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Editorial Team

From the Editors

Dear JOMES Readers,

We are pleased to present the 12th issue of the Journal of Mixed Methods Studies (JOMES), which brings together two studies that exemplify the analytical scope and methodological diversity of mixed methods research across educational and public administration contexts.

The first article, "*A Methodological Protocol for Analyzing Dyadic Phenomena: The Cross-Network Informational Analysis* (CNIA)," by Beck and Ferasso, introduces an original mixed methods protocol that integrates qualitative research synthesis with quantitative informational network analysis. This article offers a robust and innovative framework, particularly valuable for scholars conducting theoretical and integrative research on dyadic phenomena.

The second contribution, "*A Methodological and Disciplinary Analysis of Postgraduate Theses on Turkish Court of Accounts (2014–2025*)," by Evrim Ağaçdelen, offers a comprehensive methodological and thematic mapping of postgraduate research in the field. Drawing on descriptive and thematic analyses, the study reveals dominant disciplinary orientations, methodological preferences, and notable gaps in the literature, particularly regarding the judicial dimension of the Court of Accounts. This work not only synthesizes an extensive body of research but also provides a clear roadmap for future scholarly inquiry.

The third article, *"No Clue… No Signs… Unpredictable and Bizarre: The Burden of Impaired Awareness of Hypoglycemia Among Patients on Hemodialysis,"* by Radhika C. K., Asha S. Kumar, and Noble Gracious, employs a sequential explanatory mixed methods design to examine both the prevalence and lived experiences of impaired awareness of hypoglycemia. By integrating quantitative assessment with in-depth qualitative insights from patients, family members, and healthcare professionals, the study highlights the profound clinical, psychological, and social implications of this underrecognized condition and underscores the need for individualized, person-centered care strategies.

Together, these three articles illustrate how mixed methods research enhances methodological rigor, deepens interpretation, and strengthens the practical relevance of scholarly knowledge across diverse domains. We extend our sincere thanks to the authors, reviewers, and readers for their continued support of JOMES.

Sincerely,

Professor Anthony J. Onwuegbuzie
Editor-in-Chief

Professor Şakir Çınkır
Deputy EditorSincerely,

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Research Article

A Methodological Protocol for Analyzing Dyadic Phenomena: The Cross-Network Informational Analysis (CNIA)

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Abstract
This paper proposes a methodological protocol for analyzing dyadic phenomena based on two (or more) categorical variables by integrating qualitative and quantitative methods. A novel methodological protocol based on the MMR Paradigm was proposed to meet the need for adequately exploring dyadic phenomena by a methodological integration that increases the robustness and in-depth exploration of findings. This protocol consisted of Research Synthesis, Classification, Information Network Analysis, and Exploratory Data Analysis, finalized by a meta-inference. Its application suits empirical research, literature reviews, and other theoretical studies. The main contribution of the CNIA protocol to MMR is its application for theoretical research dealing with dyadic phenomena under the MMR Paradigm. A practical application and methodological suggestions were presented.

Keywords: *dyadic phenomena; categorical variables; mixed methods research paradigm; informational network analysis; research synthesis*

A Methodological Protocol for Analyzing Dyadic Phenomena: The Cross-Network Informational Analysis (CNIA)

Introduction

In any field of study, there are many ways of conducting theoretical studies, such as Bibliometrics, Research Synthesis (RS), Systematic Literature Review (SLR), and meta-analysis, only to name the most common. Some of these methods are more used than others, remaining preferred theoretical and empirical studies, varying from one field of study to another. Nevertheless, researchers have the practicality of choosing one given method already assumed by scholars and following its steps to achieve results. Less commonly, researchers use methods in a combined way, such as bibliometrics and Network Analysis (NA) or SLR and bibliometrics.

Dyadic phenomena (DPs) have been more commonly studied in some fields like Administrative Sciences, Social Sciences, Politics, Psychology, and Medicine (Korsgaard et al., 2015; Goldsmith et al.2017; Lyons & Lee, 2018; Kim et al., 2020). However, the available methodologies have not fully responded to the needs of such an approach (Krasikova & LeBreton, 2012). For instance, although various categorical variables (CVs) can be in-depth studied through heterogeneous information NA (Sun et al., 2012), a qualitative analysis could improve interpretations by getting integrated with the quantitative results.

Few methodologies propose an *integrated approach* for gaining a deeper and broader understanding of the phenomena under study (Åkerblad, Seppänen-Järvelä & Haapakoski, 2021; Nooraie et al., 2020). This integration is pivotal in *Mixed Methods Research* (MMR) when analyzing empirical findings from quantitative and qualitative strands and integrating the different inferences into a meta-inference (Teddlie & Tashakkori, 2009). Among the benefits of MMR is that this methodological approach strengthens the inferences quality (Tashakkori, Johnson & Teddlie, 2020). This manuscript departs from the methodological gap in addressing the need for an in-depth exploration of DPs and the MMR precepts by proposing a new integrative methodological protocol. Thus, this methodological paper aims to propose a methodological protocol for analyzing DPs based on two (or more) different CVs by integrating qualitative and quantitative methods.

In this protocol, named *Cross-Network Information Analysis* (CNIA), we departed from the robustness proportioned by the MMR and its integration to strengthening the power of explanation for CVs in DPs (Krasikova & LeBreton, 2012; Tashakkori et al., 2020). The CNIA protocol incorporates two strands: one qualitative - comprising RS, classification, and inferences; and another quantitative - comprising Informational NA, Exploratory Data Analysis (EDA), and inferences. The integration of inferences of each strand is performed at the final analysis (i.e., meta-inference).

The originality of this methodological protocol contributes to scholars in many ways. First, to the best authors' knowledge, no methodological proposal is available for analyzing DPs with two or more CVs. Second, a novel integrative protocol for analyzing CVs of the DP was proposed and applied. Third, this methodology has qualitative and quantitative strands that increase the *rigor* and *reliability* of results. Fourth, this research offered a new qualitative-quantitative procedure for analyzing data via Informational NA precepts, including a classification that preceded the quantitative analysis. Fifth, more significant results are achieved when integrating the inferences into the meta-inference

Methodological and Conceptual Background

In this section, the methodological concepts of science and data analysis, RS, NA, and EDA are revisited. These four methodological backgrounds help understand the procedures used for building CNIA.

Science and Data Analysis

Advancing the frontiers of knowledge and understanding of phenomena are the driver forces of science literature. In this way, scholars make empirical or theoretical advancements. In all cases solid and reliable *information* is used for building scientific knowledge, which is done by performing rigorous methods and analyses. For this reason, *data analysis* plays a critical role as an optimal tool for the accuracy and objectivity of science research (Hair et al., 2019). The deepened understanding of data analysis allows scientists to work with theoretical constructs through propositions and hypotheses at the abstract and empirical levels, which implies in analyzing distinct data and variables (Laudan, 1981; Hair et al., 2019). The main types of *variables for data analysis* are (Agresti, 2002; Hair et al., 2019): CVs; quantitative variables; response variables; and explanatory variables.

CVs, also known as qualitative variables and nonmetric variables, are defined as variables "with

values that serve merely as a label or means of identification" (Hair et al., 2019, p. 473). CVs are also elements of information networks, which are part of DPs (Krasikova & LeBreton, 2012; Sun et al., 2012). CVs can be nominal or ordinal, and dichotomous or multichotomous (Agresti, 2002; Hair et al., 2019). The CNIA protocol intends to analyze information networks of DPs. Information networks comprise two or more CVs. Although NA metrics are quantitative, the CVs are the informational input of networks. Moreover, networks are critical for analyzing DPs. Thus, this section underlined the relevance of rigor in analyzing quantitative and qualitative data for scientific development. Furthermore, this section presents the concepts and main types of variables for data analysis.

Research Synthesis

RS is a replicable systematic technique for exploring and analyzing findings from previous research (Mosteller & Colditz, 1996; Atkinson et al., 2015). Initially used in Life Sciences, other sciences fields have used RS, such as Linguistics (Norris & Ortega, 2000), Teaching and Education (Minner, Levy & Century, 2010), Managerial Sciences (Beck & Ferasso, 2022), and Engineering (Cordray, Harris & Klein, 2009). Also, RS has gained space mainly among Social Sciences scientists after the post-World War II (Chalmers, Hedges & Cooper, 2002; Hedges & Cooper, 2009).

Furthermore, RS is also recommended to complement literature review studies due to an integrative perspective of empirical research for creating generalizations (Cooper et al., 2019). Furthermore, RS allows a *deeper understanding of the findings* of retrieved research papers thanks to the qualitative approach that analyzes and integrates the findings from selected studies, and the interpretation resulting from the found evidence (Cooper et al., 2019; Cooper, 2015; Suri, 2011).

Thus, RS was included in CNIA by considering the RS of MMR (Voils et al., 2008; Sandelowski et al., 2012). In this perspective, qualitative and quantitative studies are previously examined throughout RS by aggregation. RS by aggregation comprises assimilating the findings to have the same structure or connection between two aspects or features of the phenomenon under study (Voils et al., 2008; Sadelowski et al., 2012). The ultimate goal of any RS is to produce a *cumulative integration of results* from previous research aiming at the quality of the information resulting from these analysis processes (Heyvaert, Maes & Onghena, 2013). Then, the cumulative integration of results is used for the next stage, the codification.

Codification is one of the critical aspects of RS. A coding scheme, generated by the researcher, depends on his knowledge on the subject under study for deciding to which category an item pertains. The categories are generated by code forms or code book, making the coding procedure more accurate. The main purpose of the coding scheme is to provide further *classification of items into categories* (Stock, 1994), which is useful for dealing with CVs. The researcher must define procedures for evaluating coding decisions and avoiding errors, such as ambiguities in the judgment process, coder bias, and coder mistakes (Orwin, 1994). For non-numerical information, classification occurs according to the *variations of characteristics* found across the analyzed studies, which is part of the coding convention. The reliability of coders and coding procedures are checked through revisions of coded results by other coders following a coding scheme protocol (Stock, 1994). Therefore, RS provides the *principles to synthesizing data and classifying data items into CVs* for CNIA.

Network Analysis

In CNIA, *NA* is helpful for analyzing the pattern of complex interplay among - networked elements - from one or more *CVs*. *Network* is "a collection of points joined together in pairs by lines" (Newman, 2018, p. 1). In scientific terms, points within networks are known as *nodes* and the lines are *edges*. In this way, *NA* "is useful to understand the pattern of interactions of nodes and edges within a system" (Beck & Ferasso, in press, p. 6). The systemic relationships analyzed in networks can be made from many science fields (Borgatti et al., 2009; Newman, 2018), and the main network *types* are: *technological*, e.g., the physical internet system that links computers by cables; *social*, e.g., social media, teams, groups of people, and firms; *biological*, e.g., neural networks, and food web of predator-prey relationships; and *informational*, e.g., texts, speeches, world wide web, literature, and bibliometric data.

Furthermore, it is crucial to understand the *type of ties* since they represent the *DPs* represented in the network (Borgatti et al., 2009). DPs occur when at least two elements are interrelated due to some nature or determined reason. According to Borgatti et al. (2009), the main typology of ties in network analyses (Figure 1) are variables based on similarity (e.g., attribute, location, and membership similarities), social relations (e.g., role-based, kinship-based, affective-based, and cognitive-based relationships), interactions (attitudes and actions, such as having sex with, advincing, helping, and harming someone), and flows (e.g., flows of information, resources, and beliefs).

Figure 1

A Typology of Ties Studied in Network Analysis

Similarities			Social Relations				Interactions	Flows
Location	**Membership**	**Attribute**	**Kinship**	**Other role**	**Affective**	**Cognitive**		
e.g.,	e.g.,	e.g.,	e.g.,	e.g.,	e.g.,	e.g.,	e.g.,	e.g.,
Same spatial and temporal space	Same clubs Same events etc.	Same gender Same attitude etc.	Mother of Sibling of	Friend of Boss of Student of Competitor of	Likes Hates etc.	Knows Knows about Sees as happy etc.	Sex with Talked to Advice to Helped Harmed etc.	Information Beliefs Personnel Resources etc.

Note. From "Network Analysis in the Social Sciences," by S. P. Borgatti, A. Mehra, D. J. Brass, and G. Labianca, 2009, *Science*, *323*(5916), p. 894. Copyright 2009 by American Association for the Advancement of Science.

In this way, networks can be directed or undirected. *Directed networks* have edges pointing out a DP originated from one node to another, and *undirected networks* represent reciprocity regarding the DP. For instance, the food web network is a directed network because one species eats another species (species are the nodes, and eating represents the edges); and friendship is an undirected network because friendship is reciprocal among people (people are nodes, and friendships are the edges). In essence, *edges* represent directed or undirected DPs that connect a *node* to another, and *nodes* can be concrete or abstract things from a variety of network types and fields.

The fundamental metrics for NA can be applied for all network types. However, each metric

will reveal specific aspects of the networks, and for this reason, the chosen variable should be aligned with the respective purpose of the analysis (Borgatti et al., 2009; Newman, 2018). The most used metrics in NA are centrality measures, since the position of a node within a network "determines in part the opportunities and constraints that it encounters, and in this way plays an important role in a node's outcomes" (Borgatti et al., 2009, p. 894). Also, other important metrics in NA are reciprocity, transitivity, homophily, and similarity.

Centrality is based on the idea that some nodes play a critical role in the network (Borgatti et al., 2009; Newman, 2018), and this measure quantifies the importance of a node in a given network. In general, centrality reveals the *outstanding* nodes in networks. The three main measures of Centrality have been 'Degree Centrality' (DC), 'Closeness Centrality' (CC), and 'Betweenness Centrality' (BB) (Bastian, Heymann & Jacomy, 2009; Newman, 2018). Other important centrality measures are 'PageRank', 'Eigenvector Centrality', and 'Katz Centrality' (Newman, 2018).

DC is basically "the number of edges connected to it" (Newman, 2018, p. 159), which reveals the *nodes* with more power of influence or prestige in networks. In directed networks, DC can be *in-degree* (i.e., quantity of edges inward a node) and *out-degree* (i.e., quantity of edges outward a node). In undirected networks, centrality reveals the quantity of edges connected to a node. *CC* "measures the mean distance from a node to other nodes" (Newman, 2018, p. 170), and thus, it identifies the nodes with the - shortest mean distance - to other nodes in the network. Nodes with higher CC have better accessibility and fast influenceability to other nodes. DC and CC have generally been positively correlated (Newman, 2018). *BC* "measures the extent to which a node lies on paths between other nodes" (Newman, 2018, p. 173), and thus, it identifies which nodes are in the pathway between other nodes. High BC can indicate that a node has informational control within a network and if this node is removed from the network, the edges and distance between the nodes will hugelly change (Newman, 2018).

In *Information NA*, homogeneous and heterogeneous pieces of information can be considered (Yu, Han & Faloutsos, 2010; Sun et al., 2012). Information NA has been used as tool for: social-media analysis (Schmitt et al., 2018); multiple subfields of social, economic, environmental, and political research (Jacobs & Cramer, 2017; Barbi & Prataviera, 2019); and medical, biological, and pharmaceutical research (Wang et al., 2016). On the one hand, *Homogeneous Information Networks* have only one type of information in the network, e.g., the nodes in a given network are only articles. On the other hand, *Heterogeneous Information Networks* have two or more types (or clusters) of information (Sun et al., 2012; Shi et al., 2016; Shi et al., 2017; Xie et al., 2021), e.g., the nodes could be theoretical concepts, phenomena, and science literature publications connected in a given network. In this sense, NA has also been useful for representing qualitative data (Canché, 2022).

Two examples of Heterogeneous Information Network are: (1) In the study of Beck and Ferasso (in press), in which two clusters of nodes were analyzed: 'Sustainable Development Goals' and 'Stakeholder Capitalism Literature'; and (2) in Wang et al. (2019) that investigated 'Genes' and 'Ovarian Cancer'. Although the two examples aforementioned have only two *CVs* in each study, research can utilize more than two variables if demanded by the research purpose (Borgatti et al., 2009; Sun et al., 2012; Newman, 2018). Shi et al. (2016) argues that *Heterogeneous Information Network Analysis* allows creating a new way of developing data mining, and fusing more complex information with multiple semantics. Thus, it allows "merging information from

heterogeneous sources with differing conceptual, contextual and typographical representations" (Shi et al., 2017, p. 11).

Therefore, analyzing *Heterogeneous Information Networks* is a useful tool for analyzing informational complex structures with diverse semantics, since it "contains abundant knowledge about relationships among objects" (Sun et al., 2012, p. 2023). Thus, the complexity of heterogeneous information networks can be addressed by fused analysis under MMR Paradigm (Nooraie et al., 2020). For this reason, the *Heterogeneous Information Network* is the optimal network type to be performed in CNIA.

