It orients readers towards the subject of the research. In these extracts, the authors started with the 'Introduction' move. Background information is stated to serve as an established knowledge to instigate the research. The length of the RA abstracts varies. This indicates that the research essentializes the introduction as part of the abstract. There was an identification of the research gap(s) presented in the extracts. The results of the study corroborate with Saidi and Talebi (2021) and Skelton (1994) who found that M1 had the least occurrence among the moves identified in their study. The present study finalizes that situating research through the 'Introduction' move in Biostatistics journals is relatively small.

Move 2: Purpose

Hyland (2000) explains that the 'Purpose' move outlines the intention of the research. That is, it fleshes out the aim or what the research hopes to achieve. With a 90% occurrence, M2 has the status of an obligatory move. It had a high frequency of occurrence with 37 out of the 40 abstracts analysed. Extracts 3 and 4 serve as examples of the 'Purpose' move.

Extract 3

We develop likelihood-based sufficient dimension reduction methods (SDR) to find linear combinations that contain all the information in the compositional data on an outcome variable, i.e., are sufficient for modeling and prediction of the outcome. (BS 2)

Extract 4

The aim of this study is to determine whether the potential toxic copper element values measured in soils (X1), vegetables (X2) and waters (X3) have an effect on the copper elements in the stomach and intestinal tissue (Yi) (ppm) of individuals in an area of approximately 2400 km2 covering the east of Erciyes stratovolcano. (IJCBB 2)

The 'Purpose' move is an obligatory move in this paper. It constituted 90% of the abstracts. The purpose move is classified into two forms (Saidi & Talebi, 2021). These are the purposive form which adopts expressive terms such as 'the purpose of', 'the aim of', and 'the goal of'; and the descriptive form which presents features of the research and discusses significant objectives such as 'we extend' (BS 6) and 'this work presents' (JCE 1). From extracts 3 and 4, it can be confirmed that the authors adopted both the descriptive and purposive forms of stating the 'Purpose' move in the abstracts. These forms occur in all the RA abstracts. Li (2011), and

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Van Bonn and Swales (2007) confirm that the 'Purpose' move is obligatory as it had higher frequencies in their studies. It is therefore confirmed that the 'Purpose' move is typical of the journals.

Move 3: Method

This move elaborates the design, approach, method, instruments and procedures adopted in the research. The 'Method' Move had the second-highest frequency of occurrence amongst the moves. It is an obligatory move (92.5%). Instances are provided in Extracts 5 and 6.

Extract 5

The sample sizes of their data sets are typically orders of magnitude smaller than those used for common transfer learning applications like image classification, document identification, etc. We present a parsimonious hierarchical Bayesian transfer learning framework to directly estimate population-level class probabilities in a target domain, using any baseline classifier trained on source-domain, and a small labeled target-domain dataset. To address small sample sizes, we introduce a novel shrinkage prior for the transfer error rates guaranteeing that, in absence of any labeled target-domain data or when the baseline classifier is perfectly accurate, our transfer learning agrees with direct aggregation of predictions from the baseline classifier, thereby subsuming the default practice as a special case. (BS 10)

Extract 6

We used retrospective data on 446 hospitalized patients with COVID-19 who admitted from 7 March to 8 Oct 2020 in a referral hospital in Tehran, Iran. The prognostic effects of variables, including age, gender, comorbidity status, and symptoms were analyzed by using Kaplan-Meier methods and a competing risk analysis. Length of stay in hospital was calculated using time of last status minus time of admission. All analyses performed using SPSS version 22.0 and STATA version 15. (JBE 10)

Extracts 5 and 6 illustrate the occurrence of M3 in the abstracts. Authors use the 'Method' move to elaborate on the mechanism of conducting the research. In Extract 5, the authors start the move by presenting the sample procedures adopted and proceed to the process they used to overcome the methodological challenge encountered. With Extract 6, the authors present the participants and timeframe of selection of the participants as an introduction to the move. They then describe the experimental procedures through the variables they used. Finally, a description of the statistical-test techniques is presented using two software for data analysis. Comparing the extracted moves, the study shows that designing the method is informed by the RA.

Essentially, Li (2011), Martin-Martin (2005), and Kearttikul and Wimonkasem (2017) reveal that the method move is obligatory given its highest or second-highest occurrence in their analysis of RA abstracts. Relevantly, Abdollahpour and Gholami (2018) identified M3 as an obligatory move in Medicine abstracts. Putri et al. (2020) also report that M3 is a frequent move in their analysis of 171 abstracts. Almost all the RA abstracts analysed contained the 'Method' move, making it obligatory. Pho (2008) asserts that the thrust of RAs will be difficult to grasp if this move is missing. The finding of this analysis contrasts that of Zanina (2017) and Agbaglo and Fiadzomor (2021) who report the move as core in Management journals and

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TESOL Quarterly journal respectively. This can be accounted for through the difference in the disciplines.

