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INTEGRATING QUANTITATIVE AND QUALITATIVE DATA IN MIXED METHODS RESEARCH

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ABSTRACT

Objective: to describe our experience integrating quantitative and qualitative data in a mixed methods study.

Methods: we described our experience through real-life examples based on a nursing doctoral thesis on professional practice governance within a hospital environment.

Results: three main topics are delineated in this article: the foundation, characteristics, and typologies of mixed methods research; quantitative and qualitative data collection, analysis, and integration; and the benefits and challenges of mixed methods research.

Conclusion: it is supported that a mixed method research allowed for the identification of the convergence and divergence between the qualitative and the quantitative data, contributing for the production of results that complement each other.

DESCRIPTORS: Nursing research. Methodology. Nursing administration research. Nursing service, Hospital. Management. Working environment.

INTEGRAÇÃO ENTRE DADOS QUANTITATIVOS E QUALITATIVOS EM UMA PESQUISA DE MÉTODOS MISTOS

RESUMO

Objetivo: descrever a experiência da integração entre dados quantitativos e qualitativos, por meio de uma pesquisa de métodos mistos.

Método: trata-se de um relato de experiência da utilização dessa abordagem metodológica em um estudo de tese de doutorado em enfermagem sobre a governança da prática profissional de enfermagem no ambiente hospitalar.

Resultados: o texto apresenta três tópicos principais: fundamentação teórica sobre as características e tipologias dos estudos de métodos mistos; procedimentos de coleta, análise e combinação dos dados; e benefícios e desafios da realização desse tipo de estudo.

Conclusão: sustenta-se que a realização de uma pesquisa de métodos mistos permitiu a identificação de convergências e divergências entre os dados qualitativos e quantitativos, contribuindo para a produção de resultados que se complementam entre si.

DESCRIPTORIOS: Pesquisa em enfermagem. Metodologia. Pesquisa em administração de enfermagem. Serviço hospitalar de enfermagem. Gerência. Ambiente de trabalho.

INTEGRACIÓN ENTRE DATOS CUANTITATIVOS Y CUALITATIVOS EN UNA INVESTIGACIÓN DE MÉTODOS MISTOS

RESUMEN

Objetivo: describir la experiencia de la integración entre datos cuantitativos y cualitativos, a través de una investigación de métodos mixtos.

Método: se trata de un relato de experiencia de la utilización de ese enfoque metodológico en un estudio de tesis de doctorado en enfermería sobre la gobernanza de la práctica profesional de enfermería en el ambiente hospitalario.

Resultados: tres temas principales se delinear en este artículo: las bases, características y tipologías de la investigación de métodos mixtos; recopilación, análisis e integración de datos cuantitativos y cualitativos; y los beneficios y desafíos de la investigación de métodos mixtos.

Conclusión: se apoya que la realización de una investigación de métodos mixtos permitió la identificación de convergencias y divergencias entre los datos cualitativos y cuantitativos, contribuyendo a la producción de resultados que se complementan entre sí.

DESCRIPTORES: Investigación en enfermería. Metodología. Investigación en administración de enfermería. Servicio hospitalario de enfermería. Gerencia. Ambiente de trabajo.

INTRODUCTION

In the past two decades, mixed methods, the application of both quantitative and qualitative research approaches to investigate a research area of interest in a single study, has gained momentum in various disciplines, including nursing. The use of mixed methods allows for a deeper understanding of a phenomenon of interest than the use of either a quantitative or qualitative approach alone, especially when the phenomenon is complex.¹⁻²

The idea of mixing different research methods was established by anthropologists and sociologists in the early 1960s, and such innovation was named "triangulation" in the late 1970s. The increased use of mixed methods did not start until the 1990s. Only in the past 20 years, mixed methods has become a "new" scientific research approach.²⁻³

Along its evolutionary path, besides "triangulation," researchers in various disciplines have used different terms for the new research approach such as "multi method investigation," "integrated/combined research," "hybrid study," and "mixed methodology." Today, however, the most commonly used term is "mixed methods".³⁻⁵

