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QUALITY DATA ANALYSIS SOFTWARE USED IN NURSING RESEARCH

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ABSTRACT

Objective: to identify and map the use of qualitative data analysis software used in research conducted within the Brazilian nursing graduate programs.

Method: scoping review, whose data collection was conducted in March 2017 from the Coordination for the Improvement of Higher Education Personnel's (*Coordenação de Aperfeiçoamento de Pessoal de Nível Superior*) Thesis and Dissertation Database. Dissertations and theses produced in the scope of graduate programs in Brazilian nursing that were qualitative research using software were included. Data were submitted to simple descriptive statistics.

Results: the final sample consisted of 239 studies, especially descriptive studies (99; 41.5%), with a qualitative approach (194; 81.2%). They used the software in the data analysis step (148; 61.9%); 11 distinct software were used. Potentialities and difficulties of using the software were highlighted.

Conclusion: Brazilian nursing has appropriated the use of qualitative data analysis support software in its research.

DESCRIPTORS: Software Qualitative research. Nursing research. Search. Health research evaluation.

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SOFTWARES DE ANÁLISE DE DADOS QUALITATIVOS UTILIZADOS NAS PESQUISAS DA ENFERMAGEM

RESUMO

Objetivo: identificar e mapear o uso de *softwares* de análise de dados qualitativos utilizados nas pesquisas desenvolvidas no âmbito dos programas de pós-graduação da enfermagem brasileira.

Método: *scoping review*, cuja coleta de dados foi realizada em março de 2017 a partir do Banco de Teses e Dissertações da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior. Foram incluídas dissertações e teses produzidas no âmbito dos programas de pós-graduação da enfermagem brasileira que se configuravam como pesquisas qualitativas com uso de *software*. Os dados foram submetidos à estatística descritiva simples.

Resultados: a amostra final foi de 239 estudos, com destaque para os estudos descritivos (99;41,5%), com abordagem qualitativa (194;81,2%), que utilizaram o *software* na etapa de análise dos dados (148;61,9%); 11 distintos *softwares* foram utilizados. Destacaram-se as potencialidades e dificuldades de uso dos *softwares*.

Conclusão: verificou-se que a enfermagem brasileira tem se apropriado do uso de *softwares* de apoio à análise de dados qualitativos em suas pesquisas.

DESCRITORES: *Software*. Pesquisa qualitativa. Pesquisa em enfermagem. Pesquisa. Avaliação da pesquisa em saúde.

SOFTWARE DE ANÁLISIS DE DATOS DE CALIDAD UTILIZADO EN LA INVESTIGACIÓN EN ENFERMERÍA

RESUMEN

Objetivo: identificar y mapear el uso del *software* de análisis de datos cualitativos utilizado en la investigación realizada dentro de los programas de posgrado en enfermería de Brasil.

Método: revisión de alcance, cuya recopilación de datos se realizó en marzo de 2017 del Banco de Datos Tesis y Disertación de Coordinación de Mejoramiento de Personal de Nivel Superior (*Coordenação de Aperfeiçoamento de Pessoal de Nível Superior*). Se incluyeron disertaciones y tesis producidas en el ámbito de los programas de posgrado en enfermería brasileña que se configuraron como investigación cualitativa utilizando *software*. Los datos se presentaron a estadísticas descriptivas simples.

Resultados: la muestra final consistió en 239 estudios, especialmente estudios descriptivos (99; 41.5%) con un enfoque cualitativo (194; 81.2%), que utilizaron el *software* en la etapa de análisis de datos (148;61, 9%). Se utilizaron once *softwares* distintos. Se resaltaron las potencialidades y dificultades de usar el *software*.

Conclusión: se descubrió que la enfermería brasileña se ha apropiado del uso de *software* para apoyar el análisis de datos cualitativos en su investigación.

DESCRITORES: *Software*. Investigación cualitativa. Investigación en enfermería. Investigación. Evaluación de investigación en salud.