Move 4: Product

This move is conventionally termed as 'Results' (Swales, 1990; Swales & Feak, 2004; Fryer, 2012). This move reports the findings of the research or what was achieved. This was the most frequent move amongst all the moves. It is an obligatory move (100%) in Biostatistics RA abstracts. Examples of this move are provided in Extract 7 and 8.

Extract 7

Our results showed that sample size, effect size, and number of items are important indicators of IRT based power estimation for PROMIS measures. When effect size is small and sample size is limited, the IRT model provides higher power than the closed form formula. (JCE 8)

Extract 8

Death due to CKD occurred in 29 (26.6%) of the patients. Sixty-seven (61.5%) had uric acid higher than 6.8 (mg/dl) and 39(35%) had phosphorus higher than 4.7 (mg/dl) which was a poor prognosis. The incidence of death was 48.4%. Calcium<8.5 (mg/dl) (p=0.002), Calcium > 9.5 (mg/dl) (p=0.003), Albumin 4-6.3 (g/dl) (p=0.034), Phosphorus (p=0.022), hemoglobin<10 (g/dl) (p=0.043), hemoglobin>12.5 (g/dl) (p=0.006) and iPTH (p<0.001) were significant variables which had an effect on death hazard rates. (JBE 4)

The authors use the 'Product' move to present the results of their analysis. This move is significant because the results of the study are what the authors hoped to achieve or otherwise. With the results of the research, the RA will not be complete. In Extract 7, the authors report the findings of their study through correlations. Unlike Extract 7, Extract 8 reports the main findings concerning the participants used in the study. This result is achieved by statistically associating and analysing the representation of the chemicals in the patients. It was noticed that the results were not presented in relation to the objective or hypothesis. Nonetheless, primarily, they report what was achieved as stated by Hyland (2000). Putri et al. (2020) recorded a 100% occurrence of the Product move in their analysis of RA abstracts. Also, Darabad (2016) and Imsa-ard (2021) report the frequent use of the 'Product' move.

Move 5: Conclusion

Hyland (2000) reports that the 'Conclusion' move reports, interprets, and extends the results of the study beyond the scope of the paper; it draws inferences and provides implications. In this study, the 'Conclusion' move has an obligatory status (90%), with 36 occurrences out of 40.

Extract 9

COS use in this cohort of trials was low, even when relevant COS were available. Increased use of COS in clinical trials can improve evaluation of intervention effects and evidence synthesis and reduce research waste. (JCE 2)

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Extract 10

Our approach can be applied to a wide variety of disease transmission models, and we provide examples with applications to the common cold, Ebola, hand foot-and-mouth disease. (BS 3)

M5 contained information about the conclusion of the research. The RA evaluated the significance of the study, suggested continuous application of results, and provided wider implications. These instances are evident in Extracts 9 and 10. Extract 9 summarizes the results and suggests an application of the model for better evaluation. This relates to drawing inferences from the results. Extract 10 draws a wider implication for the RA. No limitations were provided in Move 5. The finding of the frequency of this move contrasts that of Alhuqbani (2013) who identified M4 as optional. Given the obligatory status of this move, it can be attributed to the importance of the author's place on it to provide implications and or suggestions. It, therefore, becomes mandatory for other scholars in the field of Biostatistics to conclude their abstracts.

Sequencing of Moves

Sequencing of moves is significant in the analysis of the rhetorical structure. From the analysis, six (6) sequences were identified. The move sequence and frequency of occurrence are hierarchically presented in Table 5.