Mixed methods is recommended when one of the four following scenarios is evident: 1) When very little is known about a new concept, a qualitative approach can be used before a quantitative approach; 2) when findings from a research approach can be better interpreted by using findings from the other approach; 3) when a sole approach is not sufficient to generate meaningful findings; and 4) when quantitative findings can be enriched by qualitative findings.^{2,4} Oftentimes with mixed methods, results from one method can help identify appropriate participants to be questioned for richer information.⁵

The international literature on mixed methods is extensive. However, experiential examples are limited, and very little information has been provided on mixed methods in Brazil. For example, on January 30, 2016, when using the words, "mixed methods and nursing" in Gopubmed®, a free database available in PubMed-Medline, 644 documents were populated, but only one was written by Brazilian researchers. Therefore, the purpose of this article is to share our experiential examples of quantitative and qualitative data integration using mixed methods based on a study in Brazil.

This article will not only broaden readers' mixed methods perspectives in terms of data integration, but also will increase their awareness of another research area of nursing governance in Brazil. Importantly, this article can help escalate mixed methods research efforts, a new way of thinking, among Brazilian researchers in nursing and elsewhere.⁶

Overall, the objective of this paper is to describe the experience of integrating quantitative and qualitative data through mixed methods research.

METHOD

This is an experiential report based on a doctoral nursing mixed method thesis with its main objective to elaborate an interpretative model of shared governance of the nursing professional practice in a hospital environment.⁷

The manuscript is organized in three parts. First, for educational purposes, the text begins with the foundational characteristics and typologies of mixed methods studies followed by the collection, analysis and data combination methods of the study on which this paper is based. Last, the benefits

and challenges of undertaking mixed methods are presented.

THE MIXED METHOD RESEARCH THEORETICAL FOUNDATION

In terms of the relationship between quantitative and qualitative research, mixed methods studies promote an understanding of chosen phenomena in a manner that would not be possible using a single approach.⁴ Four main aspects must be taken into consideration when planning a mixed method research study: time distribution, weight attribution, combination and theorization.

Concerning time distribution, it must be determined if qualitative and quantitative data will be collected in stages (sequentially) or simultaneously (concurrently). When data are collected in stages, the definition of which come first depends on the researcher's initial idea. Qualitative data are collected first when the idea is to explore a topic of specific interest with participants. Later, the researcher enlarges the understanding through the collection of quantitative data with a population or a representative sample of it. When the qualitative and the quantitative data are simultaneously collected, implementation takes place about the same time because of the nature of the research question.⁵

Weight attribution refers to the definition of priority given to the quantitative or the qualitative research of the study. The same weight can be given to data arising from both approaches or either one can be emphasized, according to the interest of the researcher.⁵

The concept of combination relates to the manner by which data are mixed, meaning to establish whether the qualitative and quantitative data are indeed fused, or if they will be kept separate, or if they will be somehow combined. It is said that data in mixed method research are connected when there is a combination of the quantitative and the qualitative research with data analysis from the first stage of study and when data collection takes place in the second stage. Integration occurs when the qualitative and the quantitative database are fused and produce information that support each other mutually. Incorporation occurs when secondary data are collected with a supportive role for the information from a main database.⁵

A theoretical perspective guiding the execution of a mixed method project is another factor to be taken into consideration. All researchers have theories, hypotheses or guiding structures in their investigations, even when such theories might be implicit or not mentioned.⁵

Based on the definition of these four factors, procedures for a mixed method study can be understood as one of six research strategies as described in the literature: sequential explanatory, sequential exploratory, sequential transformative, concurrent triangulation, concurrent nested and concurrent transformative.^{1,4-5}

These strategies can be outlined using a rating system developed to facilitate communication amongst mixed methods researchers. This system is composed of labels and abbreviated symbols to represent different aspects of research as shown in table 1.