INTRODUCTION

Qualitative research is characterized as a scientific approach guided by the study of subjectivities and meanings, which generally occurs from the interpretation of subjects about how they live experiences.¹

From this perspective, qualitative data are eminently textual, that is, they are composed of words whose meaning is necessary to understand from their production context, so that their analysis is recognized as being complex.²

As it is guided by subjectivities, the historical course of qualitative studies is marked by various prejudices and challenges, especially regarding the methodological rigor and reliability of its analysis processes.³ As a result, researchers have been concerned with producing valid, reliable and objective qualitative interpretations over the years.⁴

Thus, analysis strategies definition in qualitative research is understood as one of the main challenges within this methodological approach. Such choice should start from the study object, the establishment of objectives in response to the research problem, theoretical assumptions and the adopted framework.⁵ Those are elements that require preparation and scientific maturity of the researcher.

In addition, another choice characterizes qualitative research today. Data organization and coding can be performed by manual or computational methods. Historically used manuals consist of the production of physical files for each category and code, literally manual paper work, cutouts, collages, among other strategies.⁶

In turn, computational methods are known as Computer Assisted Qualitative Data Analysis Software (CAQDAS).⁷⁻⁸ Its widespread use dates back to the mid-1980s, when technological development boosted the use of computers in research.⁷⁻⁸

CAQDAS allows the insertion of data files in various formats, depending on the software, and facilitates the encoding of the material, especially those resulting from large textual volume. They are also recognized for the production of graphical analysis elements and for the possibility of multivariate analysis. However, analysis process remains inherent to the researcher.⁶

It is essential to emphasize that the choice of using software to support data analysis should take into account all methodological aspects inherent to qualitative research, already elucidated in this manuscript. It must therefore be a reasoned decision by the researcher, in order to meet the specific criteria of each software that justify and support its use.

It is unquestionable that, when used correctly, CAQDAS can assist in providing more stable, objective and reliable analyzes, with less interference from the subjectivity or bias of the researcher.⁹

In this context of insertion of CAQDAS in qualitative investigations, nursing stands out.¹⁰ Therefore, it is necessary to understand how this process has been experienced in the Brazilian context.

It is emphasized that a better understanding of the use of CAQDAS can elucidate appropriateness and inconsistencies of use, in order to support decision making about elements that need to be reviewed and/or incorporated into the teaching process of future researchers.¹⁰

The objective of this study was to identify and map the use of qualitative data analysis software used in research produced in the Brazilian nursing graduate programs.

METHOD

This is a scoping review guided by the recommendations of the Joanna Bright institute (JBI) Institute Reviewer's Manual¹¹ and presented according to the PRISMA Extension for Scoping Reviews (PRISMA-ScR) recommendations: Checklist and Explanation.¹² The PCC mnemonic was used to formulate the research question, as described: P (Population) - Qualitative research; C (Concept) - Software; C (Context) - Brazilian nursing graduate programs. Thus, the research was guided by

the question: what data analysis support software have Brazilian nursing researchers used in their qualitative research?

Data collection was carried out in March 2017, in peers, from the Coordination for the Improvement of Higher Education Personnel's (CAPES - *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior*) Theses and Dissertations Database. That was a database that integrates the dissertations and theses produced under the Brazilian graduate programs. The choice for this source of data collection was due to the need to access in-depth information about the methodological aspects of the research analyzed, which is made possible by dissertations and theses.

The study population consists of dissertations and theses produced within the scope of Brazilian nursing graduate programs that were configured as qualitative research using software.

Dissertations and theses; built within the scope of Brazilian nursing graduate programs; published in full online; which are qualitative research using software were included.

No time limit has been set. However, as the database used underwent recent updates, some limitations were found in the search and selection of studies: 1) only abstracts of papers published between 2013 and 2016 were available; and 2) the availability of abstracts was limited to the first 10,000 papers.

The study followed a systematized research protocol according to the recommendations of the JBI (2015). A preliminary search was performed in the databases JBI CONNECT +, DARE, The Cochrane Library and PROSPERO. No protocols and reviews with similar theme were identified.

Then, the research was carried out, whose search was carried out in the CAPES Thesis and Dissertation Database by combining the two Health Sciences Descriptors (DeCS - *Descritores em Ciências da Saúde*) components of the PCC mnemonic of this research - (P) Qualitative Research AND (C) Software. The Concentration Area (Health Science) filter was used to select research related to graduate nursing programs, which corresponded to the Context (C) established.

After applying the search filters (Concentration Area and available abstracts), the title and abstract of all identified studies were evaluated based on the inclusion and exclusion criteria established by two reviewers independently.