Table 4: Sequencing of Moves

Move Sequence	**Frequency (Percentage)**
M1>M2>M3>M4>M5	23 (57.5%)
M2>M3>M4>M5	8 (20%)
M1>M3>M4>M5	3 (7.5%)
M1>M2>M3>M4	3 (7.5%)
M1>M2>M4>M5	2 (5%)
M2>M3>M4	1 (2.5%)
Total	40 (100%)

Source: Four Biostatistics Journals

Extract 11

M1 *Recent efforts to characterize the human microbiome and its relation to chronic diseases have led to a surge in statistical development for compositional data.* ***M2*** *We develop likelihood-based sufficient dimension reduction methods (SDR) to find linear combinations that contain all the information in the compositional data on an outcome variable, i.e., are sufficient for modeling and prediction of the outcome.* ***M3*** *We consider several models for the inverse regression of the compositional vector or transformations of it, as a function of outcome. They include normal, multinomial, and Poisson graphical models that allow for complex dependencies among observed counts.* ***M4*** *These methods yield efficient estimators of the reduction and can be applied to continuous or categorical outcomes. We incorporate variable selection into the estimation via penalties and address important invariance issues arising from the compositional nature of the data. We illustrate and compare our methods and some established methods for analyzing microbiome data in simulations and using data from*

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*the Human Microbiome Project. **M5** Displaying the data in the coordinate system of the SDR linear combinations allows visual inspection and facilitates comparisons across studies.* (BS2)

Regarding the sequencing of moves, six patterns were identified. The most frequent sequencing was the linear five-move ordering (M1>M2>M3>M4>M5) with a 23 occurrence, followed by four four-move patterns (M2>M3>M4>M5) 8 occurrences with no 'Introduction' move, (M1>M3>M4>M5) 3 occurrences with no 'Purpose' movie, (M1>M2>M3>M4) 3 occurrences with no 'Conclusion' move, and (M1>M2>M4>M5) 2 occurrences with no method move. The final sequencing was a three-move pattern (M2>M3>M4) with 1 occurrence which excluded the 'Introduction' move and 'Conclusion' move. Malawi (2017) points out that there are four types of sequencing in terms of linearity: completely linear, semi-linear, non-linear, and circular. Deducing from Malawi's (2017) types of linearity, in the present study, M1>M2>M3>M4>M5 is considered to be completely linear, M2>M3>M4>M5, M1>M3>M4>M5, M2>M3>M4 and M1>M2>M3>M4 are semi-linear move patterns. The preferred sequencing is exemplified in Extract 11.

From the results, the most preferred and dominant sequence of moves in the selected journals in Biostatistics is the conventional pattern as M1>M2>M3>M4>M5, which occurred 57.5% in the abstracts. It is inferred that the authors prefer this pattern because there is available space to highlight the authors' discursive practices. The findings of this study correspond to that of Agbaglo and Fiadzomor (2021), and contrast that of El-Dakhs (2018) who reports a frequent sequence of M2>M3>M4>M5 and Sukhapabsuk (2021) who reveals M2>M3>M4 as the frequent sequence.

Textual Space

In this paper, the textual space considers the number of words allocated to each move in the RA abstract. The space allocated to a move determines its significance in the abstract. The results are presented in Table 5.

Table 5: Textual Space of Moves

Moves	**Textual Space**	**Average Number of Words in a Single Move**
M1	1529 (17.2%)	1529/31 = 49
M2	960 (10.8%)	960/36 = 27
M3	2281 (25.7%)	2281/37 = 62
M4	2736 (30.8%)	2736/40 = 68
M5	1370 (15.5%)	1370/36 = 38
Total	8876 (100%)	244

Source: Four Biostatistics Journals

From Table 5, the highest frequent move, Product, received the highest allocated textual space in the abstracts. As such, authors should provide the required information per the function of the Purpose move in the abstract (Hyland, 2004; Swales, 1990). The Method move, which was the second highest frequent move, was also allocated the second highest textual space. Interestingly, the Introduction move which was the least frequent move had a higher textual

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space than M2 and M5 which are obligatory. The results reveal that the Product move is given much significance amongst the other moves in the writing of abstracts.

Every discipline and publication have their style of writing which includes the allocation of textual space for writing abstracts. Previously, Samraj (2002) proposed that a typical abstract should be written in about 150 to 200 words. Given the recent advancements and changes in conventions, generally provide a word limit for abstracts, from a minimum of 150 to a maximum of 250 words.

Djuwari (2012) reveals that identifying the textual space in abstracts inspires them to structure their writing. More importantly, as the study identified M1>M2>M3>M4>M5 as the most preferred sequencing of moves (57.5%), the total average number of words in this sequence should be 244 which falls within the range of 150 to 250 words. This means that the RA abstracts in Biostatistics do not deviate from the style of writing abstracts.

Therefore, it is stipulated that the maximum number of words in an RA abstract should be 250 as has been generally held in most journals. That is, the average number of words in the abstracts and each move commensurate with the requirement and importance placed on it.