Table 1 – Rating system for mixed methods research

Rating	Definition
QUAN	A study conducted quantitatively
QUAL	A study conducted qualitatively
quan	Quantitative secondary data in relation to qualitative data
qual	Qualitative secondary data in relation to quantitative data
Plus sign: +	Simultaneous or concurrent collection of quantitative and qualitative data
Arrow: →	Sequential manner of data collection, e.g.: QUAN → qual, collection QUAN, followed by qual collection
Parenthesis: ()	Method incorporated within another larger project, e.g.: Qual(QUAN)

Source: Produced from Creswell; Plano Clark.⁴

Table 2 presents a summary of each mixed methods strategy and its rating system.

Table 2 - Main mixed methods strategies

Strategy	Definition	Rating
Sequential explanatory	Quantitative data is collected and analyzed in the initial stage of the research, followed by the collection and analysis of qualitative data developed upon the initial quantitative results.	QUAN → qual
Sequential exploratory	Qualitative data is collected and analyzed in the initial stage of the research, followed by the collection and analysis of the quantitative data developed upon the initial qualitative results.	QUAL → quan
Sequential transformative	A two-stage project with a theoretical view overlaying the sequential procedures. There is an initial stage (quantitative or qualitative) followed by a second stage (quantitative or qualitative) developed over the previous stage.	QUAN → qual QUAL → quan
Concurrent triangulation	Quantitative and qualitative data are collected concurrently and later compared with the aim of determining convergence, differences and combinations.	QUAN + QUAL
Concurrent nested	Quantitative and qualitative data are collected concurrently. However, one is a main method to guide the project and the other a secondary database.	Qual(QUAN) → Quan(QUAL)
Concurrent transformative	Adopts a specific theoretical perspective, with quantitative and qualitative data collected concurrently. However, one method can be incorporated into the other.	QUAN + QUAL → quan

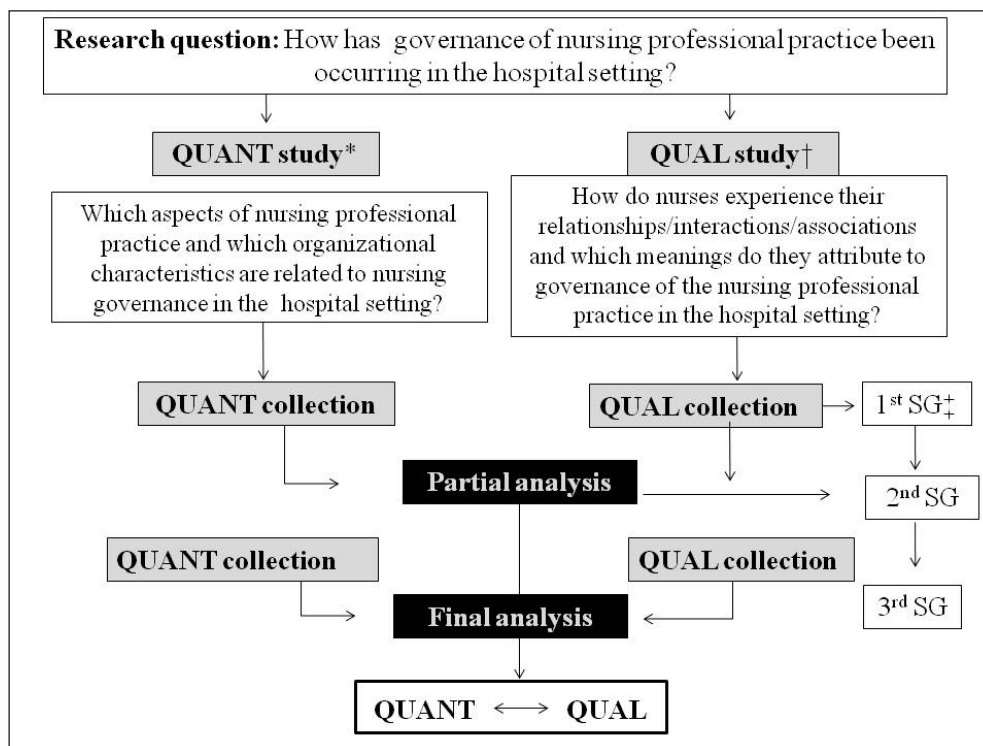
Source: Produced from Creswell⁴ and Creswell; Plano Clark.⁵