Finally, the selected publications were retrieved in their entirety and data were extracted. At this stage, 67 studies were excluded, which corresponded to research produced in graduate programs in other health areas. The final sample consisted, then, of 239 researches (Figure 1).

The following data were extracted from and recorded in a spreadsheet built in Microsoft Excel 2016: academic level; year of publication; higher education institution; research type and approach; qualitative data analysis software used; stage of software use in research; benefits of using the software; and difficulties in using the software.

Data were analyzed using simple descriptive statistics (n and%).

No ethical appraisal of the research was required as the data source consisted of papers in the public domain.

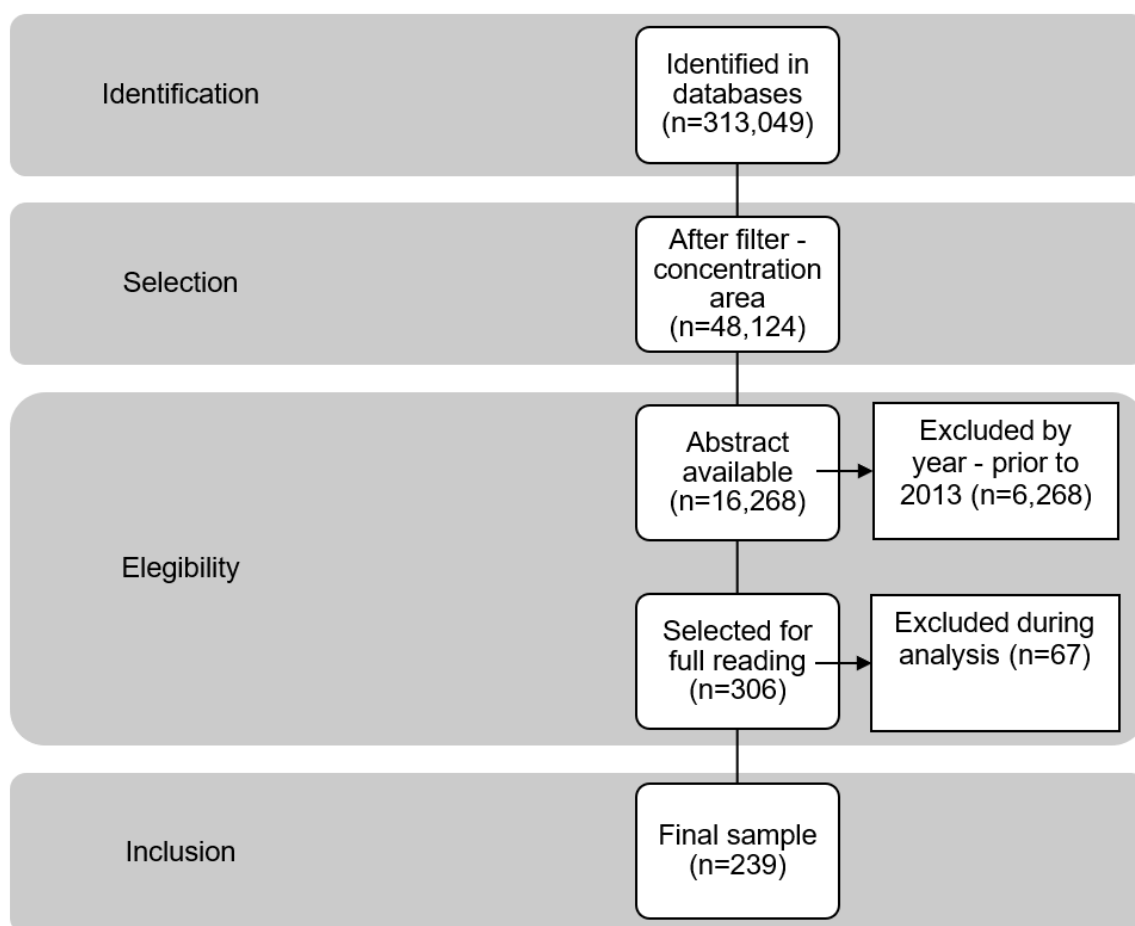


Figure 1 – Study sample selection diagram. Natal, RN, Brazil, 2017

RESULTS

Of the number of 306 qualitative researches produced in the Brazilian health graduate programs that used software to support data analysis, between 2013 and 2016, 239 (78.1%) were produced by nursing researchers. This reveals the dynamism in the graduate education of this area of knowledge.