Exploratory Data Analysis

EDA provides excellent means for identifying the properties and analyzing the distribution of a sample data. Thus, EDA analyzes the behavior of the data elements for a determined variable. The main sample data properties revealed in EDA are the means, medians (i.e., second quartile), modes, first and third quartiles, and outliers (Tukey, 1977; Hair et al., 2019). Identifying outliers is crucial in EDA. *Outliers* "are elements having significantly different behavior under a variable in a dataset" (Beck & Ferasso, in press, p. 8). In networks, a node outlier may be "shows irregularity in its structure within its locality", an edge outlier may connect "disparate communities of nodes", it can be an inference based on EDA analysis of a Network metric, or any other abnormal behavior of network data (Aggarwal, 2017, p. 25).

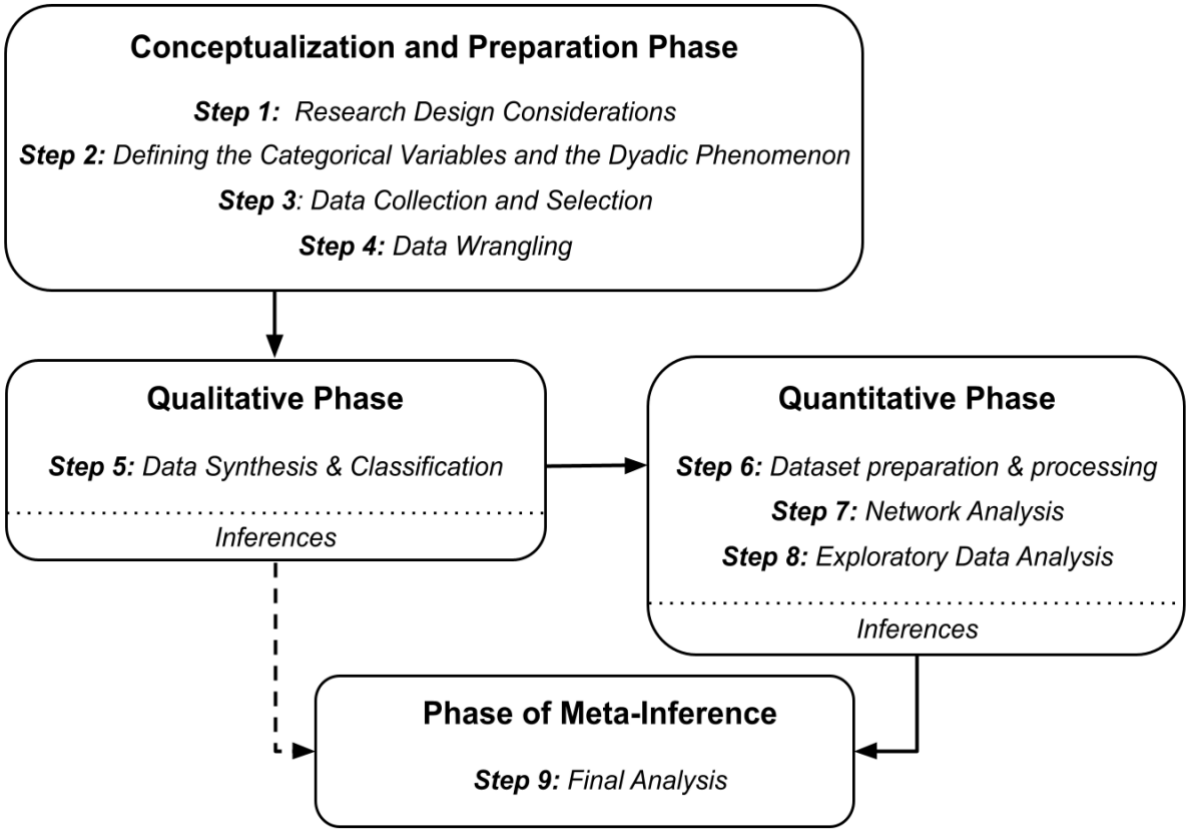
Furthermore, boxplot is an efficient EDA tool for visualizing data in overview and plotting outliers (Nuzzo, 2016) by considering the interquartile range (IQR) and whisker limits of Tukey (1977) or Altman (1991). The Altman's whiskers are only recommended for samples bigger than forty elements because they extend the whiskers limits to the 5th and 95th percentiles, and thus, considering only 90% of the data and more elements as outliers (Spitzer et al., 2014; Nuzzo, 2016) In other words, EDA has also been applied on sample data in NA for identifying outliers, properties, and network behavior (Aggarwal, 2017; Beck & Storopoli, 2021; Beck & Ferasso, in press). Therefore, the metrics of NA in CNIA can be carefully scrutinized by EDA as well as identifying the outliers in the networks.

Guidelines for Cross-Network Informational Analysis

The CNIA protocol was conceived into four phases, starting with a conceptualization and preparation phase, as depicted in Figure 2. Then, qualitative and quantitative phases are performed, and the final phase is the meta-inference.

Figure 2

Cross-Network Informational Analysis' General Guidelines: The Phases and Steps



Each of the four phases are discussed in detail in the next sections.

Conceptualization and Preparation Phase

Step 1: Research Design Considerations

Initially, researchers should decide if CNIA is appropriate to their intended research. There are three primary considerations here. First, the reasons for conducting the research should be clear and concise on (Tashakkori et al., 2020): (a) the social, practical and theoretical relevance; and (b) researchability of the data, theory, and sources; and (c) a justifiable gap based on a DP. Moreover, in CNIA, the analyzed purpose should aim to explore the DPs of two or more data elements or variables.

Second, as CNIA is based in part on NA, the research purpose should be related to analyzing the characteristics and behavior of the variables and data among them. In other words, the properties of the variables and data in a given network are relevant to explain the studied phenomenon stated in the research purpose. For instance, in the Physical Sciences, scholars have analyzed the "universal characteristics of nonrandom networks", while in Social Sciences, they have focused on the "variation in structure across different groups or contexts, using these variations to explain differences in outcomes" (Borgatti et al., 2009, p. 894). Therefore, it could

be viable to apply CNIA if the research purpose aims to explore the *universality* or *variability* of the variables and data.

Third, data size matters. On the one hand, the data size should not be ample to the extent that the researcher can not synthesize and classify the data. On the other hand, the data size should not be too small to the extent that the scientific rigor is denied. For instance, it cannot correctly execute EDA in variables with less than five elements (Nuzzo, 2016). Therefore, the data size should be considered when deciding if CNIA or other method protocol will be performed.

Step 2: Defining the Categorical Variables and the Dyadic Phenomenon

The CVs should be chosen by considering the *research question* and the *DP*. The research purpose indicates the type of data to be used in the CNIA, which should be CVs. For instance, the research purpose of the study of Beck and Ferasso (in press, p. 1) was to explore "how Stakeholder Capitalism can contribute to global governance to achieve all of the 17 SDGs". They chose the 'scientific literature' on stakeholder capitalism to represent one CV, and the 'Sustainable Development Goals' for the other CV. In that example, the DP is the 'contribution' of the first CV (i.e., literature) to the last one (i.e., SDGs). However, there will be DPs in which A connects to B and B to A simultaneously. Therefore, understanding the *type of ties* (as seen in Figure 1) responsible for connecting the *CVs* matters. Usually, the verb that represents the connection among CVs reveals the *type of tie* and the *DP* (e.g., to like, to inform, to help, to advice, to hate, to know, and to act).

Step 3: Data Collection and Selection

In this step, data regarding the CVs previously chosen should be collected. First, considering that scientific data and methods should be replicable, this step should be explained in detail. It is recommended that data be available in the public domain (as public repositories and accessible websites). For instance, in the study of Beck and Ferasso (in press), the 'scientific literature' CV (i.e., articles) was collected from the Scopus database through a Boolean search with complete years of publications limited. Therefore, if the data is derived from a scientific database, the advanced search expression and the day of collection should be written and clearly expressed. As for the 'Sustainable Development Goals' CV, the data used were merely the mission statement of each SDG (Beck & Ferasso, in press), which is publicly available at the United Nations' (2022) website.

Step 4: Data Wrangling

Possible missing values, false-positives and errors should be cleaned from the database. A careful reading of the information of the CVs should be done to assure that the elements address the research purpose. For instance, Beck and Ferasso (in press) read the 45 total elements (i.e. articles) within the 'scientific literature' CV gathered from Scopus and excluded 10 because they were not related to the other CV on 'SDGs'. In other words. Therefore, data wrangling is necessary to assure that the data are related to the CVs, DP, and research purpose.

Qualitative Phase

Step 5: Data Synthesis and Classification

In this step, the researcher starts the *data synthesis* and *classification* following RS by aggregation principles of any CV, not only the literature for which this method was created.

The researcher needs to define the protocol for analyzing the information, and it starts by defining the coding scheme. Considering that there are a wide array of coding scheme possibilities, researchers can code using their knowledge of a subject, a predefined classification, or both. For example, Beck and Ferasso (in press) used the predefined classification where the 17 SDGs were the 17 possible categories. Also, the code form used by Beck & Ferasso (in press) was a table in which literature syntheses according to each of 17 SDGs. The researcher needs to adopt coding decisions, i.e., the procedures to avoid errors when judging ambiguous information and procedures to reduce coder bias and mistakes. Coding decisions can achieve greater accuracy if inspected by another researcher following the same coding scheme.

The retrieved full texts, comprising quantitative, qualitative studies, or both, are thoroughly inspected to identify the *main contributions* to the synthesis. Afterward, a synthesis procedure synthesizes categorical data by reducing the findings/contributions in critical elements for classification and indicating categorical data sources. Therefore, *assessing the quality of information and adherence to the codes* is a critical and intelligible activity of researchers. Furthermore, previously discussed coding decisions strengthen methodological accuracy and reliability.

Departing from the synthesized information, the researcher needs *to integrate the results* by identifying similar syntheses by avoiding duplicate coding and classifying information. For this reason, RS precepts were recommended for CNIA. Then, the researcher relates the integrated results according to the adherence to a specific classification. The coding procedure considers the different characteristics that vary across the syntheses and is built according to the qualitative interpretation of data (inferences). Therefore, the researcher can also apply coding decisions at this point.

The last procedure is the final inspection of the classification according to the adherence of syntheses and classifications and of the inferences. Therefore, another researcher must inspect the reliability of the results by revising all the data synthesis and classification procedures.

Quantitative Phase

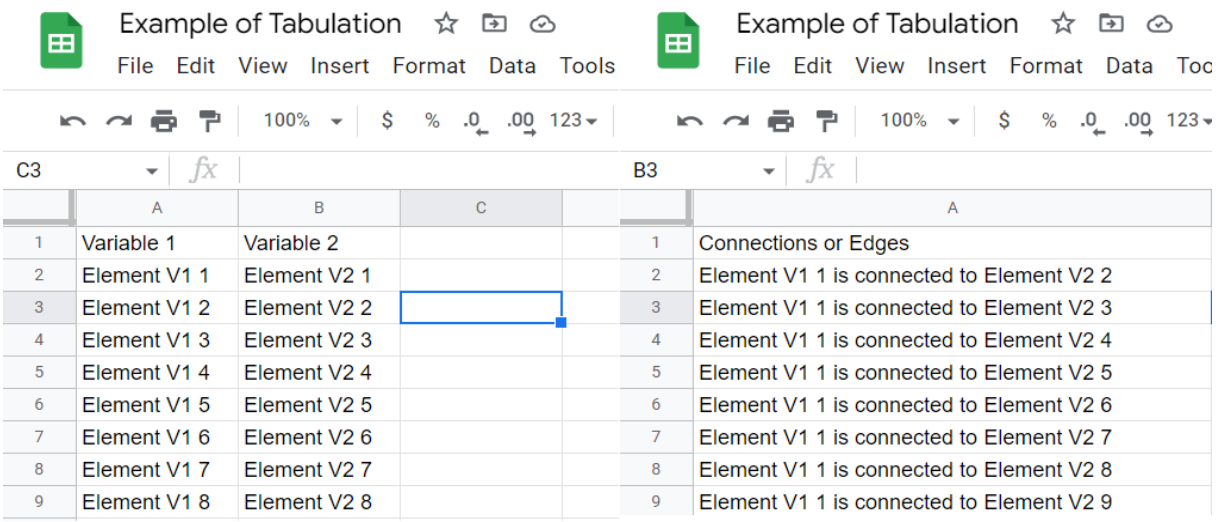
Step 6: Dataset preparation and processing

The data synthesized and classified in step 5 should be transformed into a network by software such as *Gephi* (Bastian et al., 2009) or a programming language such as using the *igraph* package in *R programming language* (Csardi & Nepusz, 2006). It is essential to organize a *new dataset* with the information created in Step 5, thus: (1) two or more variables and their elements should be tabulated, i.e., the elements of each variable are the network nodes; (2) connections between the elements should also be tabulated, i.e., the connections are the network edges; and

finally, (3) the data tabulated should be coded/manipulated through the preferred chosen software. Figure 3 illustrates an example of tabulation for the variables with their elements (nodes) and the connections (edges). Therefore, tabulating helps scholars to manipulate data when coding them into a programming language or manipulating them on software.

Figure 3

Example of Tabulation



	A	B	C
1	Variable 1	Variable 2	
2	Element V1 1	Element V2 1	
3	Element V1 2	Element V2 2	
4	Element V1 3	Element V2 3	
5	Element V1 4	Element V2 4	
6	Element V1 5	Element V2 5	
7	Element V1 6	Element V2 6	
8	Element V1 7	Element V2 7	
9	Element V1 8	Element V2 8	

	A
1	Connections or Edges
2	Element V1 1 is connected to Element V2 2
3	Element V1 1 is connected to Element V2 3
4	Element V1 1 is connected to Element V2 4
5	Element V1 1 is connected to Element V2 5
6	Element V1 1 is connected to Element V2 6
7	Element V1 1 is connected to Element V2 7
8	Element V1 1 is connected to Element V2 8
9	Element V1 1 is connected to Element V2 9

Step 7: Network Analysis

After coding, the results for the selected metrics are gathered from the chosen software. Thus, the network can be visualized according to a network layout algorithm, such as *Fruchterman Reingold* and *Yifan Hu* algorithms (Fruchterman & Reingold, 1991; Hu, 2005). Two examples of applications in *Information Networks*: First, Beck and Ferasso (in press, p. 6) chose the *Fruchterman Reingold* algorithm "due to its usability, reliability, and conceptually-intuitive features, better fitting for the research purpose". Second, Beck and Storopoli (2021, p. 6) chose *Yifan Hu* "due to its more realistic demonstration of the dynamism within the network in an efficient and high-quality manner". However, by choosing *Yifan Hu*, nodes can be so far from each other that network visualization can be compromised depending on network characteristics.

Most importantly for CNIA is choosing the metric that best fits to addressing the research purpose. In CNIA, centrality measures in CNIA reveal the most central and peripheral elements within the network. In other words, centrality measures highlight the outstanding elements of the CVs analyzed in CNIA. For this, the *DP* and the *type of tie* should be considered since they are related to the *verb* grounding the *DP* (e.g., to like, to inform, to help, to advice, to hate, to know, to act, etc.). Thus, exploring *centrality measures* in CNIA could reveal the central points of the information network behavior and should be chosen accordingly the research purpose:

First, based on the notion of power as the existing *higher number of connections* to other nodes, *DC* should be chosen to reveal the most *influential* and *prestiged* element (*node*) regarding certain *DP*. In other words, the rationale behind DC is that higher connection to other nodes,

higher will be the degree of a node to be *influential* under a *DP* to other nodes.

Second, although often positively correlated to DC (Newman, 2018), *CC* is based on the notion of power as fast accessibility and influenceability to other nodes, which implies understanding which nodes have the *shortest mean distance* to other nodes. CC should be chosen to unveil nodes in strategic locations in the network regarding the *speed* or the *shorter pathways* to be connected to other nodes.

And third, *BC* is based on the notion of power as a node being in the pathway between other nodes, and thus, power is *the ability to connect* others. In other words, it is the ability to create or the essence of having certain *DP*. Therefore, BC should be chosen to unveil nodes in strategic locations in the network regarding the *connectivity role* among nodes. If a node with high BC is removed, the structural distance among the nodes will drastically change and increase.