Lexico-grammatical Features

This portion presents the linguistic realisations evidenced in the moves. The focus is on tense, modality and personal pronouns. There were interesting revelations where some features were more prominent than others in some movies. For convenience in identification, the features are summed up according to the listing of the journal names (that is, IJCBB, JBE, BS and JCE). The results are presented in Table 6.

Table 6: Realisation of Lexico-grammatical Features

Moves	**Tense**		**Modality**	**Personal Pronouns**
	Present	Past		
M1	32 (14+6+11+1)	21 (7+3+8+3)	15 (5+2+6+2)	1 (1+0+0+0)
M2	32 (8+4+16+4)	13 (6+3+2+2)	11 (1+0+10+0)	2 (2+0+0+0)
M3	23 (5+0+17+1)	105 (24+39+13+29)	1 (0+0+1+0)	35 (6+5+12+12)
M4	31 (8+3+15+5)	69 (16+17+12+24)	6 (0+0+4+2)	18 (2+2+12+2)
M5	22 (4+4+7+7)	31 (8+9+3+11)	19 (5+4+3+7)	17 (6+4+6+1)

Source: Four Biostatistics Journals

Tense

Here, the focus was on lexical verbs in the present and past tense forms. The frequency of each of the verb tenses was calculated. The tense feature was analysed in each of the moves linearly with the journals' articles. With the present tense, there was a close lexico-grammar relationship established between the Introduction, the Purpose and the Product on one hand; as against the close relationship between the Method and Conclusion on another. Salager-Meyer (1992) states that medical-related abstracts can be constructed in terms of verb tenses. With the

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past verb tense, the Method move recorded the highest frequency of 105, followed by the Product with 69, the Conclusion with 31, the Introduction and Purpose recording 21 and 13 frequencies respectively. Correlating the tense identified, in Move 1 authors prefer the present tense since they use it to provide current knowledge regarding the topic and identify the research gaps. In Move 2, the use of the present tense is preferred to the past tense given that the authors state the instantaneous objective of the research or describe what is to be achieved. With Move 3, the highest frequency was recorded concerning the past tense. Authors report the procedures and mechanisms they adopted in carrying out their research which mandates the use of past tense. Also, the same deductions can be made for Move 4 which recorded a high frequency of past tense as well. That is, the authors report their main findings using the past tense. Likewise, the Conclusion movie had frequent use of the past tense as compared to the present tense forms. From the results illustrated in Table 6, the highest frequency of the past verb tense suggests that the past tense is a preferred type in the writing of abstracts in Biostatistics journals. Swales and Feak (2012) report the high occurrence of past tense in the Method move of articles. Nonetheless, the present verb tense is preferred in Moves 1 and 2. This contrasts the findings of Salager-Meyer (1992) who reported the realisation of past tense in Move 2. Examples are provided in extracts 11:

Extract 11

*An imputation-based, an inverse probability weighted (IPW), and an augmented inverse probability weighted (AIPW) estimator are **developed** and **evaluated** for the mean prediction error and the area under the receiver operating characteristic curve when the goal is to predict event status at a landmark time. The weights **used** for the IPW and AIPW estimators are **obtained** by fitting a multistate model which jointly **considers** the event process, the recurrent assessment process, and loss to follow-up.* (BS 9)

From Extract 11, the present tense identified is *considered* while the past tense verb forms identified are *developed*, *evaluated*, and *used*. These findings are in agreement with Hyland (1999), Swales (1990), Swales and Feak (2012), Tseng (2011). Swales and Feak (2012) explain that the usage of tense varies, depending on the journal or the article.

Modality

The study identified a high frequency of modal verbs associated with the Conclusion and Introduction moves of the abstracts. The Method move recorded the least occurrence of modal verbs because the authors did not need to explain what they plan to do in the future. The modal verbs cannot serve the communicative purpose of reporting what has been done already. Examples are provided in Extract 12.

Extract 12

*Remark that, if one is observing some unusual feeling in the heart, chest or in some related areas, this **could** result in carrying out an Electrocardiogram (ECG) test or examination. (IJCBB 3)*

*These approaches need to prevent the spread of the outbreak and increase the citizens' belief as the outbreak **will** damage the countries' functional capacity.* (JBE 1)

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The use of *could* in IJCBB expresses modal finiteness which conveys probability. This is a hedging strategy that shows the level of being uncommitted (Hu & Cao, 2011; Hyland, 1998) through a lower level of certainty. There was also the use of *may* to show probability as well. While the modal *will* is usually used to express volition, in JBE 1, it expresses a kind of certainty. Fryer (2012) reveals the higher frequency of modality in the results section of abstracts. Contrarily, the present study reports the frequent use of modality to express futurity in the Introduction and Conclusion moves. While the modal verbs were used in the Introduction moves to bring current knowledge and speculations were made, they were used in the Conclusion move to provide implications, suggestions and need for further research. Examples of the modal verbs used in M5 include *should*, *may* and *will*. Chen (2010) asserts that the occurrence of modal verbs is more move-determined than discipline-determined. Nurhayati (2017) reports the use of the modal verbs in Move 1 and Move 5 as well.