Of these surveys, 149 (62.4%) were dissertations resulting from academic masters, 73 (30.5%) constituted theses and 17 (7.1%) consisted of dissertations resulting from professional masters.

The temporal dimension was restricted to the years 2013 to 2016, according to the limitation already mentioned, so that was highlighted the year 2015, when 80 (33.5%) component studies were produced from this research sample.

The papers analyzed were developed in the context of 36 different higher education institutions, especially those located in the Southern Brazilian Region (94; 39.4%), of which the *Universidade Federal de Santa Catarina*, a production field of 54 (22.9%) selected searches (Figure 2).

Regarding the type of research explained by the authors of the analyzed studies, descriptive studies (99; 41.5%) and descriptive-exploratory research (78; 32.6%) were highlighted. The other types of studies cited were: exploratory (21; 8.8%); evaluative (4; 1.7%); ethnographic (3; 1.3%); convergent care (2; 0.8%); methodological (2; 0.8%); and experimental (1; 0.4%). Twenty-nine (12.1%) authors did not explain the type of research performed.

Regarding the methodological approach adopted, 194 (81.2%) studies reported following a qualitative approach, and the remaining 45 (18.8%) denoted a mixed approach.



Figure 2 – Geographic distribution of the analyzed studies, according to the Brazilian Federative Units, in absolute and relative numbers. Natal, RN, Brazil, 2017

Eleven different qualitative data analysis software were used in the dissertations and theses evaluated (Table 1). In 229 (95.8%) researches, only one software was used, while ten (4.2%) authors used two software in a combined way.

Table 1 – Qualitative data analysis software used in the dissertations and theses analyzed. Natal, RN, Brazil, 2017. (n=239)

Software	n	%*
Atlas.ti	58	24.3
Alceste	47	19.7
NVivo	42	17.6
IRAMUTEQ	37	15.5
EVOC	30	12.6
Qualiquantisoft	12	5.0
Ethnograph	6	2.5
Tri-deux-mots	6	2.5
WebQDA	5	2.1
MaxQDA	3	1.3
OpenLogos	3	1.3

* The sum is greater than 100% because 10 papers used more than one software.

Regarding the software use stage: 148 (61.9%) reported having used it in the data analysis; 54 (22.6%) in the data processing; and the remaining 37 (15.5%) denoted the combined use for treatment and data analysis.

Table 2 shows the objectives of the studies, the research approach, the software use stage and other relevant information about the research that used the five most used software in the dissertations and theses analyzed.

Regarding the benefits of using qualitative data analysis support software, 162 (67.8%) surveys did not cite any benefits. Of those mentioned, the following stood out: contributes to the organization of the data (50; 20.9%); enables different types of analysis (44; 18.4%); optimizes the analysis time of large textual volume (30; 12.6%); allows a standardized analysis with greater methodological rigor (18; 7.5%); enables analysis of different types of documents (8; 3.3%); It is easy to use (1; 0.4%); and allows analysis by group of researchers (1; 0.4%).

Regarding the difficulties of using the software, 230 (96.2%) researchers did not make any use limitations explicit. Of those that highlighted difficulties in the use of software, the following were emphasized: demands a long time of study of the researcher (5; 2.1%); performs complex analyzes that are difficult to understand (3; 1.3%); has risk of wrong analysis due to mismanagement (2; 0.8%); and has a high acquisition cost (1; 0.4%).

Table 2 – Information on the use of the five qualitative data analysis support software most used in the dissertations and theses evaluated, in absolute and relative numbers - (number; percentage). Natal, RN, Brazil, 2017. (n=239)