For this study,⁷ a concurrent triangulation strategy was adopted. The qualitative and the quantitative data had equal weight and were mixed upon integration (QUAN + QUAL). The theoretical perspective adopted was that shared nursing governance in an organization is beneficial yet complex. Shared governance is based upon the idea that nurses, as the main “front line” professionals of the health care, have greater chances of determining and evaluating patient’s needs, as based upon strong clinical practice standards.⁸ Organizational complexity is linked to the idea of management relations and procedural logic, seeking the re-organization of structures and management models under the perspective of complexity, while considering the uncertain, the unpredictable, the new and the changing as being continuous and permanent in an organization.⁹

Data collection, analysis and combination are presented below.

DATA COLLECTION, ANALYSIS AND COMBINATION PROCESSES

The setting of this study was a university hospital in southern Brazil. Data collection took place in two stages, November 2012 and November 2013, after the approval from the Research Ethics Committee of reference (CAAE: 09885612.1.0000.0121). Quantitative data were collected via a cross-sectional design. A constructive perspective from the Grounded Theory (GT)¹⁰ was adopted for the qualitative arm. The study design is presented in Figure 1, as a summary of how the two research arms were mixed.



*QUANT: quantitative, †QUAL: qualitative, ‡SG: sample group

Figure 1 - Diagram representing the study design

The eligible sample of the quantitative arm was derived from 162 nurses. Inclusion criteria were the exercise of their activities over three or more months. Subjects absent due to holidays or other reasons of any kind were excluded. From the 132 nurses eligible to take part in the study, nine denied participation and 17 did not return their responses. Therefore, the final sample included 106 nurses (80.3%). Regarding the socio-demographic profile of the participants, ages ranged from 23 to 61 years old, with a median age of 48 years and the most frequent age range from 41 to 50 years old. Of the 106 nurses, 53 (50%) were married and 98 (92.5%) were females. The average length of experience was 13 years and six months (min=6.96 years; max=35 years and Standard Deviation= $sd\pm 9.46$) and the average time of working at the institution was 12 years (min=6.96 months; max=33.42 and $sd\pm 9.69$). Weekly working hours were about 37.41 (min=30; max=74 and $sd\pm 11.8$) and 89 of the participants (84%) did not work elsewhere.

Two tools were applied: a socio-demographic profile form and the Brazilian Nursing Work Index-Revised (B-NWI-R). The B-NWI-R measures the presence of the working environment characteristics that promote nursing professional practice.¹¹ For the entire data collection, the 15 items from the B-NWI-R composing the four subscales were used: autonomy

(five items), control over the environment (seven items), nurse-physician relationship (three items) and organizational support (ten items derived from the three first subscales).¹¹

The B-NWI-R is a Likert-type scale, with possible scores ranging from one to four. Participants were asked to respond if they were in agreement or not with the statement "this factor is present in my daily work" according to the following options: completely agree (one point); partially agree (two points); partially disagree (three points) and completely disagree (four points). The lower the score, the greater the favorable attributes. The scale cut-off value is 2.5. Thus, values below 2.5 indicate environments favorable to professional practice and values above 2.5 points represent unfavorable environments.¹¹

As presented in Figure 1, the collection of quantitative data occurred in two moments. There was a partial analysis of the data between this moments in order to evaluate aspects that could be explored in the qualitative data collection, with the 2nd sample group. Quantitative data were entered in a Microsoft Excel® sheet and then transferred to and analyzed by the Statistical Package for the Social Sciences (SPSS®) program, version 19.0 for Windows®, by means of descriptive and inferential statistics.

The GTA theoretical sample for the qualitative study was achieved through three sample groups (SG), totaling 63 participants (P): 1st SG – 32 registered nurses (P1 to P32); 2nd SG – 13 nurse managers (P33 to P45); and, 3rd SG – 18 health team professionals made up of nine technician/auxiliary nurses, five physicians, two psychologists, one nutritionist and one speech therapist (P46 a P63). The 2nd and the 3rd SG were defined to support and/or redirect the hypothesis elaborated from data collection with the 1st SG, where governance of the nursing professional practice is directly related to the performance of nursing managers and to the relationship of the nursing and health teams. Statements of people interviewed were identified with codes using the letter “P” for participant and a

corresponding number in the order that interviews were performed: P1, P2, P3...P63.