Step 8: Exploratory Data Analysis

EDA scrutinizes the NA metrics and provides objective and replicable results since it applies the IQR and the whisker limits recommended either by Tukey (1977) or Altman (1991) for the variables studied. In other words, EDA provides more details of properties of the variables. Moreover, EDA provides details of the properties of each variable, such as mean, median, first and third quartiles, mode, and the outliers. These properties are highly recommended to be depicted in boxplots. EDA in CNIA can be performed in three levels of analysis: (1) at the *whole network level* by considering all the clusters, nodes and edges; (2) at the *cluster level* (i.e., CV level), by considering the nodes within a cluster, it is applicable *only* to clusters with more than *5 elements* (see Nuzzo, 2016); and (3) at the *individual level* (i.e., element level), by considering each specific node and its edges, which is *only worth it when analyzing outliers* identified at the whole network and cluster levels. The individual level is particularly made *at the same time* as the whole network or cluster level for identified *outliers*. The bottomline is that EDA reveals the behavior of the elements among the variables as well as if the elements behave normally or abnormally (i.e., for significantly less or more saliency) within a network.

Phase of Meta-Inference

Step 9: Final Analysis

Finally, the researcher performs comparisons between data syntheses and classification (qualitative phase) results and the NA and EDA (quantitative phase) results. Considering the MMR paradigm, CNIA followed the sequential mixed design, where the qualitative phase preceded the quantitative phase (Teddlie & Tashakkori, 2009; Tashakkori et al., 2020). Thus, in each qualitative and quantitative phase, inferences were generated separately. Therefore, the *inferences are integrated into the meta-inference* at this final step.

Inferences represent interpretations and conclusions achieved through a solid understanding process of the collected data. The quality of inferences depends on how the researcher makes sense of results and interpretations when 'connecting the dots.' Therefore, inferences in the MMR paradigm require from the researcher (Tashakkori et al., 2020): (a) high creativity levels of the researcher; (b) insightful intuition; and (c) an ability to reconstruct the aspects of the phenomenon from a 'big picture' perspective.

Meta-inference quality requires carefully inspecting all inferences to guarantee how well they explain the phenomenon altogether (Teddlie & Tashakkori, 2009; Tashakkori et al., 2020). This inspection allows the researcher to build the meta-inference and comprises the integration of qualitative and quantitative inferences. The meta-inference is useful for structuring the analysis and discussion sections.

An exemplary application of the CNIA protocol

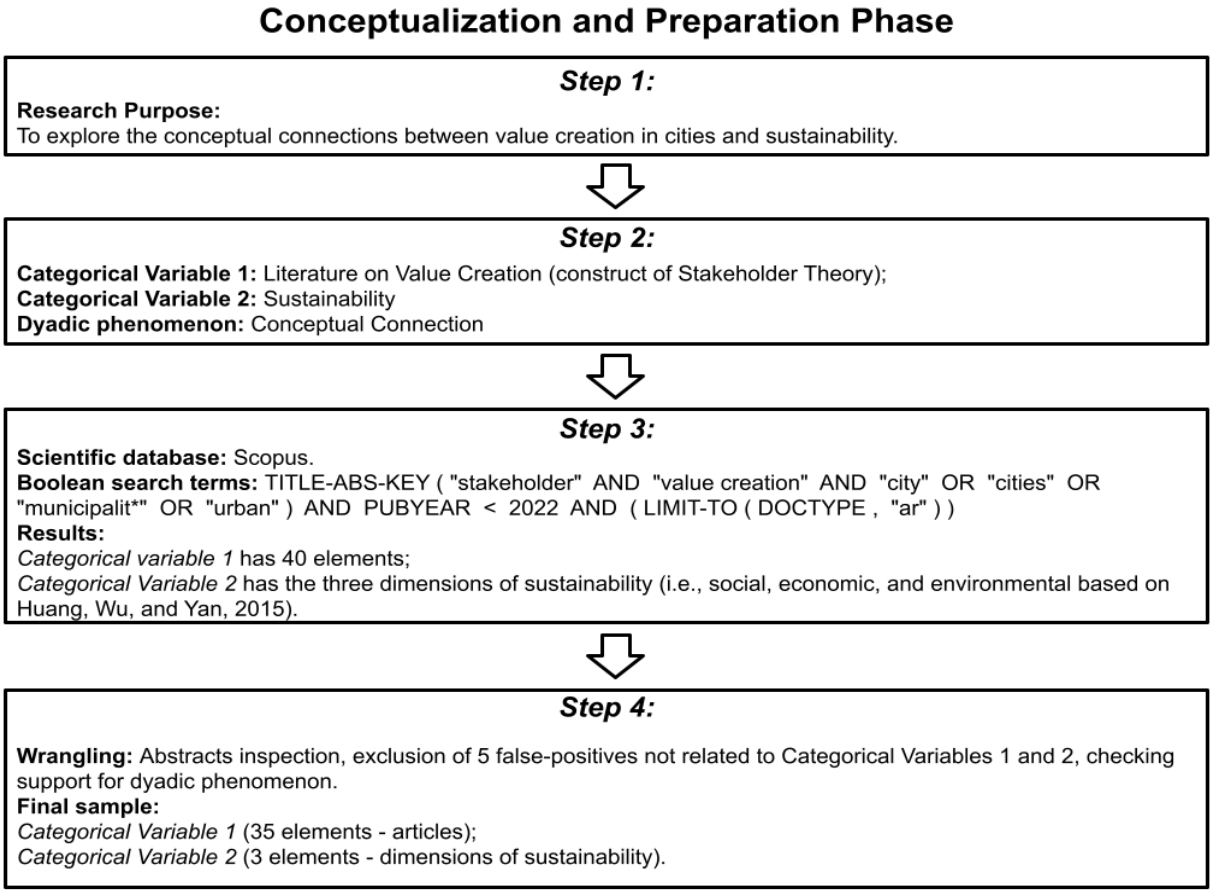
This section illustrates how to use CNIA with an exemplary application, which employed the value creation construct of Stakeholder Theory and the three dimensions of Sustainability.

Conceptualization and Preparation Phase

This example explained how to conduct all the steps of CNIA. Figure 4 illustrates the conceptualization and preparation phase.

Figure 4

Conceptualization and Preparation Phase of Exemplary Application



Analyzing the research purpose makes it possible to identify critical elements for CNIA use, i.e., the *DP* and *CVs*. Since the example considered the literature in one field of study as a CV,

the elements (articles) were retrieved from the Scopus database. Additionally, the second CV was predefined, i.e., the three dimensions of sustainability (Huang, Wu & Yan, 2015). After the wrangling procedures, the final sample is prepared for the next phase of CNIA.

Qualitative phase

Step 5 comprises the qualitative phase of the study. In this step, a descriptive synthesis of CV1 is made by simultaneously classifying them and considering the predefined elements of CV2. In other words, the main contributions and findings of the literature on Value Creation of Stakeholder Theory at the city level (composed of 35 articles) were simultaneously synthesized and classified into the three predefined dimensions of sustainability, i.e., social, economic, and environmental.

First, the protocol used for analyzing the information considers the adherence of the elements in CV1 (i.e., articles considering the title, abstract, findings, and conclusions) to CV2 (i.e., dimensions of sustainability).

Second, critical for the synthesis, the *codification process* has a clear coding decision and scheme. About the *coding scheme*, the knowledge of author 1 was the base for coding the articles (i.e., the elements of CV1); and the predefined classification comprised two sustainability dimensions (Huang et al., 2015). As for *coding decisions*, the authors made the decisions consensually, and author 2 revised the coding scheme to avoid dubious information in the articles. Furthermore, after finishing the coding scheme, all procedures were revised by author 2 to avoid bias and mistakes.

In *assessing information quality*, a reducing procedure embodies the main findings and contributions of the codified papers. Thus, the article's corresponding code (i.e., reference) and its synthesis provided the elements used for further classification. The procedure to guarantee the quality of information was how well the synthesis fitted the category, according to the knowledge of author 1. Furthermore, the synthesis and classification procedures were inspected by author 2 to guarantee methodological accuracy and reliability. As result, 32 articles were classified in the Economic dimension classification, 28 in the Social dimension, and 15 in the Environmental dimension.

Integrating results is part of the classification procedure. Accordingly, all the synthesized contributions were inspected to identify how the contributions could be integrated within a given classification. Also, duplicated contributions were integrated into the same synthesis to avoid repetitions. Furthermore, for the classification performed by author 1, the syntheses were inspected to their variance and interpreted qualitatively regarding their content. Lastly, integration was inspected by author 2. The synthesized contributions totalled in 20 central themes (the most salient were smart cities, value creation, innovation, and stakeholder engagement) that were classified according to the three dimensions of sustainability.

In the *final inspection*, the adherence of syntheses and classifications were reinspected by both authors separately, and disagreements were solved after consensus. Thus, the interpretations and conclusions of the syntheses and classifications allow the researcher to produce inferences and information for the next step of the CNIA protocol.

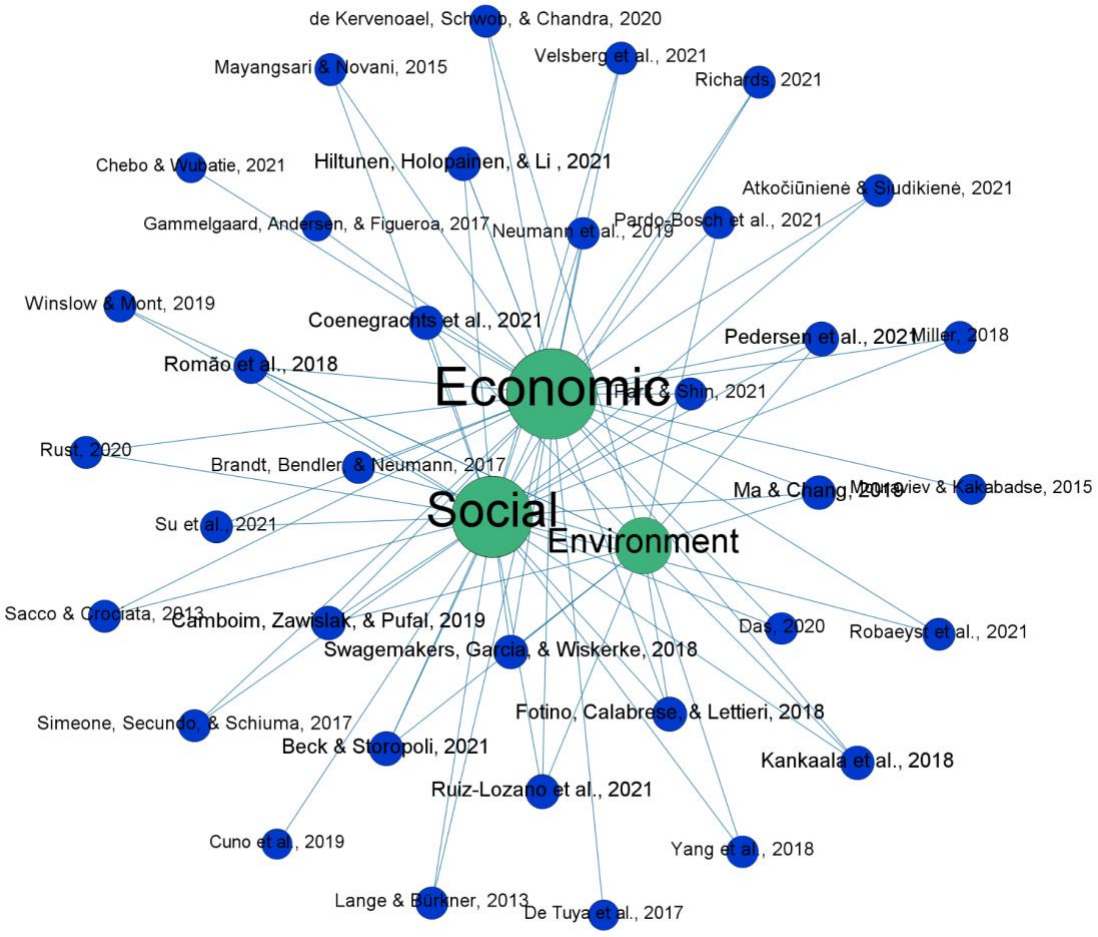
Quantitative phase

In step 6, the results of classifications made in step 5 regarding CV1 and 2 are used as input for a new dataset used in NA and EDA. Finally, the network and its properties were generated through *Gephi*.

In step 7, the NA is performed. It starts by analyzing the results of network properties focusing on the main centrality measures (i.e., DC, CC, and BC). The network visualization is also generated using the algorithm proposed by Fruchterman & Reingold (1991), and in this example, it created a total of 38 nodes and 76 edges.

Figure 5.

Exemplary Network Visualization



The CNIA methodology for the NA considers that two predetermined clusters based on CVs must be formed. Noteworthy is that more than two clusters can be formed according to the needed CVs and research purpose. Then, the NA identifies how the elements and relations are distributed throughout the network, revealing its centralities and visualization. Finally, the researcher must follow the dyadic relations between the two (or more) CVs to interpret the

results. Thus, the novel procedure for analyzing the informational network is the *focus on* two (or more) *CVs* exhibited in the network properties, which allows for identifying the *salient* categorical elements in a conceptual/informational DP.

In step 8, EDA is performed to enhance the replicability and objectivity of NA. Importantly, EDA scrutinizes network centrality measures. For example, EDA scrutinized the DC, CC, and BC for revealing the behavior of the two CVs at all network levels.

At the whole network level, results revealed that sustainability's economic and social dimensions were outliers (above the upper data extreme whisker) in the DC, CC, and BC network metrics. Conversely, although the environmental dimension was an outlier only in the DC, it was not an outstanding node in CC and BC measures. Therefore, the concept of 'Value Creation' at the city level has reached only conceptual connections with the economic and social dimensions of 'Sustainability', but the environmental dimension has been underestimated in the literature.
At the cluster level, EDA cannot be applied to 'Sustainability' because it has only three elements. Seven outliers (below the lower data extreme whisker) were identified in 'Literature', none of them connected to the environmental dimension. The same outliers presented the higher mean distance among the nodes. Therefore, there is a weak conceptual connection between these outliers, they possess a peripheral contribution to the DP of the example (i.e., value creation literature and sustainability dimensions).

Therefore, EDA allowed the identification of outliers in the exemplary network by objectifying the NA centrality measurements. Thus, researchers can benefit from EDA at this quantitative phase to strengthen their NA and objectively explain the data obtained from previous network analyses.

Phase of Meta-Inference

In step 9, the inferences were obtained from data syntheses and classification (qualitative phase) and NA and EDA (quantitative phase). Then, these inferences were integrated into a meta-inference.

In the example used for this study, from the syntheses and classifications, the inferences allowed for achieving specific conclusions. In summary, the syntheses revealed that Value Creation is conceptually connected to developing smart sustainable cities, innovation ecosystems, and stakeholder engagement. These elements are critical for sustainability at the city level, but only a few studies adequately address environmental issues.

From the NA and EDA, the main conclusions underlined that Value Creation literature is the most conceptually connected to the economic and social dimensions. However, the challenge is strengthening the connection between Value Creation literature and the underestimated environmental dimension.

The meta-inference from the qualitative and quantitative inferences was built. The main conclusions are: (1) both strands underlined the conceptual connections among the Economic and Social dimensions in the Value Creation literature; and (2) that the environmental dimension needs to be better integrated into the concept of Value creation.

In other words, the qualitative phase provided details of the elements, revealing that smart sustainable cities, innovation ecosystems, and stakeholder engagement play critical roles in the connection between Value Creation and Sustainability, and few studies addressing environmental issues. Furthermore, The quantitative phase reinforced objectively that the environmental sustainability dimension has not been fully integrated into the Value Creation literature.

This meta-inference explained the DP of the used example and was checked by the two authors. Therefore, both inferences were in accordance and enacted complementary, *reinforcing the robustness* of meta-inference. However, the inferences may also present discordant results that the researcher can explain.

Discussion and Conclusion

This research aimed to propose a methodological protocol for analyzing DPs based on two (or more) different CVs by integrating qualitative and quantitative methods. Thus, this research proposed a new methodological protocol, the CNIA, based on the need to explore DPs in-depth and more comprehensively by integrating quantitative and qualitative approaches.

The CNIA comprises synthesis, classification, NA, and EDA because these methods provide more robustness for analyzing DPs. This robustness is achieved thanks to the integrative perspective of qualitative and quantitative methods since their interdependence allows a greater comprehension of the findings. In the CNIA, the syntheses provided the information quality and the main sampled literature contributions that permitted classifications according to predefined categories. These classifications were also relevant for use as input for the NA and EDA. Although both methods presented interconnections, inferences were generated separately and independently. Information NA helps examine complex informational structures and diverse semantics regarding DPs by exploring in-depth CVs. Also, EDA can objectively explain and strengthen the network data performed in network analyses since it can identify outliers and general data distribution measures within the network. The inferences were then integrated to create the meta-inference, which is critical for having a deeper and broader understanding of the DP under study. Therefore, CNIA proved to be useful for any research that explores DPs in any field of study.