Research approach n (%)	Stage of use n (%)	Other relevant information n (%)
1st most used software: Atlas.ti 58 (24,3%)		
Qualitative 55 (94.8)	Analysis 30 (51.7)	Combined use with another software 1 (1.7)
Mixed 3 (5.2)	Treatment 20 (34.5)	
	Treatment and analysis 8 (13.8)	
2nd most used software: ALCESTE 47 (19.7%)		
Qualitative 32 (68.1)	Analysis 32 (68.0)	Combined use with another software 6 (12.8)
Mixed 15 (31.9)	Treatment 2 (4.3)	
	Treatment and analysis 13 (27.7)	Use of social representations framework 22 (46.8)
3rd most used software: NVivo 42 (17.6%)		
Qualitative 37 (88.1)	Analysis 25 (59.5)	Combined use with another software 2 (4.8)
Mixed 5 (11.9)	Treatment 3 (31.0)	
	Treatment and analysis 4 (9.5)	
4th most used software: IRAMUTEQ (37; 15.5%)		
Qualitative 32 (86.4)	Analysis (26; 70.3)	Combined use with another software 1 (2.7)
Mixed 5 (13.6)	Treatment (4; 10.8)	
	Treatment and analysis 7 (18.9)	Use of social representations framework 6 (16.2)
5th most used software: EVOC 30 (12.6%)		
Qualitative 22 (73.3)	Analysis 24 (80.0)	Combined use with another software 8 (26.7)
Mixed 8 (26.7)	Treatment 3 (10.0)	
	Treatment and analysis 3 (10.0)	Use of social representations framework 24 (80.0)

DISCUSSION

The prominence of nursing in the production of qualitative studies has already been elucidated by other researches, both nationally and internationally.^{1,10} This aspect is justified by the adequacy of this methodological approach to various objects of study that are researched in this area of knowledge.

Thus, it is recognized that qualitative research has contributed and continues to be relevant for the advancement of knowledge and for the consolidation of Brazilian nursing graduate programs.¹

In addition, in a review study by Australian researchers seeking to map the use of CADQAS in articles indexed in the SCOPUS database between 1994 and 2013, it was revealed that most studies using such software were published in science journals from especially by nursing researchers.¹⁰

Thus, the fact that 78.1% of the initial population of this research consisted of studies by nursing researchers and that this production has been growing over the years corroborates these aspects. This demonstrates that this area of knowledge has advanced in incorporating innovative elements in its qualitative investigations, in line with an already established worldwide trend and with ascending quantitative.^{10,13-14}

Therefore, the incorporation of software to support qualitative nursing research demonstrates a search for innovative research methods in response to current demands for methodological rigor and creativity of the researcher.¹⁵

Regardless of the nature of the research, the researcher who uses digital resources seeks to ensure that data is analyzed judiciously and systematically, managing time more efficiently and increasing reliability.¹⁶

Amid the challenges and myths that still characterize the use of software in qualitative research, its increasing use represents a quest for both the legitimacy of this data analysis approach and the affirmation of its impact and rigor.¹⁶⁻¹⁷

Thus, the qualitative data analysis stage, seen as a labyrinth of possibilities and paradigms¹⁸ for the researcher, gains new nuances, with the support of technological resources that give transparency to such elements.

The optimization of data organization, reducing the time for coding, especially large textual volume, as well as the possibility of performing different types of analysis supported by graphic resources are highlighted as potentialities of using CAQDAS.¹⁵

Thus, it is clear that the use of software in textual analysis is a path that can not be deviated and that highlights new challenges for researchers, who need to learn to use them effectively in their research.¹²

A review study that analyzed the use of software in qualitative research produced in the context of Brazilian graduate programs in the field of health highlighted that the researchers pointed the study time needed by the researcher; the complexity of the analyzes; the language of the software; in addition to the possible risks of misinterpretation as major difficulties when using CAQDAS. It was emphasized that the researcher's central role cannot be neglected in qualitative research, with or without software.¹⁵

With regard to the highlighting of studies resulting from academic masters and produced in the South of Brazil, it is understood that such quantities are in line with the distribution of graduate programs in Brazil. There is a predominance of this modality of course and greater number of graduate programs in this Brazilian region.¹⁹

Regarding the type and approach of the study mentioned by the authors themselves, there was an emphasis on descriptive studies with qualitative approach and less use of mixed approach. This reality resembles the results raised by international research with several areas of knowledge.¹⁰

The mixed approach has different conceptions and even different nomenclatures - mixed method or combined method, for example. It is understood that such an approach consists of the use

of quantitative and qualitative strategies in the same research project, justified when the phenomenon under analysis is complex and the objective is very broad.²⁰

This approach uses strategies from different research methods within the same study so that information from one researcher sheds light on the interpretation of results from the other.²¹

Mixed methods represent a new step in the evolution of the discussion about research methodologies, with special emphasis on social sciences and health. The problems approached by researchers are complex and the use of only one research approach (quantitative or qualitative) is insufficient and inadequate to understand and unveil this complexity.²²

However, the choice to use a mixed approach to data analysis must be well-founded. Both quantitative and qualitative aspects must follow adequate methodological rigor and contribute fundamentally to the understanding of the investigated phenomenon. Also, just using numerical data in textual element analysis is not a mixed approach.