Qualitative data were collected through in-depth interviews⁸ and analyzed through the software NVIVO® in two stages: 1) an initial stage with the denomination of each data segment, and 2) a selective and focused stage, where the most significant or frequent initial codes were integrated, summarized and organized into categories and subcategories.¹⁰ Thus, the phenomena “exercising governance in the nursing professional practice in a university hospital” was evident as shown in ten categories and 33 subcategories.

The main methodological aspects of the study are summarized in Table 3.

Table 3 - Summary of methodological aspects of the study

STUDY DESIGN	Mixed methods research with concurrent triangulation of data	
	QUANTITATIVE	QUALITATIVE
	Cross-sectional study	Grounded Theory (GT), constructivist approach
Specific objective	To analyze the professional nursing environment, organizational characteristics and variables associated with nursing governance in a hospital setting	To build an interpretative model from meanings attributed by nurses to the relationship/interactions/associations in the process of nursing practice governance
Participants	<ul style="list-style-type: none"> 106 nurses 	<ul style="list-style-type: none"> 63 participants Three sample groups
Data collection	<ul style="list-style-type: none"> Personal, professional and working environment description form Brazilian version of Nursing Work Index – Revised (B-NWI-R) 	<ul style="list-style-type: none"> Intensive interviews
Data analysis	<ul style="list-style-type: none"> Descriptive statistics Inferential statistics SPSS®, version 19 	<ul style="list-style-type: none"> Initial coding Selective and focused coding NVIVO®, version 10

Integration of quantitative and qualitative results

Integration is a key process, as in the final analysis stage of this study, when using mixed methods. In our case, qualitative and quantitative data were compared for similarities and differences, integrated or combined as appropriate. Three examples of mixing data are presented below.

Example 1

In the quantitative arm, the average score of the B-NWI-R Autonomy subscale was 2.07 (sd±0.5; min=1; max=3.4) indicating that the hospital environment favors nursing autonomy. These quantitative results did not allow for the understanding of how nurses experience and build their autonomy and what helps to maximize such autonomy, but

our qualitative results did generate rich information and inform the cultural context pertinent to the phenomenon of interest.

Qualitative research enables the understanding of human experiences in relation to a research phenomenon.¹² It was showed by the examples of our qualitative categories include “Emphasizing the importance the Nursing Administration’s support and counseling” and “Occupying a central position in the working organization and care giving setting”. These categories indicated that the nurse’s autonomy was possible through the support from the nurse management and their work in the institution and the professional practice support and counseling commissions. Such an environment enables the nurse to act in the work’s organization and care management, as exemplified by the statements: *The link between units is the head of the*

department [...], thus when the head of the unit has a problem, she reports to the head of the division (P5); [...] we have a lot of support, especially from the Centro de Educação e Pesquisa em Enfermagem (Nursing Research and Education Centre) and a Permanent Committee of Assistance Materials (P35).

Example 2

The average B-NWI-R Control environment subscale was 2.48 (sd±0.54; min=1; max=3.86), which also indicates a favorable profile to governance in nursing practice. However, the resulting value is close to the tool's cut off, as values from 2.5 correspond to unfavorable characteristics in the nursing working environment.⁹

In the qualitative study, the categories "Confronting hardships on human resources in public services" and "Facing bureaucracy and slowness of support services" offered means to interpret the average of this subscale, as is exemplified by the statements: [...] *working with people is harder, as they are public servants, as many people have gone through the probation period and cannot be fired (P17); [...] some things are slow, sometimes it takes months to fix a saline solution stand, due to lack of people, or due to lack of the spare part (P43).*

Despite these difficulties, it was found that input and dedication by the nurses existed to reach control over their environment in the category "Establishing and keeping control over the caring environment", as shown by the following statements: [...] *we manage to have a global vision, the control of all that's happening (P19); I always try to find out what's happening [...], sometimes I am not around, but I am always "aware" of what's happening (P29).*