The main contribution to MMR is the application for theoretical studies dealing with CVs of DPs. Moreover, although the used example was a review based on literature and predefined classifications, CNIA can also be used by practitioners and policymakers in exploring other CVs (e.g., reports, socioeconomic and demographic data, and any other information sources), and in empirical scholarly research.

Among the limitations, the CNIA considered the syntheses based on human-based interpretations. One limitation could be when a larger quantity of documents must be synthesized. Further investigations could test the efficiency of Natural Language Processing, Machine Learning, or Deep Learning for synthesizing large samples of documents. Considering the NA of CNIA, the categories also can be formed by machine learning or deep learning.

The example used the NA centrality measures; however, CNIA is not limited to these measures. The measures should be chosen according to the research purpose; thus, further investigations

may consider new metrics, such as reciprocity, transitivity, homophily, and similarity. Replications of this methodological protocol are recommended in order to increase its improvements.

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"We, Beck and Ferasso, considered the scientific ethics guidelines".

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Review Article

A Methodological and Disciplinary Analysis of Postgraduate Theses on Turkish Court of Accounts (2014-2025)

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Abstract
This study aims to map the methodological trends and interdisciplinary differences in postgraduate theses on the Turkish Court of Accounts published between 2014 and 2025. For this purpose, 49 theses (16 doctoral, 33 master's) accessed from the Council of Higher Education (YÖK) National Thesis Centre were first subjected to a descriptive analysis (by year, discipline, method, etc.) and subsequently to an in-depth thematic analysis under four main themes. The results of the analysis revealed that the vast majority of the studies focus on the "audit" function of the Court of Accounts, while its constitutionally significant "judicial" function is largely neglected, especially by the discipline of law. Furthermore, it was determined that conceptual and qualitative approaches are dominant in the examined theses, and a general lack of methodological transparency was observed. The study presents a current panorama of the literature on the Court of Accounts, thereby making the methodological and thematic gaps in the field visible and offering concrete recommendations for future researchers.

Keywords: Turkish court of accounts, supreme audit, thesis analysis, methodological trends, thematic analysis, literature review.

Introduction

The constitutional framework of public power in the financial sphere has been shaped historically through the right to budget. This right fundamentally underpins both the authority of legislative bodies in financial decision-making processes and their power of oversight over the executive. The democratic oversight of public resources by parliaments through the aforementioned budgetary right is recognized as a common and indispensable element of modern constitutional systems (M. Önder & Mehmet Ali Meydanlı, 2019). Today, Court of Accounts have become one of the fundamental and indispensable elements of democratic governance by assuming the budgetary oversight function that should be performed directly by parliament (Ö. Önder & Türkoğlu, 2012, p. 198). The Turkish Court of Accounts also plays a central role in the effective functioning of this oversight mechanism.

From a historical perspective, financial control has always played a key role in Türkiye's more than a thousand-year-old tradition of state governance (Köse, 2007). In this context, the Divan-ı Muhasebat institution during the Ottoman Empire formed the institutional and functional basis of today's Court of Accounts. The Court of Accounts, which acquired a modern structure during the Republican era, has expanded its scope and responsibilities in line with the comprehensive changes and reform processes experienced in the contemporary public financial management system. (Kış, 2012) This situation has made it necessary for the institution to reshape its audit approach and practices (Durak Oldaç & Ergen, 2020). In fact, the Court of Accounts, which is

guaranteed by Article 160 of the Constitution of the Republic of Türkiye, is defined in the Court of Accounts Law No. 6085 as a constitutional body that performs financial audits of public administrations in Türkiye and exercises judicial authority over their accounts. Its main duties are to audit the financial activities of public administrations, exercise judicial authority over accounts and transactions, and submit reports to the Grand National Assembly of Türkiye (TBMM) (Court of Accounts Law, 2010). These duties aim to ensure the effective, transparent and lawful use of public resources through the Court of Accounts' audit and judicial functions. These multifaceted and critical roles undertaken by the Court of Accounts reinforce the institution's indispensable position in public administration (Akdağ, 1997).

In Türkiye, within the principle of separation of powers, the Court of Accounts is not classified among the high courts, but is defined as a sui generis constitutional structure, and the institution's judicial function is of particular importance (Köse, 2007). In this context, academic studies on the constitutional identity, judicial nature, audit activities, reporting function and institutional independence of the Court of Accounts are important in terms of examining the critical roles of the institution and determining its contribution to public administration.
The constitutional position, historical development and audit functions of the Court of Accounts have been the focus of considerable attention in academic literature. In this context, in addition to numerous academic studies on the subject, the Court of Accounts Journal, reports and various guides published by the institution itself constitute an important body of literature. Within such literature, postgraduate theses in particular stand out as research that examines the functions of the Court of Accounts in depth and evaluates them from different perspectives.

These studies, which are prepared at the MA and PhD levels in Türkiye and are accessible through the National Thesis Centre of the Council of Higher Education (CoHE), are generally expected to offer case analyses, field research, and empirical data with a depth that exceeds the scope of articles. Thanks to these qualities, postgraduate theses have become a fundamental reference source for new research and, over time, have themselves become a subject of research. In fact, these sources are examined as primary data sources in many academic studies. A literature review indicates that such methodological and content analysis studies are widely used, especially in the field of educational sciences (Karadağ, 2009). However, in recent years, it is observed that this approach is not limited to educational sciences but has spread to different disciplines.

In this context, in addition to administrative and economic sciences such as auditing (Kaya, 2019), marketing (Karaaslanoğlu et al., 2019), accounting (Baral, 2025), and logistics (Bedlek & Bozyiğit, 2022), similar studies are observed to be made in theses in fields such as social services (Zengin & Çalış, 2017), child protection (Başar, 2023), higher education (Tepe, 2018), and technological subjects such as artificial intelligence (Alkan & Sevli, 2023).

As a reflection of the general trend, it is possible to find various studies analysing postgraduate theses written in fields such as public finance, auditing, and financial law, which are the focus of this study. For example in a study that examined 1,714 postgraduate theses prepared between 2003 and 2017 in the field of finance using bibliometric analysis methods, the demographic characteristics of the theses as well as their content and method distributions were analysed. The study revealed that keywords such as ‘tax,’ ‘European Union,’ and ‘informal economy’ were prominent in finance theses, while surveys and econometric applications were the most preferred methods in empirical studies (Beşel, 2017). In another bibliometric analysis

conducted in the field of financial law, it was revealed that the most frequently studied topics in the 320 theses examined were 'tax law' and 'taxation.' This study emphasised that the majority of theses were based on conceptual methods such as legislation analysis, while those containing quantitative analysis were limited in number (Kuyumcu, 2025). Similarly, in a content analysis of doctoral theses written in the field of auditing between 1995 and 2018, it was determined that the most popular topics were 'internal auditing' and 'independent auditing,' while 'public auditing' received less attention. Among the findings of the same study, it was also noted that the majority of doctoral theses in this field were oriented towards empirical research and most frequently used the survey method (Kaya, 2019). In another study that intersects with the subject of our current study, theses written on 'Auidit of Court of Accounts' between 1991 and 2023 were examined using bibliometric analysis. This analysis indicated that the theses were mostly concentrated in the main fields of finance and public administration, and that the most frequently used keywords were 'audit,' 'high audit,' and 'performance audit.' In addition, it was pointed out that topics such as artificial intelligence and digitalisation in Court of Accounts audits are potential areas for future research (Engin, 2024). The literature presented above indicates that theses in the Court of Accounts and related fields are generally examined using methods such as bibliometric and content analysis. While these approaches are valuable in providing a quantitative and structural map of the literature, they are sometimes limited in combining different methodological and thematic trends within a holistic framework.

Research Questions

The main objective of this study is to eliminate this fragmentation by drawing up a methodological map of the literature in question. The study asks questions such as: 'To what extent do theses written on the Court of Accounts present basic elements such as research questions and methods in a structurally transparent manner?', 'Which methodological approaches (qualitative, quantitative, mixed, conceptual) stand out in research in this field, and how do these approaches differ according to discipline?', 'Which of the Court of Accounts' basic institutional functions, such as auditing and adjudication, do academic studies focus on more?', 'How do the theses examined define and substantiate their original contribution to the literature?' The study aims to reveal the current state and basic trends of the Court of Accounts literature by analysing methodological preferences and interdisciplinary differences in theses. It is believed that this holistic perspective will provide a roadmap for future researchers by identifying the strengths and weaknesses in the field and highlighting neglected areas of research.

Method

The data set for this study was obtained from the Higher Education Council (YÖK) National Thesis Centre database, using the keywords 'Court of Accounts', 'High Audit', and 'Accounts Judgment' between 2014 and 2025.

The analysis process was carried out in two stages. In the first stage, a general overview of the literature was presented by examining the distribution of theses by year, university, and discipline. In the second stage, thematic analysis was performed to understand the depth of content beyond this general overview.

Thematic analysis is a qualitative research method that aims to systematically identify, analyse,

and report on common and recurring patterns, or 'themes,' within a data set. This method not only organises and defines the data, but also provides a deeper understanding by interpreting different aspects of the research topic. Unlike many other qualitative methods, its lack of adherence to a predefined theoretical framework grants it significant flexibility. Unlike content analysis, it focuses on capturing meaningful patterns related to the research question rather than counting the quantitative frequency of themes. During the analysis process, themes can be identified either inductively, based directly on the data, or deductively, based on an existing theoretical interest (Braun & Clarke, 2006, pp. 79, 98). The reason for preferring this approach is to go beyond merely taking a structural snapshot of the Court of Accounts literature and to reveal the fundamental focuses, methodological preferences and conceptual gaps that shape this literature with interpretative depth.

In this context, the findings obtained from the research include frequency distributions that present the general appearance of the theses, followed by thematic analysis that reveals content patterns.

Results

In this section of the study, the findings obtained from the analysis of the 49 postgraduate theses examined are presented in two parts. First, under the heading General Profile of Theses, the studies are categorised according to year, discipline, and university. Then, under the heading Thematic Analysis of Theses Written in the Context of the Court of Accounts, the depth of the theses' content is interpreted through four main themes.

General Overview of Theses Written on the Turkish Court of Accounts

As part of our research, theses published in the National Thesis Centre between 2014 and 2025 were scanned. The index was searched using the keywords 'Court of Accounts', 'High Audit', 'Court of Auditors', and 'Accounts Judgment'. According to the results obtained, there are a total of 49 postgraduate theses in the context of the Court of Accounts between 2014 and 2025. Table 1 displays information about the master's theses.

Table 1

Master Theses Written within the Context of the Court of Accounts (2014-2025)

Code	Thesis Title	Year	University
YL-1	Fiscal sustainability, good governance and supreme audit institutions-*Mali Sürdürülebilirlik, İyi Yönetişim ve Yüksek Denetim Kurumları*	2025	Kırıkkale University
YL-2	An evaluation on the functionality of the Court of Accounts audit and account trial in local governments-*Yerel Yönetimlerde Sayıştay Denetimi ve Hesap Yargılamasının İşlevselliği Üzerine Bir Değerlendirme*	2024	Bilecik Şeyh Edebali University
YL-3	The implementation of fiscal rules for municipalities in Turkey and auditing of compliance with fiscal rules by the Turkish Court of Accounts-*Türkiye'de Belediyelere Yönelik Mali Kural Uygulamaları ve Mali Kurallara Uyumun Sayıştay Tarafından Denetimi*	2024	Hacettepe University
YL-4	An evaluation of the audit of the Turkish Court of Accounts in terms of the effectiveness of external audit in Turkey-*Türkiye'de Sayıştay Denetiminin, Dış Denetimin Etkinliği Açısından Değerlendirilmesi*	2024	Ankara Hacı Bayram Veli University

YL-5	The impact of the adoption of international standards on the quality of Turkish Court of Accounts Audit-*Uluslararası Standartlara Geçişin Sayıştay Denetiminin Kalitesine Etkisi*	2024	Ankara Hacı Bayram Veli University
YL-6	The audit of the court of accounts in Turkish public Financial Administration-*Kamu Mali Yönetiminde Sayıştay'ın Denetimi*	2024	Tokat Gaziosmanpaşa University
YL-7	Quality in Turkish Court of Accounts audit-*Sayıştay Denetiminde Kalite*	2024	İzmir Kâtip Çelebi University
YL-8	Audit: Turkey and other country comparison of applications-*Sayıştay Denetimi: Türkiye ve Diğer Ülke Uygulamalarının Karşılaştırılması*	2023	Kütahya Dumlupınar University
YL-9	Level of compliance of accounting practices in higher education institutions with generally accepted accounting principles: A study on audit reports of Turkish Court of Accounts-*Yükseköğretim Kurumlarında Muhasebe Uygulamalarının Genel Kabul Görmüş Muhasebe İlkelerine Uyum Düzeyi: Sayıştay Denetim Raporları Üzerine Bir Araştırma*	2023	Burdur Mehmet Akif Ersoy University
YL-10	Audit of the General Directorate of Police by the Court of Accounts-*Emniyet Genel Müdürlüğünün Sayıştay Tarafından Denetimi*	2023	Muğla Sıtkı Koçman University
YL-11	Financial discipline and the role of salary in Turkey-*Türkiye'de Mali Disiplin ve Sayıştayın Rolü*	2023	Sivas Cumhuriyet University
YL-12	The importance of the court of accounts in the auditing of public institutions: Challenges encountered in practice and recommendations-*Kamu Kurumlarının Denetiminde Sayıştayın Önemi: Uygulamada Karşılaşılan Sorunlar ve Öneriler*	2023	İstanbul Ticaret University
YL-13	Audit of municipal companies in Turkey-*Türkiye'de Belediye Şirketlerinin Denetimi*	2023	İstanbul University
YL-14	The roles and contributions of the parliamentarian model and the judicial model of sais in the national budget process: Comparison of the financial and non-financial effects of the national audit office and the turkish court of accounts on the budget-*Ofis tipi ve kurul tipi yüksek denetim kurumlarının ulusal bütçe sürecindeki rolü ve katkıları: Ulusal denetim ofisi ve Türk sayıştayının bütçe üzerindeki mali ve mali olmayan etkilerinin karşılaştırılması*	2022	Ankara Yıldırım Beyazıt University
YL-15	A comparative investigation of performance audit implementations in Turkish sai with the national audit office and European court of auditors-*Türk Sayıştayında Performans Denetimi Uygulamalarının İngiltere ve Avrupa Sayıştayı ile Karşılaştırılarak İncelenmesi*	2021	Ankara University
YL-16	Analysis of audit findings of the court of auditors and solution proposals in revolving fund enterprises under the Ministry of Health-*Sağlık Bakanlığına Bağlı Döner Sermaye İşletmelerinde Sayıştay Denetim Bulgularının Analizi ve Çözüm Önerileri*	2020	Bursa Uludağ University
YL-17	External audit of municipal budgets: The case of İstanbul Metropolitan Municipality-*Belediye Bütçelerinin Dış Denetimi: İstanbul Büyükşehir Belediyesi Örneği*	2020	İstanbul Medeniyet University
YL-18	The financial structure of the metropolitan municipalities and court of accounts audit-*Büyükşehir Belediyelerinin Mali Yapısı ve Sayıştay Denetimi*	2019	Bolu Abant İzzet Baysal University
YL-19	The place of the Court of Accounts and the audit of the Court of Accounts in public financial management-*Kamu Mali Yönetiminde Sayıştay'ın Yeri ve Sayıştay Denetimi*	2019	Manisa Celal Bayar University

YL-20	The effects of the Turkish Court of Accounts on the new audit model and local administrations: The case of municipalities-*Türk Sayıştay'ının Yeni Denetim Modeli ve Yerel Yönetimler: Belediyeler Örneği*	2019	Hatay Mustafa Kemal University
YL-21	Qualification and analysis of audit of municipal companies-*Belediye Şirketlerinin Denetiminin Yeterliliği ve Analizi*	2019	Gazi University
YL-22	Performance audit in metropolitan municipalities after the Law No.6360-*6360 Sayılı Kanun Sonrasında Büyükşehir Belediyelerinde Performans Denetimi*	2019	Ankara University
YL-23	Constitutional position and judiciary function of the Turkish Court of Accounts-*Sayıştayın Anayasal Konumu ve Yargı Fonksiyonu*	2018	Hacettepe University
YL-24	Court of accounts of selected countries in the public financial management system and Turkish court of accounts analysis-*Kamu Mali Yönetim Sisteminde Seçilmiş Ülke Sayıştayları ve Türk Sayıştayı Analizi*	2018	Süleyman Demirel University
YL-25	Institutional capacity development as a public policy: The case of Turkish court of accounts-*Bir Kamu Politikası Olarak Kurumsal Kapasite Geliştirme: Sayıştay Örneği*	2017	Abant İzzet Baysal University
YL-26	Development and implementation of the state budget and audit by the Court of Accounts-*Devlet Bütçesinin Gelişimi, Uygulanması ve Sayıştay Denetimi*	2017	Adnan Menderes University
YL-27	A study examining public servants' knowledge about self efficacy perception and use of information and communication technologies (ICT):(The case of Turkish court of account)-*Kamu Çalışanlarının Bilgi ve İletişim Teknolojilerine İlişkin Öz Yeterlik Algısı ve BİT Kullanım Düzeylerinin İncelenmesi (Sayıştay Başkanlığı Örneği)*	2017	Gazi University
YL-28	Forensic accounting on the audit of Turkish court of accounts and forensic accounting perception of the Turkish court of accounts auditors-*Sayıştay Denetiminde Adli Muhasebe ve Sayıştay Denetçilerinin Adli Muhasebe Algısı*	2017	Gazi University
YL-29	The role and changing importance of Turkish Court of Accounts in functioning of accountability-*Hesap Verebilirlik Mekanizmasının İşleyişinde Türk Sayıştay'ının Rolü ve Değişen Önemi*	2017	Kırıkkale University
YL-30	Budget control in Turkey and national extent of supreme audit-*Türkiye'de Bütçe Denetimi ve Sayıştay Denetiminin Ulusal Boyutu*	2017	Çukurova University
YL-31	Local administrations in Turkey judicial and administrative audit-*Türkiye'de Yerel Yönetimlerin Yargısal ve İdari Denetimi*	2017	Yüzüncü Yıl University
YL-32	Supreme audit as one of the ways of audit of administration-*İdarenin Denetim Yollarından Biri Olarak Sayıştay Denetimi*	2016	Karadeniz Teknik University
YL-33	Review on the regularity audit of the Court of Accounts and analysis of applicability in Turkey-*Sayıştay'ın Düzenlilik Denetiminin İncelenmesi ve Türkiye'de Uygulanabilirliğinin Analizi*	2014	Gazi University

An analysis of master's theses reveals that thesis production has intensified in certain years. In particular, 2017, 2023, and 2024 appear to be the years with the highest number of master's theses.