Personal Pronouns

Personal pronouns in the RA abstract are significant. Hyland (2008) opines that personal pronouns inspire different reactions to a text and assessments of the status of knowledge. It establishes a rhetorical stance and maintains a degree of acceptance in a discourse community (Hyland, 2001). In this study, the subjective forms were included in the analysis. From the results in Table 6, the Method move had the highest frequency of personal pronoun use occurring 35 times. The Product and Conclusion moves were the next with 18 and 17 occurrences respectively. The Introduction and Purpose move recorded 1 and 2 occurrences respectively. Examples are provided in Extract 13.

Extract 13

We *searched the Core Clinical Journals indexed in PubMed for RCTs published in 2019 and included a continuous primary outcome with repeated measures.* ***We*** *randomly sampled RCTs from the eligible trials. Team of methods trained investigators screened studies for eligibility and collected data using the pilot-tested, standardized questionnaires.* (JCE 4)

Although several novel methods have been proposed in the literature, ***it*** *still lacks accessible software to implement these methods.* (IJCBB 1)

From the text analysis of the personal pronouns, *we* (first-person plural pronoun) was the most occurring personal pronoun. According to Hyland (2008), the use of *we* is very important as it communicates to readers that the point of view of the authors is authentic and they believe in their claims. Morton and Storch (2019) reveal that the use of *we* is better than *I*. From extract 13, the use of *we* establishes a closeness between the authors and their construed readers in their academic discipline. The third-person singular pronoun was also recorded. This was used in making general claims related to the topic of investigation. The high frequency of personal pronouns in the Method move distinguishes it from the other moves in the abstract (Pho, 2008). The finding is also supported by Juan and Tao (2013) who found the occurrence of personal pronouns, mostly in 98% of medical abstracts they analysed. Fryer (2012) reports the frequent occurrence of personal pronouns in Method move.

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CONCLUSION

The present study aimed at examining the move structure and lexico-grammatical features of RA abstracts published in Biostatistics. The study revealed that the most frequent move in the abstracts is the Product, which reports the main findings of the RA. The Purpose, Product, Method and Conclusion moves were obligatory moves while the Introduction was a core move. M1>M2>M3>M4>M5 was the preferred sequencing of the moves in the abstracts. That is, the RA was constructed in a completely linear form to highlight the space for discursive practice. The highest textual space was allocated to the Product move and the average number of words in the abstract 244, which falls within the range of a 150 to 250 typical abstract word limit. The study identified personal pronouns and past verb tense to be dominant in the Method move. While there was a low occurrence of modal verbs, they frequently occurred in the Introduction and Conclusion moves. The communicative purposes of these findings have been provided. The study contributes to knowledge, practice and provides insights for further studies.

First, given that the study incorporated four different kinds of journals in this study, the results apply to the focus on the abstracts in the journals. This study adds to the repository of studies that have focused on individual disciplines. Given that Biostatistics is a novel discourse community, the results of this study highlight the innovativeness in journals published in Biostatistics.

Second, the findings of this study serve as a resource for learners, researchers, scholars and professionals in the Biostatistics discourse community. This is informed by the model that guided the study. The move structure and lexico-grammatical features analysed could serve as a useful resource and a critical approach to reading and writing Biostatistics RA abstracts. The results serve as a feedback to improving writing skills generally (Bonsu, 2021b). While this discipline is in the larger medical discourse, the implications fall well with Salager-Meyer (1994), Juan and Tai (2013) and Nwogu (1997). This informs the conventions and journal-style guidelines, following the completely linear move structure.

Finally, the study provides insights for further studies in EAP research. The results of this study are generalizable. However, the study is limited by the number of articles used. As such, a further study can be conducted including large data (RA). Also, it is recommended that further studies in this area can adopt two models or frameworks for analysing abstracts to report the variations that occur in the data set. Again, another study can pair journals in Biostatistics to other disciplines with the view of exploring any variations in the move structure and linguistic realisation of the moves.

Conflict of Interest

There is no conflict of interest.

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