Example 3

No statistical significance was found between nursing practice governance (B-NWI-R mean=2.21 (SD±0.39); min=1.3, max=3.11) and time of professional experience (p-value=0.102), and time of working in the institution (p-value=0.280). However, this variable was found to be considered as important by participants through the qualitative arm in order for them to achieve control over their working environment. *The control over the situation and over the working environment comes with time. At least one year is needed to know what has to be done when a new problem arises, to have the ability to keep calm and to think about what needs to be done (P16).*

BENEFITS AND CHALLENGES OF INTEGRATING QUANTITATIVE AND QUALITATIVE RESULTS

Conducting a mixed method study does not mean carrying out two separate studies to address a specific issue, but one study that employs different methods to answer a specific research question, seeking for rich and comprehensive information.¹³ The examples presented above show that mixed methods research allows for undertaking different methodological designs while producing mutually complementary results favoring a more complete and extensive interpretation of the phenomena being investigated. Thus, the identification of the convergence and divergence between data was the main benefit of our study. If each study arm had been undertaken as a single study, results from this study would have been different.

Similar benefits from qualitative and quantitative data integration have been also described in another study in the field of nursing management. This study researched the characteristics of working organization by a nursing team as related to bath in bed care. A concurrent incorporated strategy was used through simultaneous quantitative and qualitative data collection and the choice of a main method and a secondary database. Here, the qualitative arm was adopted as the main method and the quantitative data formed a secondary database.¹⁴

Furthermore, through mixed methods research, a stage in a study can aid in the decision-making of another ongoing stage.^{4,5} A case in point is a study that adopted a sequential explanatory strategy to identify the frequent user's profile of an emergency service and the associated factors through a cross-sectional epidemiologic study, followed then by the qualitative stage to explore the reasons for the repeated use of the service. Subjects participating in the qualitative stage were selected based upon the results from the quantitative stage, taking into consideration the quantity of reoccurrences.¹⁵

The main challenges faced in a study using mixed methods are the weight attribution for the qualitative and quantitative results and time management for the research to be done. In our study, equal weight attribution for both qualitative and quantitative data was kept. To that end, both studies were simultaneously developed; that is, both qualitative and quantitative data were simultaneously collected and analyzed. Integration of data was achieved at the end of the research to identify the results convergence and divergence. As for the

execution time of the research, planning is needed so that all stages are undertaken with quality according to ethical principles. A research team to help with data collection was organized under the careful supervision of the main researchers in order to maintain the quality of data collected.

It is also important to highlight that the development of mixed methods research demands good knowledge of the epistemological and operational aspects of quantitative and qualitative approaches. Therefore, it must be considered in some instances that a specialist may be required to help with some approaches of the research. In this study, the undertaking and validation of the analyses and interpretation of quantitative data was performed with the aid of a statistical consultant, and a combination of quantitative and qualitative findings was done through consultation with a mixed methods expert.

CONCLUSION

Conducting mixed methods research allowed for the identification of the convergence and divergence of qualitative and quantitative data, contributing to results that mutually complement each other. Integration of qualitative and quantitative methods opened up for the researchers a greater overall understanding of governance of nursing professional practice in a hospital setting.

Mixed methods studies allow for greater relevance of research as long as the researchers know how to clearly identify the potentials and limitations of such research at the time of applying their methods, taking into account the nature of the object of their study when planning the research. Mixed methods research aims at converging qualitative data and quantitative, the paradigmatic pluralism—thus, potentially reaching a broader answer to the problem or phenomena under investigation. To that end, the attribution of the desired weight for the qualitative and the quantitative data as well as the use of techniques for mixing data is essential for the quality of the mixed methods study.

Finally, more specific studies on mixed methods research need to be conducted for the development of the method, as has been happening internationally, and to aid the researchers who make use of it. It is in this sense that this study contributes a step towards the construction of such knowledge in the scope of mixed methods research and to future research in the health and nursing fields overall.

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