Information on 33 doctoral theses written between 2014 and 2025 in the context of the Court

of Accounts is presented in Table 2.

Table 2

PhD Theses Written within the Context of the Court of Accounts (2014-2025)

Code	Thesis Title	Year	University
DR-1	The problem of sustainability and effectiveness in the context of strategic planning in metropolitan municipalities: An empirical research based on Court of Accounts and budget reports-*Büyükşehir Belediyelerinde Stratejik Planlama Bağlamında Sürdürülebilirlik ve Etkinlik Sorunsalı: Sayıştay ve Bütçe Raporlarına Dayalı Ampirik Bir Araştırma*	2024	Atatürk University
DR-2	Administrative, financial and criminal liability in the public procurement system and the position of the Court of Accounts judiciary-*Kamu İhale Sisteminde İdari, Mali ve Cezai Sorumluluk ve Sayıştay Yargısının Konumu*	2024	İzmir Kâtip Çelebi University
DR-3	Procedural law of the Turkish Court of Accounts-*Sayıştay'ın Yargılama Usul Hukuku*	2023	Anadolu University
DR-4	Supreme audit in Turkey and South Korea public administration: A comparison of Turkish Court of Accounts and Board of Audit and Inspection of South Korea- *Türkiye ve Güney Kore Kamu Yönetimlerinde Yüksek Denetim: Türk Sayıştayı ve Güney Kore Denetim ve Teftiş Kurulu Karşılaştırması*	2023	Ankara Hacı Bayram Veli University
DR-5	Turkish Court of Account as an instrument of balance and control-*Denge ve Denetimin Bir Aracı Olarak Sayıştay*	2023	Kırıkkale University
DR-6	The relationship between parliaments and supreme audit institutions within the context of the parliamentary oversight function: A comparative analysis of the United Kingdom, France and Türkiye-*Parlamentonun Gözetim Fonksiyonu Bağlamında Parlamento ve Yüksek Denetim Kurumları Arasındaki İlişkiler: Birleşik Krallık, Fransa ve Türkiye'nin Karşılaştırmalı Analizi*	2023	Ankara Yıldırım Beyazıt University
DR-7	As an audit institution the General of Audit Committee (1938-1950)-*Bir Denetim Kurumu Olarak Umumi Murakabe Heyeti (1938-1950)*	2023	Tokat Gaziosmanpaşa University
DR-8	Government systems and supreme audit: An examination of supreme audit institutions with special reference to Turkish Court of Accounts-*Hükümet Sistemleri ve Yüksek Denetim: Sayıştay'ın Konumu Üzerine Bir İnceleme*	2022	Ankara University
DR-9	Sustainable development-oriented audit approach: A corporate and functional model proposal for Turkish Court of Accounts-*Sürdürülebilir Kalkınma Odaklı Denetim Anlayışı: Sayıştay İçin Kurumsal ve İşlevsel Bir Model Önerisi*	2022	Hacettepe University
DR-10	Implementation on transformation of performance audit in the state: 1996-2010 court of account experiences-*Devlette Performans Denetimi Uygulaması ve Dönüşümü: 1996-2010 Sayıştay Deneyimi*	2022	Ankara University
DR-11	The role of the Court Accounts in terms of the effectiveness of performance auditing in metropolitan municipalities in Turkey-*Türkiye'de Büyükşehir Belediyelerinde Performans Denetiminin Etkinliği Açısından Sayıştay'ın Rolü*	2022	Manisa Celal Bayar University
DR-12	Within the framework of supreme audit standards, an examination of performance audit and evaluation of its applicability in Turkey-*Yüksek*	2020	Gazi University

	Denetim Standartları Çerçevesinde Performans Denetiminin İncelenmesi ve Türkiye Uygulamasının Değerlendirilmesi		
DR-13	Comparative analysis of Supreme Audit Institutions in foreign coutries-*Karşılaştırmalı Ülke Uygulamalarında Yüksek Denetim Kurumu Olarak Sayıştay*	2018	Kocaeli University
DR-14	The effects of fiscal transparency, the independence and the organizational structures of sais' on fiscal performance: A panel data analysis-*Mali Şeffaflık ile Yüksek Denetim Kurumlarının Bağımsızlığı ve Örgütlenme Yapılarının Mali Performans Üzerindeki Etkisi: Bir Panel Veri Analizi*	2017	Hacettepe University
DR-15	CAATT (Computer-assisted audit tools and techniques) usage on information systems auditing of internal audit in special budget government authority and proposes a model-*Özel Bütçeli Kamu Kurumlarında İç Denetim Kapsamında Bilişim Sistemleri Denetiminde CAATT (Bilgisayar Destekli Denetim Araç ve Teknikleri) Kullanımı ve Bir Model Önerisi*	2017	Süleyman Demirel University
DR-16	The effect of organizational culture on organizational commitment: A resource on public organizations-*Örgüt Kültürünün Örgütsel Bağlılık Üzerine Etkisi: Kamu Kuruluşlarına Yönelik Bir Araştırma*	2017	Türk Hava Kurumu University

When the publication years of the doctoral theses listed in Table 2 are examined, it can be observed that in-depth academic interest in this field has intensified, particularly in recent years. The fact that a large portion of the doctoral theses examined were completed in 2022, 2023, and 2024 confirms this trend.

When examining the distribution of the 49 theses that make up the data set by university, Gazi University ranks first with 5 theses. Hacettepe University and Ankara University follow with 4 theses each. The distribution of theses written on the Court of Accounts according to institutes and departments is presented in Table 3.

Table 3

Frequency Distribution of Postgraduate Theses Written in the Context of the Court of Accounts by Institute and Department

Institute/Department/Science Branch	Frequency
Institute of Social Sciences / Department of Finance	19
Institute of Social Sciences / Department of Political Science and Public Administration	8
Institute of Social Sciences / Department of Business Administration	7
Institute of Social Sciences / Department of Public Administration	5
Institute of Social Sciences / Department of Public Law	4
Institute of Educational Sciences/ Department of Educational Sciences	1
Institute of Social Sciences / Department of European Union and International Economic Relations	1
Institute of Social Sciences / Department of Public Economics	1
Institute of Social Sciences / Department of Accounting and Auditing / Department of Accounting and Auditing	1
Institute of Social Sciences / Department of Accounting and Financial Management	1
Graduate School of Education / Department of History	1

According to Table 3, with 19 theses, the Department of Finance within the Institute of Social

Sciences has become the field in which the most theses have been written. This is followed by the Department of Political Science and Public Administration with 8 theses, the Department of Business Administration with 7 theses, and the Department of Public Administration with 5 theses. It is observed that studies related to the Court of Accounts are mainly concentrated in the fields of finance, political science, public administration and business administration. When this distribution is examined, it is concluded that despite the interdisciplinary nature of academic studies related to the Court of Accounts, the discipline of law is not sufficiently represented in theses in this field. Despite the legal complexity of the Court of Accounts' judicial function, this issue has not been sufficiently examined in the theses. As a result, the institutional functioning of the Court of Accounts has generally been addressed through its finance-related audit function. This trend indicates that the judicial powers of the Court of Accounts are less visible or take a back seat in academic literature.

The subject categories of the theses have been regrouped for this study based on the tags in the National Thesis Centre. The distribution according to these categories is presented in Table 4.

Table 4

Frequency Distribution of Postgraduate Theses Written in the Context of the Court of Accounts by Subject Category

Subject Category	Frequency
Finance	13
Public Administration	8
Public Administration, Business	6
Business	3
Public Administration, Finance, Business	3
Public Administration, Finance	2
Law, Public Administration	2
Public Administration, Political Sciences	2
Law	2
Finance, Law	2
Hukuk, Public Administration, Political Sciences	1
Political Sciences	1
Economy, Public Administration, Finance	1
Law, Public Administration, Finance	1
Finance, Business	1
Public Administration, History, Turkish Revolution History	1

According to the data in Table 4, the most frequently tagged subject category is ‘Finance.’ This tag was employed in 13 theses, clearly demonstrating the intensity of studies on public financial management, one of the main audit areas of the Court of Accounts. This is followed by the subject categories ‘Public Administration’ and ‘Business Administration,’ especially combinations of these areas (e.g., ‘Public Administration, Business Administration’ in 6 theses, ‘Public Administration, Finance, Business Administration’ in 3 theses), theses examining the relationship between the Court of Accounts' audit activities and administrative processes and business practices also occupy an important place. Although fields such as law and political science are less frequent, combinations such as ‘law, public administration’ reveal that the Court

of Accounts' legal and administrative functions are examined from various perspectives. These findings show that academic studies related to the Court of Accounts are mainly concentrated around the disciplines of finance, public administration and business.

After identifying the objectives of the published theses, it is believed that the frequency query reflects general trends regarding the focus of the studies, and the distribution of these trends is presented in Table 5.

Table 5

Purpose-Word Frequency Distribution of Postgraduate Theses Written in the Context of the Court of Accounts

Purpose-Word	Frequency
Control	75
Court of Accounts	57
Finance	26
Public	19
High Audit	17
Performance	16
Türkiye	15
Turkish	11
Detection	9
Analysis	9
International	9
Local	9
Budget	9
Metropolitan Municipality	8
Solution	8
Regularity	7

As observed in Table 5, the words “Audit” and “Court of Accounts” stand out at the top of the list with 75 and 56 frequencies, respectively, indicating that these theses are primarily shaped around the audit function and institutional structure of the Court of Accounts. Following this, the terms ‘Financial’ with 26 frequencies, “Public” with 19 frequencies, and ‘Performance’ with 16 frequencies appear in the ranking. This emphasises the importance given to performance auditing focused on efficiency and effectiveness in public administration, in addition to the Court of Accounts' classic financial auditing duties. The frequency of the words ‘High’, “Türkiye” and ‘Turkish’ indicates that the studies generally focus on the general functioning of the Court of Accounts, which is the supreme audit institution at the national level, and its practices specific to Türkiye. Furthermore, the frequent use of words such as ‘detection,’ ‘analysis,’ ‘international,’ ‘local,’ and ‘budget’ in the objectives of the theses indicates the methodological approaches of the studies, international comparative perspectives, local government audits, and connections with budget processes. These findings reveal that the academic literature on the Court of Accounts covers a wide range of topics, from auditing, which is the core function of the institution, to financial, public and performance auditing. In addition to all these findings, it is noteworthy that the frequency of terms directly referring to the Court of Accounts' judicial function is low or non-existent. This suggests that while the

theses examined focus on the audit and administrative aspects of the Court of Accounts in their objectives, its judicial functions are relatively less emphasised or neglected in academic studies. The distribution of methodological approaches in the theses examined in the study is summarised in Table 6.

Table 6

Frequency Distribution of Methodological Approaches in Postgraduate Theses Written in the Context of the Court of Auditors

Methodological Approach	Frequency
Qualitative Research Method	37
Mixed Research Method	8
Quantitative Research Method	4

In the theses examined within the scope of the research, it was determined that qualitative research methods were used in 37 studies, mixed research methods in 8 studies, and quantitative research methods in 4 studies.

Thematic Analysis of Theses Written in the Context of the Court of Auditors

In this section of the study, theses written in the context of the Court of Accounts between 2014 and 2025 are examined under four themes;
Theme 1: The Status of the Research Question and Methodology Being Addressed Under an Independent Heading
Theme 2: The Nature of the Research Methodology Used
Theme 3: Focus on the Functions of the Court of Accounts
Theme 4: Original Value of the Studies and Contribution to the Literature.The findings for each theme are listed below:

Theme 1: The Research Question and Methodology Being Addressed Under a Separate Heading

The research question and method that form the basis of an academic study are of great importance in terms of the transparency, comprehensibility, and reproducibility of the study. The aim is to reveal how the elements identified in theses on the Court of Auditors are positioned within this theme.

The research question and method that form the basis of an academic study are of critical importance in terms of the scientific value of the study. Indeed, in academic studies, especially empirical research, it is essential that information is presented in a systematic and transparent manner. To this end, the Introduction, Methods, Results, and Discussion (IMRaD) format, which has become standardised in many scientific disciplines, ensures that the research process is clearly understood by the reader (Day & Gastel, 2020). The independent and detailed presentation of the 'Methods' section, one of the cornerstones of this structure, serves several critical functions that determine the scientific validity and reliability of the study. Firstly, clearly stating the method increases the transparency and comprehensibility of the research (Publication Manual of the American Psychological Association, 2020). Secondly, detailing the

research process is an indispensable condition for the reproducibility and verifiability of the findings, which are fundamental criteria for the reliability of scientific knowledge. (Karasar, 2015) Finally, a clear explanation of the method allows reviewers, advisors, and other researchers to easily evaluate the methodological soundness and academic value of the study. (Publication Manual of the American Psychological Association, 2020)

In the theses in our dataset, there is significant diversity in the way the research objectives and methods are presented. Some theses address these elements under separate and distinct headings, while others prefer to explain them within the text in various sections of the study. For example, in the thesis coded DR-1, the research objectives and questions are addressed separately under the heading 'Research Objectives and Questions,' while the thesis structure and sections are addressed under the heading 'Thesis Structure and Sections.' Additionally, the 'Research Methodology' heading provides details on sample selection and the methods used in the analysis. Similarly, the thesis coded DR-16 has clear and independent headings such as 'Purpose of the Research' and 'Research Method.' In the master's thesis coded YL-9, these fundamental elements of the research are presented independently under the subheadings 'Purpose and Importance of the Research' and 'Research Method.' In the master's thesis coded YL-25, the basic purpose of the research is clearly stated in the introduction; in addition, the research method is explained in the 'Research Method' section. This type of structure allows the reader to easily grasp the skeleton of the research and evaluate the reliability of the study.

In contrast, many theses have chosen to explain the purpose and/or method of the research in various sections of the work, particularly in the introduction or abstract sections. This approach has been observed in theses with the codes DR-10, DR-12, DR-4, DR-8, DR-9, YL-1, YL-10, YL-16, YL-17, YL-18, YL-19, YL-2, YL-20, YL-22, YL-26, YL-27, YL-4, YL-6, YL-7, and YL-8. Although the information is presented in the context of the thesis, its absence from an independent main heading may make it difficult for readers to locate specific sections and may hinder quick access to the methodological foundation of the study.

In the thematic analysis, disciplinary trends regarding the presentation of research questions and methods in theses are evident. In most of the theses examined, regardless of discipline, the research question and method are not presented under separate and distinct headings, but are generally mentioned within the text in the abstract, introduction, or relevant section descriptions. This situation can be attributed to the structural standardisation of the thesis or the author's personal preferences. When examined by discipline, both the use of independent headings (DR-1 and YL-25) and in-text explanations (DR-10, DR-4 and DR-8) are common in the field of Public Administration, indicating that there is no single dominant practice in this field. Similarly, in the Business discipline, the purpose and methodology of the research are sometimes presented under independent headings (DR-16, YL-25 and YL-27) and sometimes explained within the text (DR-9); the use of independent headings is particularly prominent in the methodology section. In contrast, in theses in the field of finance, it has been found that information about the purpose and method of the research is generally provided within the text, and that it is less common for this information to be presented under distinct and independent headings. In the fields of accounting, law, and history, the use of independent headings is less common than in other fields. It can be inferred that studies in these disciplines tend to integrate the research design into the subject as a whole due to the nature of their subjects (such as legal text analysis, historical narrative, or examination of accounting records), and this information is generally included in the general introduction or abstract sections of the thesis.

Theme 2: Nature of the Research Method Used

Within this theme, the aim is to examine in detail the nature of the research methods used in thesis studies (qualitative, quantitative or mixed). Thus, the aim is to reveal which methods the theses in the data set focus on and how these methods relate to the thesis topics.

When the analysed theses are examined in terms of the research methodologies used, different combinations of mixed, quantitative, qualitative and conceptual/descriptive/legal analysis methods are observed.

Theses that adopt qualitative research methodology are seen to examine issues using methods such as content and document analysis. This approach is useful for understanding the contextual depth and nuances of complex phenomena. In the thesis coded DR-2, public losses in public procurement processes were examined through Court of Accounts decisions and related expenditure documents, as well as expert reports. The thesis coded as DR-7 used historical and document analysis methods by analysing the audits and reports of the High Audit Office throughout history. The thesis coded as DR-9 adopted a qualitative approach such as Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis in the audit approach focused on sustainable development.

Qualitative document analysis has also been used extensively in master's theses. For example, thesis YL-10 conducted a content analysis of the Court of Auditors' annual regularity audit reports. Theses coded YL-12, YL-13, YL-16, YL-17, YL-18, YL-20, YL-21, and YL-23 also provided a qualitative perspective by conducting comprehensive document reviews of audit reports, financial audit findings, and legal documents.

Although few in number, theses that use quantitative research methodology are based on numerical data and statistical analysis. In the thesis coded DR-14, basic economic variables were examined through econometric models. The thesis coded DR-16, on the other hand, reached quantitative findings by testing the differences in organisational culture factors according to gender using statistical methods such as T-tests and variance analysis. The thesis with code YL-1 employed econometric analysis methods to examine the compatibility of fiscal policy with budget constraints using cointegration test results. The theses with codes YL-25 and YL-28 analysed participants' demographic characteristics, institutional perceptions, and views on audit procedures through survey data to draw quantitative statistical conclusions.

Theses using mixed research methods combine both quantitative and qualitative approaches in order to examine topics more comprehensively and in greater depth. This approach combines the generalisability provided by numerical data with qualitative methods such as interviews and observations, thereby providing a multidimensional perspective on the research problem (Tashakkori & Teddlie, 2010). For example, thesis DR-1 highlights the opportunities offered by the mixed method for obtaining richer findings in the social sciences. Similarly, in the thesis coded DR-10, the examination of performance audit reports using a qualitative technique such as content analysis was combined with primary techniques such as interviews and surveys with Court of Accounts experts to integrate both quantitative and qualitative data. The thesis with code YL-2 presents the number of reports of internal audit units in local administrations with quantitative data, while also making qualitative observations on situations such as the risk of

resources remaining idle. The thesis with code YL-27 follows a mixed design, using both surveys and interview forms to determine the self-efficacy perceptions of auditors and civil servants regarding information and communication technologies.

The conceptual/descriptive/legal analysis method is predominantly used in our data set. Theses falling into this category focus on defining, explaining or comparing existing concepts, theories, legal frameworks, systems or practices rather than using primary data collection methods. The studies are generally based on literature reviews, analysis of legal texts, and conceptual inferences. Doctoral theses coded DR-3, DR-4, DR-5, DR-8, DR-11, DR-12, DR-13, and DR-15 are examples of this approach. These theses address various topics, from audit concepts and processes to the Court of Accounts' adjudication processes, within a theoretical and legal framework.

A similar trend can be observed among master's theses. YL-3, YL-4, YL-5, YL-6, YL-7, YL-8, YL-9, YL-11, YL-15, YL-19, YL-22, YL-24, YL-26, YL-29, YL-30, YL-31, YL-32, and YL-33 also present conceptual and descriptive analyses on the concepts, types, historical development, legal frameworks and related theoretical approaches of auditing.

In addition, many of the theses in the data set (DR-2, DR-3, DR-4, DR-5, DR-6, DR-8, DR-9, DR-10, SR-11, DR-12, DR-13, YL-2, YL-3, YL-4, YL-5, YL-6, YL-7, YL-8, YL-14, YL-15, YL-19, YL-24, YL-26, YL-29, YL-30, YL-33) contain country comparisons under an independent heading or in terms of content. However, although a significant portion of these studies use the label ‘comparative analysis,’ it has been observed that they are more in the nature of multiple case studies.

When general trends are examined, it is noteworthy that theses involving empirical qualitative or quantitative data collection and analysis in the field of auditing are more limited in number than conceptual/descriptive studies. This situation indicates a strong tendency to understand the current state or theoretical structures in the field, but relatively fewer studies that collect data directly through field research or test hypotheses. Future research could contribute more to the field's body of knowledge by supporting conceptual frameworks with empirical data and presenting more in-depth field-based findings on complex auditing phenomena.

When examining the distribution of methodological approaches by discipline, the Mixed Research Method was used in a total of 8 studies. This method was most frequently preferred in the disciplines of Business Administration (DR-15, YL-14, and YL-28), Finance (DR-11 and YL-7), Public Administration (DR-1), Educational Sciences (YL-27), and Accounting (YL-9). The Quantitative Research Method was used in a total of 4 studies and was most frequently preferred in the Finance discipline (DR-14 and YL-1). It was also used in the fields of Business Administration (DR-16) and Public Administration (YL-25). The Qualitative Research Method is by far the most preferred method, with a total of 37 studies. It was particularly prevalent in Finance (DR-12, DR-2, DR-3, DR-9, YL-11, YL-18, YL-19, YL-24, YL-26, YL-3, YL-30, YL-33, YL-4, YL-6, and YL-8) and Political Science and Public Administration (DR-10, DR-4, DR-6, DR-8, YL-2, YL-20, YL-22, and YL-29). It is also seen in the fields of Law (DR-13, DR-5, YL-23 and YL-32), Business Administration (YL-16, YL-21 and YL-5), Public Administration (YL-10, YL-13 and YL-31), Accounting (YL-12), Public Economics (YL-17), European Union and International Economic Relations (YL-15), and History (DR-7.

Qualitative research methods are predominant in all disciplines. Mixed and quantitative methods have been less preferred and have been used especially in fields such as Business and Finance. This distribution shows that theoretical, conceptual and comparative qualitative analyses are preferred over empirical data-based research in the fields studied. This situation, which is particularly concentrated in the disciplines of Finance, Political Science and Public Administration, and Law, can be interpreted as a trend that is appropriate to the nature of the disciplines and the characteristics of the problems being studied.

Theme 3: Focus on the Functions of the Court of Auditors

This theme aims to reveal which functions of the Court of Accounts are more intensively focused on in the theses examined on the subject of the Court of Accounts, in terms of subject categories. It is thought that this focus will provide information about research trends, priorities and possible gaps in the field. The basic functions of the Court of Accounts are defined as audit and adjudication activities within the framework of leading academic studies and relevant legislation. When the subject categories of the theses in our data set are examined, it is seen that the audit function is generally the most focused subject area. Theses grouped under the main category of 'Audit' (YL-1, YL-4, YL-5, YL-6, YL-7, YL-8, YL-9, YL-10, YL-11, YL-12, YL-14, YL-15, YL-16, YL-19, YL-24, YL-26, YL-28, YL-29, YL-30, and YL-33; DR-1, DR-4, DR-6, DR-7, DR-8, DR-9, DR-10, DR-12, DR-14, and DR-15), addresses different aspects such as the effectiveness and quality of the Court of Accounts' audits, compliance with international standards, performance audit practices and information systems audits.

Theses focusing on the judicial function of the Court of Accounts represent a numerically limited group within the total of 49 theses examined. Theses in the 'Court of Accounts Judgments' subject category (DR-2, DR-3, DR-5, DR-13, YL-23, and YL-32) examine topics such as the judicial nature of the Court of Accounts, procedural law, and the position of these judgments in the public procurement system.

However, studies specialising in certain public service areas within the scope of the Court of Accounts' audit function are also noteworthy. In this context, it is seen that the vast majority of theses focusing on a specific type of institution concentrate on 'Auditing Municipalities'. Theses under the category of 'Audit of Municipalities' (YL-2, YL-3, YL-13, YL-17, YL-18, YL-20, YL-21, and YL-22; DR-11) examine the details of the Court of Accounts' audit function over local governments. In addition to this intense focus on municipalities, the dataset also includes a single study (YL-16) addressing irregularities in hospitals affiliated with the Ministry of Health.

Considering the broad audit authority of the Court of Accounts and its scope of responsibility covering numerous public institutions, it is noteworthy that most of the theses focus on municipalities. This situation can be interpreted as the sensitivity of local governments to financial transparency and accountability processes bringing this area to the forefront for researchers. The fact that other central or local public institutions subject to the Court of Accounts' audit (universities, ministries, directorates-general, etc.) are not specifically examined as independent thesis topics in the theses in the data set points to a significant gap in the literature.

On the other hand, 'Institutional Capacity Development - The Court of Accounts Example'

(YL-25), 'Self-Assessment - The Court of Accounts Example' (YL-27) and 'Organisational Culture - The Court of Accounts Example' (DR-16). These theses treat the Court of Accounts' own institutional development, personnel or internal culture as a case study, demonstrating that, in addition to its audit functions, the Court of Accounts' capacity and functioning as an institution are also worthy of academic interest. However, it is observed that they are fewer in number than other categories.

When looking at the interdisciplinary distribution, the fact that there are numerous theses in the disciplines of Finance, Business Administration and Public Administration under the general category of 'Auditing' shows that the audit function of the Court of Accounts is a central area of research in these disciplines.

Although a direct tendency towards the theme of 'Audit Court Judgments' is expected in the field of law, the number of theses prepared on the Audit Court in the data set examined is quite limited. There are a total of 4 theses (DR-5, DR-13, YL-23, and YL-32) written in the field of public law. Even among these theses, only the studies coded YL-23 and YL-32 focus directly on the topic of 'Court of Accounts Judgment,' while the theses coded DR-5 and DR-13 fall under the category of 'Auditing.' This situation shows that there is insufficient academic interest among lawyers in the Court of Accounts' audit and, in particular, judicial functions, and that there is a clear gap in the literature.

Theme 4: Original Value of the Work and Contribution to the Literature

When we subject the data set to thematic analysis based on the specified original values, it is seen that various contributions have been made to the literature on audit and related fields. Theses that state that they have added a unique dimension to the academic literature by focusing on topics that have not been sufficiently examined in the literature on audit and related fields form a common category. In this context, theses coded DR-14 and YL-1 have contributed to the knowledge base in this field by examining topics such as financial transparency, the independence of the Court of Accounts, and the effects of its organisational structure on financial performance, which have been addressed to a limited extent in the literature. Similarly, studies coded DR-10 and YL-10 have helped to address conceptual uncertainties and information gaps in the field of performance auditing.

In response to criticism in constitutional law literature that the Court of Accounts is the 'most neglected institution' (DR-10), these studies attempt to offer an alternative perspective on the institution. Furthermore, in response to the limited availability of sources on supreme audit institutions in democratically underdeveloped countries and the historical dimension of auditing in Türkiye (particularly the General Supervisory Board), the thesis coded DR-7 draws attention to the gap in this area.

In the context of new and emerging issues, studies addressing the relationship between the Sustainable Development Goals (SDGs) and the role of supreme audit institutions (SAIs) (DR-9) and introducing the concept of 'institutional capacity development' into academic discourse (YL-25) stand out. The thesis coded YL-25 is also significant as one of the few studies examining the impact of international actors on public policies in developing countries.

Among the theses focusing on specific institutions and areas of activity, YL-16 sheds light on

a little-studied area, such as the auditing of revolving fund enterprises affiliated with the Ministry of Health by the Court of Accounts.

The common ground of these studies is to clarify the basic concepts of the Court of Accounts audit and to develop new analytical frameworks for the institution. This general contribution provides a solid foundation for the literature by eliminating ambiguities surrounding fundamental concepts such as 'audit,' 'performance audit,' and 'compliance audit' (DR-5, DR-11, YL-10 and YL-32) on the other hand, by analysing complex issues such as the judicial position of the Court of Accounts (DR-2, YL-2) and developing solution-oriented recommendations. In this context, the 'High Audit Office for Local Governments' model (YL-2), the proposal to expand audit opinions (YL-33), and especially the practical model developed regarding the quality standards of high audit (YL-7) are of great importance in terms of offering innovative and concrete frameworks for application that go beyond the existing theoretical accumulation.

A significant portion of the theses examined have enriched the literature by addressing the Court of Accounts audit and related institutions from a comparative perspective. These studies have provided an international perspective by comparing the structure and functioning of the supreme audit institutions of Turkey and South Korea (DR-14 and YL-2). Among institutions, an original analysis examining the organisational culture of Court of Accounts and SGK employees, which is described as a first in this field (DR-16), has revealed the dynamics of different public structures. Finally, comparisons between audit types were used to examine the differences between judicial and office-type Court of Accounts models and their methodological implications (DR-12 and YL-2). İ

Some of the theses went beyond theoretical discussions and offered practical solutions and policy recommendations for current problems, while conducting in-depth analyses focusing on specific sectors. Local governments were at the centre of these studies. Critical issues such as the effectiveness of strategic planning in municipalities (DR-1), the analysis of thousands of audit reports (YL-20), financial structure problems (YL-18), obstacles to performance auditing (DR-11), and financial accountability gaps in municipal companies (YL-21) have been examined in detail. In addition to local governments, specific issues in various public sectors have also been examined. In this context, important sector-specific findings were made by focusing on issues such as accounting and tender irregularities in Ministry of Health hospitals (YL-16), causes of accounting errors in public universities (DR-3), and historical audit findings in public enterprises (DR-7).

Finally, these studies have provided practical and common recommendations for the development of the auditing profession and public administration. Among these, concrete proposals such as increasing audit and legislation training in public administrations (YL-26), integrating new approaches such as forensic accounting into the Court of Accounts audit (YL-28), and increasing internal IT competence (YL-25) stand out.

Discussion, Conclusion and Recommendation

This study aims to examine academic theses published at the National Thesis Centre between 2014 and 2025 on the Court of Accounts in Turkey in terms of methodological trends and interdisciplinary differences. A comprehensive evaluation shows that the theses examined have

made significant contributions to clarifying the institutional structure, duties and functions of the Court of Accounts. However, the analyses also reveal certain gaps and areas for improvement in the literature on the Court of Accounts.

As a result of the review, it was observed that there is a general lack of methodological transparency in academic studies prepared on the Court of Accounts. It was determined that the vast majority of theses do not have an independent and detailed section under the heading 'Method,' 'Methodology,' or 'Research Design.' This situation prevents the scientific processes of the research from being adequately explained, thereby reducing the potential for transparency and reproducibility. It has been observed that methodological approaches are generally described indirectly in other sections, such as the introduction or theoretical framework.

Another important issue is the imbalance in the academic literature's focus on the different functions of the Court of Accounts. The overwhelming majority of the theses examined focus on the Court of Accounts' 'audit' function. This situation may lead to the Court of Accounts being perceived as merely an 'audit institution' in public administration and academic circles. However, the Court of Accounts' judicial function, which is an important part of its constitutional structure and has a sui generis position within the principle of separation of powers, has been relatively less addressed and examined in depth in the literature.

One of the main reasons for this situation is considered to be the limitations of the Court of Accounts in terms of transparency and accessibility of judicial proceedings. In particular, practices such as the non-publication of reports forming the basis of proceedings, the publication of court rulings in limited numbers and subject to redaction principles (i.e., the concealment of personal data or sensitive information), and the denial of requests for information prevent researchers from conducting empirical and detailed studies on the Court of Accounts' judicial function. This situation leads to the Court of Accounts being perceived as a 'black box' and may result in the institution's multidimensional structure, particularly its judicial nature, being insufficiently understood or neglected. While other aspects of the Court of Accounts, such as reporting, institutional structure/independence, historical development, and international comparisons, are also addressed in theses, the general trend is audit-focused. In light of these findings, the following recommendations are made for future academic studies on the Court of Accounts:

In academic studies, especially master's and doctoral theses, more importance should be given to the 'Method' or 'Methodology' sections, and the research design (qualitative, quantitative, mixed), data collection tools, and data analysis methods should be clearly and thoroughly described in these sections. This approach will significantly increase the scientific value, reliability, and reproducibility of the studies.

- The judicial function of the Court of Accounts should be the subject of further academic research in order to fill the existing gap in the literature. Issues such as the rulings of the Court of Accounts, judicial finalisation processes, relations with other judicial bodies, and disputes arising from these relations should be examined in depth by the disciplines of law and public administration. Making the Court of Accounts' judicial reports and rulings more transparent and accessible to the public will pave the way for researchers to conduct richer and more empirical

studies in this field. Such studies will contribute to a better understanding of the Court of Accounts' sui generis structure and an evaluation of the institution in all its dimensions.

- In addition to theoretical and descriptive studies, more emphasis should be placed on studies that support the effectiveness of the Court of Auditors, its impact on the use of public resources, and stakeholder perceptions with empirical data (surveys, interviews, case studies, statistical analyses). Such studies will strengthen the scientific basis of the recommendations made and provide policymakers with more concrete information.

- Researchers from different disciplines such as law, public administration, finance, and political science should be encouraged to collaborate on topics related to the Court of Accounts. Interdisciplinary approaches will enable a more comprehensive examination of the various dimensions of the Court of Accounts and enrich the literature.

- With the implementation of these recommendations, it is believed that the methodological quality of academic studies on the Court of Accounts in Turkey can be improved, the important functions of the institution outside of auditing can be better understood, and more solid scientific contributions can be made to future policy-making processes.

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Research Article

No Clue… No Signs… Unpredictable and Bizarre: The Burden of Impaired Awareness of Hypoglycemia Among Patients on Hemodialysis—Findings of a Sequential Explanatory Mixed-Methods Study from South India

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Abstract
Impaired awareness of hypoglycemia (IAH) refers to the failure to sense or perceive a significant decline in blood glucose levels. This explanatory sequential mixed-method study aimed to determine the prevalence of IAH among patients undergoing hemodialysis and to explore the experiences of affected patients and their significant others. In the quantitative phase, IAH was assessed using Clark's questionnaire in 86 hemodialysis patients, followed by an in-depth qualitative phase involving interviews with 16 participants. Quantitative data were analyzed using descriptive statistics and tests of association, while qualitative data were examined through thematic analysis. The findings indicated that a Clark's score of ≥4, suggestive of IAH, yielded a mean score of 5.01 (±1.2), with 28.7% (±2.7) of participants experiencing severe IAH, and 40.4% reporting fear of hypoglycemia. Qualitative analysis revealed three main themes: awareness matters a lot, experiences of IAH and its impact on daily life, and solutions and strategies to address IAH. Overall, the results demonstrate a notably high prevalence of impaired awareness of hypoglycemia in the hemodialysis population, highlighting the importance of identifying IAH levels to support healthcare professionals in developing comprehensive and individualized clinical strategies for this high-risk group

Keywords: impaired awareness of hypoglycemia, hemodialysis, mixed-methods, clark's score

Introduction

Hypoglycemia is one of the most common clinical consequences in the spectrum of diabetes mellitus and its nature and presentation may vary in the context of chronic comorbidities (McCoy et al., 2020). A constellation of characteristic pathological changes in chronic kidney disease make the patients vulnerable to have varying degrees of hypoglycemia (Moen et al., 2009) .

Hypoglycemia is the fall in the plasma glucose level <70 mg/dL. Patients may manifest dizziness, fatigue, palpitations, sweating, headaches, nausea and numbness during hypoglycemia owing to the sympathetic activation. It can cause detrimental clinical consequences if not treated in time (Shafiee et al., 2012).

Background

The estimated prevalence of hypoglycemia among Indian type 2 diabetic patients was 57.44% and reported rate of severe hypoglycemia was 10.7% (Samya et al., 2019). Hypoglycemia has a direct relation with the number of hospitalizations, increased healthcare costs and poor quality of life (Williams et al., 2011). Impaired awareness of hypoglycemia (IAH) is the failure to sense or perceive a significant fall in the blood glucose levels (Elliott & Heller, 2011). The obvious

autonomic features are the classic clinical manifestation of hypoglycemia and it enables the patients to adopt precautionary measures to avoid lethal low glucose levels. Though the cause of IAH is multifactorial, it is presumed to occur due to the diminished counter-regulatory mechanisms in hypoglycemia out of chronic exposure (Martín-Timón, 2015). The Pedersen-Bjergaard group was the first who coin this concept and used the term "impaired awareness of hypoglycemia" – which describes the awareness of hypoglycemia as a continuum between totally intact awareness (aware) and impaired awareness (unaware) (Pedersen-bjergaard et al., 2007). The measurement of IAH is primarily through self-reported questionnaires, and the most common tools are the Clarke and Gold questionnaires (Ang et al., 2023).

It is understood that glucose metabolism is altered in end-stage kidney disease and it worsens in the scenario of haemodialysis (HD) due to the rapid fluid shifts, electrolyte derangements and malnutrition (Hayashi et al., 2021) (Sahathevan et al., 2020). These subsequent glycemic disarrays pose frequent glucose fluctuations and eventual fatal hypoglycemic spells among this population. Research studies are limited to substantiate the role of long-term diabetes mellitus or uremia as an independent predictor for IAH. A recent study from the UK has revealed that 23.2% of the study subjects with diabetes on hemodialysis had IAH and patients with a history of severe hypoglycemia episodes were found to be more prone to IAH (Habte-Asres et al., 2024). A large population registry-based Asian study has found diabetic end-stage kidney disease patients with higher adapted Diabetes Complications Severity Index (aDCSI) scores were associated with severe hypoglycemia (Chu et al., 2017). The reasons for the notable increase in the mortality rate among the HD population also need to be analyzed in this regard (Hayashino et al., 2007).

Many studies have investigated IAH in type 1 and type 2 diabetic population. Studies among diabetic patients revealed that IAH is correlated positively with the number of hypoglycemic episodes (Lin et al., 2020). A systematic review has revealed the pooled prevalence of IAH in type 2 DM was 23.2% (95% CI: 18.4%–29.3%) with the Clarke questionnaire (Yu et al., 2023). There is an absolute dearth of literature on IAH among hemodialysis patients except for a very recent study by Habte et al (Habte-Asres et al., 2024). If this phenomenon of dampened awareness exists across the dialysis population irrespective of diabetes status has not yet been evaluated and in-depth information on the patient experience was also lacking. Hence our first aim was to quantify the prevalence of IAH in the haemodialysis population and subsequently explore the experiences of patients and significant others through qualitative in-depth interviews.

Research Questions

1. What is the prevalence of IAH in the haemodialysis population?
2. How do patients undergoing haemodialysis experience and perceive the impact of impaired awareness of hypoglycemia?

Method

The study used a mixed-methods sequential explanatory design. This design involves collecting and analyzing the numerical data in the initial quantitative part and then recreating the construct through a qualitative part to elucidate it much better ("QUAN → qual") (Creswell, 2014). A cross-sectional design was used in the first phase and a phenomenological approach was used in the second phase. We chose a *sequential nested sampling design* which involves purposive

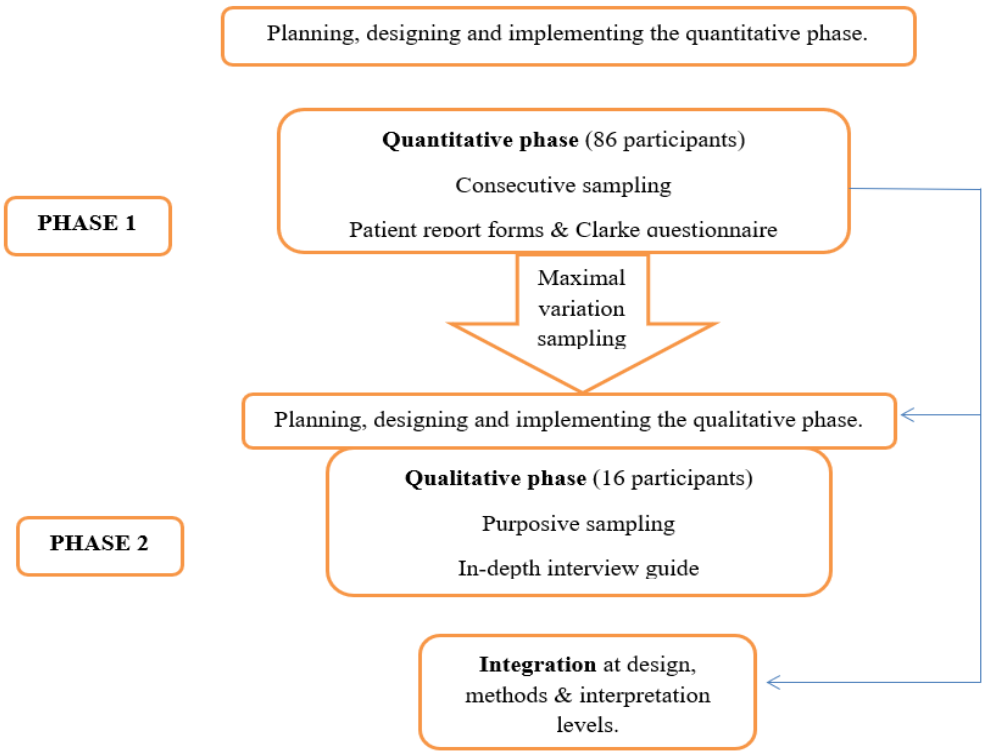
selection of samples from the quantitative phase to the qualitative phase (Onwuegbuzie & Collins, 2007). We followed a thematic analysis (TA) scheme to identify the codes, and domains and to derive the themes (Kiger & Varpio, 2020). We have reported this study using the Good Reporting of a Mixed Methods Study (GRAMMS) checklist (O'cathain et al., 2008).

This was a single-centre study encompassing all the patients undergoing maintenance hemodialysis. We conducted the study at a public sector medical college in the southernmost state of India. The centre has a full-fledged hemodialysis unit working in 3 shifts. Patients on maintenance hemodialysis were our study population. In the initial quantitative phase, we consecutively recruited all the eligible patients who met the inclusion criteria (adults undergoing hemodialysis for a minimum of 6 months, ready to give consent and able to read and write Malayalam – the official language of Kerala) at the maintenance hemodialysis unit of the centre. Patient report forms - socio-demographic-clinical data sheet and the Clarke questionnaire - were used to collect the data.

In the succeeding qualitative segment, in-depth interviews were conducted among representative candidates purposively selected from the first phase. To enhance the construct's gravity and magnitude, family members and healthcare personnel also were chosen purposively to explore their perspectives. We believe that this will yield rich data on the phenomenon of interest. We adopted a maximal variation sampling in the qualitative phase to ensure representation from varying clinical backgrounds. One of the researchers have approached the patients to invite them to the study after a thorough explanation. Written informed consent was obtained and patient information sheets were also given. Enrolment continued until saturation was attained. The methodological sequence is depicted in Figure 1. The semi-structured interview guide was prepared to elicit perspectives on the experiences of patients on IAH.

Figure 1

Methodological Sequence – Flow Chart



Data collection

Quantitative phase: The measures used in the quantitative phase were Patient report forms - socio-demographic-clinical data sheet and the Clarke questionnaire. In this phase, data was collected with the Patient report forms—the socio-demographic-clinical data sheet and the Clarke questionnaire. The socio-demographic-clinical data sheet was prepared in consultation with the experts and literature review by the investigators to collect the basic demographic (age, gender, education, occupation) and clinical details (CKD and MHD duration, comorbidities, HbA1c). Clarke score is a standardized scoring system to assess the degree of impaired awareness of hypoglycemia (IAH) which was developed and the properties were evaluated by the working group of Prof William Clarke, University of Virginia, USA. It was translated into vernacular language and found culturally appropriate and feasible in our community setting. The Clarke score consists of 8 items, encompassing different aspects of hypoglycemia. A score ≥4 suggests impaired awareness of hypoglycemia (IAH) (Clarke et al., 1995).

The eligible prospective participants were explained in detail about the study, both phases, the pattern of involvement and engagement in the qualitative phase and its process. We have taken written informed consent from each participant and they were ensured of the voluntariness, anonymity and confidentiality involved in the study. From eligible patients, the data were collected through face-to-face interviews. Both the tools were administered at the waiting lounge of the nephrology department after ensuring their comfort and it took around 15 – 20 minutes. A few patients who were not comfortable initially were consented during the later visit.

Qualitative phase: Based on the findings of the first segment, interview questions were prepared and the candidates for the qualitative phase were selected purposively, i.e. patients from the first phase (with varying levels of IAH, with varying clinical history and socioeconomic background), family members and health care team members. Separate interview guides were prepared for the three groups in a subjective frame of reference in consultation with the subject experts and in line with the literature. After piloting, necessary modifications were made and the semi-structured interview format was finalized. The interview guide consists of a broad question at first (Tell me about your hypoglycemic experiences; whether you had situations where you haven't experienced any typical symptoms?) then a few open-ended questions (Can you share an experience with us? How does it affect your daily life? How do you manage it?). Appropriate probes were added wherever necessary (Please explain more or can you cite an example). The health team members were asked mostly about the strategies to address the issue. In-depth interviews with patients and relatives were conducted in the vernacular language.

We have approached the patients to invite them to the study after a thorough explanation. At the outset, we ensured a comfortable environment for the participants. The purposes of the study and the participant's rights were elucidated and written informed consent was obtained from all the interviewees. The concept of IAH was also explained and emphasized so as not to mix it up with hypoglycemia. After ensuring the confidentiality and anonymity of their personal information, permission was obtained for audio recording. The whole process was flexible but streamlined in order to finish the interview smoothly and to adhere to the study's objectives. Each interview lasted around 40 to 55 minutes (median 45 minutes). All the interviews were audio recorded, and interview notes were also taken. This allowed for capturing nonverbal cues and gestures that would otherwise be missed in the recording. All the interviews were conducted in the patient debriefing room in the nephrology department near the HD unit. Enrolment

continued until saturation was attained. The research team has discussed on data saturation and it was obtained with 16 participants.

Data analysis

Quantitative data was analyzed using IBM SPSS software. Descriptive statistics were done to summarize the socio-personal and clinical characteristics of participants. A statistical significance level of $p < .05$ was accepted as significant.

Data analysis in the qualitative phase was an iterative and interpretive process. We used thematic analysis for data interpretation and transcripts were made out of the recorded data which was later translated into English. We read and re-read the transcripts several times to get familiarized with the data. Participants were given numbers to ensure anonymity. We generated initial codes by going back and forth through the data. Some of the initial codes were later replaced by other codes, relabeled, or removed and then collated and finally organized all the relevant codes under the proposed subdomains. Further similar codes were grouped under major themes and the reports supporting the possible themes were assembled to generate subthemes. Finally, three themes were derived and were subjected to peer and expert review. The vetted themes were again revised to ensure that the themes exactly echoed the respondents.

Trustworthiness

To ensure the trustworthiness of the data, Lincoln and Guba have proposed four important criteria, which are credibility, transferability, dependability, and confirmability (21). All the researchers possess previous experience in qualitative research. Two are nurse researchers and one has expertise in nephrology and diabetes clinical research. We read all the transcripts individually and coded them. Then codes were compared, finalized, and categorized, themes were derived both inductively and deductively in agreement with each other. Expert consultation was also sought. The researchers and participants were not related in any way.

Results

During our period of data collection, 116 patients have undergone maintenance hemodialysis at the centre. Of them, 86 patients were eligible for the study and they had a mean age of 56.5 years. The majority were males (72.5% vs. 27.9 %), 61.6 % were diabetic and of which 31.39% were on insulin. Among them, 28.7% (± 5.7) of participants experienced IAH. The mean score of IAH was 5.01(±1.2) according to Clarke's score and the mean HbA1c was 5.8 (± 1.64). Among the participants, 40.69 % had a fear of hypoglycemia. Only 3.2 % of the patients were performing regular self-monitoring of glucose at home. The mean duration of CKD was 4.8 yrs. Hospitalizations associated with hypoglycemic episodes in the last 3 months were reported by 26.74% and 62.34 % of the participants reported varying degrees of related nocturnal episodes. (Table 1).

In the next qualitative segment, data were collected from 16 participants (patients -8, family members – 4, health team members – 4). The age of patients ranged from 43–76 years with a mean age of 52.75. Both diabetic and non-diabetic patients were included (4/4) with a mean dialysis duration of 4.25 (± 1.74) years. Their mean IAH score was 6.

Table 1

Socio Demographic and Clinical Characteristics of Participants in the quantitative phase (N= 86)

S No.	Variable	Mean (SD)
1.	Age in years	56.5 (±13.4)
2.	Duration of CKD	4.72 ± 2.13
3.	HbA1c	5.77 ± 1.64
4.	Hemoglobin (gm./dl)	8.78 ± 0.85
5.	BMI (Kg/M^2)	21.15 ± 2.06
6.	Duration of dialysis (in years)	2.00 ± 0.62
	Variable	**Frequency**	**Percentage (%)**
7.	Male / Female	62/24	72.% / 27.9 %
8.	Diabetic status Yes	53	61.6 %
9.	On Insulin Yes	27	31.39%
10.	- Impaired awareness of Hypoglycemia	24	28.7.%
	-Undetermined	18	20.93%
	-Normal	44	51.16%
11	Fear of hypoglycemia	35	40.69%
12.	Regular self-monitoring of glucose	4	3.2 %
13.	Hospitalizations associated with hypoglycemia (last month)	22	26.74%
14.	Nocturnal hypoglycemic episodes.(last month)	31	62.34 %

Going back and forth through the data, the researchers could identify and highlight the trend or pattern by scribbling and colour coding. Some of the initial codes were later replaced by other codes, relabeled, or removed altogether. From the relevant code group, patterns of meaning in line with the objectives were examined for themes. Three themes were evolved; Awareness; matters a lot; Experiences on IAH, Impact on daily life, Solutions and strategies to address impaired awareness of hypoglycemia. Themes and the corresponding verbatim are following (Please refer to the code cloud and Hierarchical Model of Themes and Categories appended – figure 2).

Figure 2

Mind Map Showing The Codes, Minor Themes, and Major Themes.

Theme 1: Awareness; matters a lot - Experiences on impaired awareness of hypoglycemia

Participants reported a profoundly low blood glucose level which is devoid of any clinical features and that eventually produce a substantial degree of confusion and bewilderment among them and their families.

> Nowadays, I have low energy and am extremely weak at times. Not able to predict the spell or the trend. Previously, I have no issues with blood sugar, but it troubles me a lot these days. (Male, CKDu, 37 yrs. on MHD for the last 3 yrs. IAH- Undetermined).

> This is a new experience.... completely a bizarre one. For the last 23 years... I was diabetic. Used to get hypos in between...but it was quite different... part of life like.... used to have some shivering.... thirst or fatigue..... then I could sense that..... it was a familiar matter in the family also. Even my grandchildren used to offer candy for me... (smiles...) (72 yrs. Male patient, undergoing HD for the last 5 yrs. IAH - Severe).

Conversations revealed that fear and anxiety about nighttime events pose serious issues. Both patients and relatives were highly concerned and vigilant about these nocturnal reactions.

> This nocturnal stuff…. the worst of its kind. This is a horrifying feeling that dreads me even in the daytime. Nights are like a 'yugam' (quite a long period) for me. (Patient, female, 52 yrs. Undergoing HD for the last 4 years. IAH - Severe)

Each incident earmarks a long-lasting bearing on patients and caregivers. 'Fear of hypoglycemia' was a common feeling. During the conversation, the researcher could feel the intensity of those awful experiences - both patient and family members were pondering over. Few patients had injuries and burns during IAH episodes. Most of the reverberated words were 'unpredicted and asymptomatic'.

> The thoughts themselves numb me…that night..... while going to the washroom, he fell and had an injury to the head.....since then.....I am scared of nights.....every night... (Spouse, Female, 46 yrs.)

> No clue.....no signals.....nothing. Unpredictable. We used to end up in troubles..... a series of troubles..... one after the other. Once, I handed over a glass of hot tea to him..... he was talking to me.....within no time, I noticed that he was not responding.... a sort of 'standstill'....by the time the cup fell and had some mild burns. These are much distressing. (Spouse, Female, 48 yrs.)

The complete loss of awareness of the incident makes the patients frustrated and upset. In the scenario mentioned above, the counterpart reported a complete loss of awareness of that incident.

> I could remember even our chit-chat before that.... but later, when she narrated the whole story.... I realized my inability to recollect the interim events. It's extremely shocking..... (Male Patient, Diabetic, 54 yrs. undergoing HD for the last 7 yrs. IAH – severe).

Often, they found this as they could not manage or as being beyond their control, and it made their struggles much harder. People who are rigorously following the instructions and blood checks also felt it was a bit difficult to crack the hypos. This creates frustration and puts many of the participants in despair. They articulated the same with varying levels of intensity. One of the participants expressed concern about the extra caution and vigilance his partner exercised throughout her life to take care of him.

> You know..... she sleeps with eyes open.....(wry smile). (Patient, Male, 72 yrs. IAH – Severe, On MHD for 5 yrs. About his wife).

The blues accompanying this clinical entity and its intricacies were nearly universal among the group. Few patients had seizure episodes.

> Still remember that night...I just woke up suddenly....and he was making some incoherent sounds. There was froth from the mouth.... I was frozen.... a few seconds later, he was like a wooden piece. No response.....I screamed like anything. Nobody to call at midnight...what to do? Since then... I lost my sleep (sighs...). (Spouse, Female, 54 yrs.).

Sleep disturbances, marked anorexia, extreme fatigue and memory disturbances were the common health problems reported among patients with severe IAH. Few participants have shared their anxiety and fear about the imminent death. Falls and injuries constitute another significant issue.

> I couldn't sleep….. Sleepless nights….. you know…now, my earnest desire is to sleep madly…. fed up with these long night hours… (67 yr. old male patient on MHD for 6 yrs. IAH - severe)

> You can't imagine the degree of weariness. It's....you know... the extreme… I can't remember anything but after that...I am like a rag piece …no strength…cannot do anything…...just lying in bed…... (Female Patient, 63 yrs. Undergoing HD for the last 3 years. IAH - Severe)

> The most troubling thing...you know.....all of a sudden we hear... (he/she) is no more...one fine morning.... that fear of imminent death. ((Female Patient, Diabetic, 54 yrs. undergoing HD for the last 2 years. IAH - undetermined).

Theme 2: Impact on daily life

On probing, the participants were vocal about the direct and indirect burden posed by these unidentifiable hypoglycemic attacks. Elderly couples with no fixed income, presenting with multiple comorbidities were a universal entity, and they shared more or less similar feelings on this.

> Frequent hospitalization is a big issue..... last month also... got admitted to hospital twice. Each time...it costs a lot.... auto-rickshaw charge, hospital charge, medicine, food...nobody to help... and so on.... not able to go to work also..... (Patient, Male, 67 yrs. MHD for 6 yrs.)

Odd time happenings, transportation and unforeseen hospitalization are the typical life patterns for most patients. A mode of vicious circle which is going on and on which produces a substantial financial burden to the family.

> I don't know how to manage all these expenses. To be frank.... Somehow managing the dialysis-related and other routine expenses. These unexpected events worsen our struggles. You know..... troubling others at odd times.....running for a vehicle, money, assistance.....for me.... these all are really bothersome.....(Spouse, female - 54 yrs.)

Patients reported the consequences of this unpredictable event on their social lives and portrayed how they changed their lives.

> I am the only breadwinner in my family. I used to go for painting work on non-dialysis days. Earlier, I was ok. I had good company of friends. I used to go to films and festivals...dialysis was just a part of life.... that's all... But nowadays, I have low energy and feel extremely weak at times. Recently started this 'sugar' problems too.....(Male, 47 yrs. on MHD for the last 4 yrs.).

Financial constraints were the most projected concern owing to the loss of productive work days. A young man commented on the loss of productive days because of frequent hospitalizations.

> You know...it affects my work too.....I had sudden attacks during work.... felt embarrassed in front of my fellowmen. So now, once in a while, only I go to work. No income on dialysis days. So two days per week.....gone. On the top now this also...family income... (sighs...) ...in fact, in a pathetic stage. (non-diabetic 47 yrs. Coolie worker on MHD for the last 4 yrs. IAH - undetermined).

Being the recipient of an obligatory treatment service (hemodialysis), here just to sustain life itself is a bit extravagant, as one of the family members pointed out. So, the troubles of IAH pose an added burden to the dialysis-related stress.

> I don't know how the day-to-day affairs are going on.....working in the church school as cleaning staff. Local people used to help...you know...just because of the Karunya scheme (insurance

> programme) I am here.....to add my suffering, this sudden collapse and issues.....last time it was during meal preparation, luckily I didn't get burns. (Patient, Female, single mother, 39 yrs. MHD for the last 3 years.)

Theme 3: Solutions and strategies to address impaired awareness of hypoglycemia

Patients, family members and the health team members have opined about the feasible solutions to tackle the issue of IAH. The importance of family support and health education were highlighted.

> Yes...we need a regular structured patient education system. We used to insist on bringing interim snacks, drinks, and the importance of diet everything. But the fact is that when it comes to their routine...they may find it difficult across all hurdles. But few are doing it well (Dialysis Nurse).

> I think one major issue in communication is due to the lack of consistency of the caregiver- especially with female patients. We instruct many things with one person...then the next time it may be somebody else.... so missing that continuity in care.... that's a real issue. - Dialysis nurse.

> We both are very particular about that. My daughters are also very keen on insulin doses and diet. They chart everything ...but at times it may crack.... still manageable. (52 yrs. Male non–diabetic Patient, on MHD for the last 4 yrs.)

> It's a terrific issue (IAH spells), I know. So wherever we go, I used to keep some sweet stuff in my bag. And we are very much keen about the warning signs to prevent the attack. Luckily no grave events so far (Spouse, female, 48 yrs.).

Few of the participants were finding their ways to cope with this. A 58 yr. old diabetic lady participant with severe IAH shared her perceptions in terms of her jovial associations with healthcare personnel and echoed the value she places on the support in the management of IAH.

> Here, nurses are very friendly.....good in practical solutions also. Used to listen to them...then learn from my own experiences...too. I think I could better manage this with food. I used to eat very well.....rich breakfast, snacks, you know...liberally...(laughs).....just trying to balance...that's life. Isn't it? (Patient, Male, 67 yrs. MHD for 6 yrs. IAH - undetermined)

> I used to watch health-related programmes on television and YouTube. Interact with other patients, discuss with my family members.... etc. These all help me to know the general do's and don'ts. (Female patient, 54 yrs. Attending MHD for the last 6 years. Undetermined IAH)

The need for a person-centered approach was highlighted in the interviews with health team members. As glycemic management in the dialysis population is a sensitive matter it requires a holistic person-centered approach.

> A 'one size fits all' approach is not at all suitable.... a tailored method may be much better.... have to go a long way in this regard. - Nephrology resident.

This dearth of knowledge and understanding creates problems in glycemic management also, as one of the nephrology residents mentioned,

> Yes..... exactly...diabetic patients are conditioned to manage this hyperglycemia as they were doing in the past...but the current pathological changes they may not know.....definitely.....patient education matters a lot....

> Lack of awareness of the disease-related changes cause much confusion and doubt among patients and relatives. Many times patients ask 'I am not diabetic.... then why do you check my sugar?' This is a common scenario (Dialysis Nurse).

Patients and family members were probed about the awareness and utilization of regular blood sugar monitoring, such as self-monitoring of blood glucose (SMBG). Most of them were aware of the SMBG, but only a small number of patients were practicing the same.

> Ya...I have one (glucometer).....a few months back bought...was using it regularly. but now it's not using...because those strips are very costly. (Patient, Male, 72 yrs. MHD for 7 yrs.)

Few patients have revealed how they are anticipating the spells and making self-adjustments of insulin dosage. Patients and family, found it very useful for them.

> Previously he had very high sugar levels, but in the last few months, it's very low and he used to get these kind of bouts. Initially, we didn't know what to do...in fact.... but over the time...I could manage somehow. By adjusting insulin dose and tracking the very first changes...I don't know how? May be some intuitions...(laughs) but the frequency of events has come down. so it's just handling as it is...(Spouse, female, 48 yrs. performing regular SMBG).

Data integration:

This study followed the three-level integration process conceptualized by Creswell and Plano Clark, which occurs at three levels, viz. design, method and interpretation levels (Fetters et al., 2013). Integration at the design level occurred at the study's emergence stage, whereby the type of design employed as explanatory sequential. Integration at the methods level attained through the *connecting and merging* approaches, which combines the quantitative data and qualitative data for analysis and comparison. A mixed method matrix facilitates integration at the reporting and interpretation level (Younas et al., 2020).

Discussion, Conclusion and Recommendation

This study aimed to detect the prevalence of IAH among patients on regular hemodialysis and to explore their experiences through a sequential explanatory mixed method design. The burden of hypoglycemia among dialysis population is well studied but literature on the phenomenon of IAH in hemodialysis is scarce (Jung et al., 2010). The lack of warning signs during low glycemia puts patients in varying levels of difficulties troubling all aspects of their life. Our study findings revealed that a significant proportion of patients were experiencing IAH in their daily life. The qualitative interview transcripts were analyzed and deducted into three themes - Awareness; matters a lot; Experiences on IAH, Impact on daily life, Solutions and strategies to address impaired awareness of hypoglycemia.

Present study found that the prevalence of IAH was 28.7% which is slightly high when compared to the study by Habte et al in diabetic dialysis patients (23.2%) (9). Variances in ethnicity and BMI (21.15 ± 2.06 vs. 30.4 ±6.8) may be viewed in this regard. The interviews revealed fear of hypoglycemia as a rampant issue and this is supported by our quantitative finding (40.4%). Findings from the literature also corroborate this (9). Patients and family members generally expressed the feelings of anxiety, fear of fall and injuries. It is also evident

that IAH has significantly affected the personal and social life of patients. These findings are in tune with another qualitative study among type 1 diabetic patients by Rankin et al, which reported that the patients were adopted marked life restrictions due to IAH (Rankin et al., 2014)

Though fatigue was a fairly universal problem highlighted, it is hard to delineate the fatigue associated with recurrent severe IAH from the general fatigue syndrome commonly seen in the dialysis population (Bossola et al., 2023). However, these physiological effects have a substantial burden on these patients' lives. Financial hardships in ESKD and dialysis was much studied (Ng et al., 2021) It could be inferred that the unpredicted nature of IAH predispose this already fragile patient population to more troubles in terms of frequent hospitalization, injury, financial burden and much more.

The study has recruited patients irrespective of their diabetic status and IAH is prevalent in non-diabetic dialysis patients also. Being on dialysis is not an individual matter alone rather, it encompasses all dynamics and complexities of a frazzled family. It is well known from prior studies that the role of family is vital in the management of chronic diseases like CKD (Gahatraj et al., 2023). Our interview findings also underlined this fact. Family support and planned proactive measures could benefit patients from the unforeseen events associated with an IAH spell. On the other extreme, the distress and burnout of the family were also evident in the interview. Many studies in the literature have discussed the family experiences with hypoglycemia, but that is beyond the scope of this study (Rankin et al., 2014). Another time tested strategy - patient education also get highlighted in this study. Both patient and family agreed on this in the qualitative segment but the study could not estimate this in numerical terms. However, collective efforts by patients and their families will definitely facilitate precise tracking and management of blood sugar values and bringing about considerable relief in patient experience.

The present study findings direct to the importance of an individually tailored patient management as the attribute of IAH is highly varies between individuals. Ongoing support and proactive life style modifications may reduce the risk of complications associated with IAH and may enhance patients' quality of life. Though the comprehensive approach in hypoglycemia is well explored, the IAH as a clinical entity has not studied generally so far. The study by Catriona et al. and Timón et. al. have emphasized on the importance of a holistic structured strategy ranging from identifying the at risk individuals, designing educational and technological interventions and effective involvement of family in the reduction of complications of IAH (Farrell & McCrimmon, 2021).

Conclusion

The aim of the study was to assess the prevalence of impaired awareness of hypoglycemia and to explore the patient and other significant stakeholder's perspectives on this. It is found that impaired awareness of hypoglycemia is significantly high among these patients and many factors such as age, being diabetic and the number of hypoglycemia associated hospitalizations have a predictive potential. This mixed method study on impaired awareness of hypoglycemia has brought about an insight to the hitherto less recognized issue among dialysis patients. A comprehensive approach by involving all the patient stakeholders may open up ways to address this issue among patients on hemodialysis.

Strengths and Limitations

Our study has tried to study the construct of IAH comprehensively through a mixed method approach. Within our knowledge not much studies have done to assess the prevalence of IAH among dialysis population in India that too through mixed method research.

Our study has many limitations. As it is a single center study, it lacks generalizability. Certain pertinent variables like years of insulin use and type, the role of previous exposure to diabetic education, dietary habits were not studied.

Conflict of interest statement

The authors declare that they have no known competing interests with regard to the work.

Ethics

The study was approved by the institutional research committee and institutional ethics review board. A detailed explanation regarding the study was given to all the participants. Separate written informed consent for both phases was obtained from every participant prior to enrolment. Ensured the confidentiality of collected data and voluntariness of participation. The study followed all prevailing ethical guidelines. No physical, psychological or financial burden was enforced on the participants.

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