Regarding the stage of use of the software in the researches evaluated, the fact that 61.9% of the authors report having used CAQDAS in the data analysis is worrying, if this is not understood as a support mechanism at this stage, without substituting, therefore, the central role of the researcher.

About this fact, researchers point out some elements that need to be rethought in qualitative research using CAQDAS. These are publications that cite the software itself as if it were the technique of data analysis; reference to the software as if it were the research method itself; and papers that restrict data analysis to information in software outputs.⁹

It is imperative to emphasize that such computer programs do not decide what should be coded, which categories should be developed, let alone have their own ability to establish relationships between data or categories.²³

Although the use of software enables process improvement in answering research questions, it is unquestionably that it does not replace the analytical competence of researchers.²⁴

CAQDAS should be understood as tools used to facilitate the exploration of data to make it more transparent and reliable.⁹ Therefore, the use of software is not a data analysis method, it is merely an instrument for processing them, which does not conclude the analysis, since interpretation is essential and the researcher's responsibility.²⁵ Thus, the fundamental differentiation between the stages of data management or treatment and data analysis is suggested.¹⁰

CAQDAS provides important benefits when understood as support for better data recording, visualization, organization and systematization, which does not rule out but actually enhances the researcher's paper conceptualization and analysis.^{2-3,16}

When properly used, qualitative data analysis support software optimizes the research process by contributing to data organization. By providing different types of analysis, with the possibility of using graphics and multivariate analysis. By allowing analysis of large textual volume. By ensuring greater methodological rigor, for the transparency and impartiality of the coding process. Finally, by enabling analysis of different types of documents (depending on the software)^{2-3,5,8-9,13,25-26}

Some CAQDAS, especially cloud-based ones, still allow for collaborative data analysis by archiving this process. This makes this step more transparent and reliable, and enables the organization and management of research projects and not just textual data from a single *corpus*.^{3,16}

From all these benefits, the treatment of qualitative data is optimized. The researcher saves time on exhausting typing tasks and deals more with the task of analyzing possible relationships and correlations, which qualifies the investigation as the opportunity for longer researcher immersion and analysis.¹³

In contrast to the potential use of software, it is also essential to elucidate the challenges elucidated by researchers, which were only highlighted in 3.8% of the studies analyzed. This needs to be an element of reflection, because elucidating the difficulties experienced in the research process

is fundamental for the learning and dissemination of aspects that need to be taken as a basis for outlining coping strategies, especially to support researchers' training moments.

Among the difficulties of using the CAQDAS, the authors of the dissertations and theses components of the sample of this study highlighted: the requirement of a long time of preparation of the researcher; the production of very complex analyzes, with the risk of erroneous analysis by the research team; and the high cost of acquisition.

It is important to emphasize that the time to be allocated for the study and training of software use should not be understood as a difficulty, but as a fundamental step, without which it is not possible to carry out any kind of investigation. It should be noted, therefore, that adequate training of qualitative researchers can focus on increasing research quality.¹⁶ It is relevant that this aspect is considered by graduate programs, which are responsible for the proper training of researchers.

Thus, as a challenge of using a CADQAS, the time spent on learning is high.²³ However, this will focus on preventing the other listed difficulty: the risk of erroneous analysis. Once again, the researcher's central role in the data analysis process is emphasized.

Thus, despite the potential for numerous benefits to qualitative research, if not properly operated, software can perform a mechanical, fragmented and superficial analysis.²⁷ There is a requirement for a researcher prepared to correctly employ all the possibilities provided by the computer program.

Regarding the most commonly used software, the elucidated results coincide with those pointed out by a study that aimed to verify how the use of CAQDAS has occurred in qualitative education research, 12 so that in both of them Atlas.ti, ALCESTE and NVivo.

Atlas.ti allows the archiving of large textual volume in various formats, such as text files, videos, audios, among others. To use it, you must purchase a license or download it for free for testing, but with limited encoding and file insertion capabilities.^{7,26}

ALCESTE, acronym for *Analyse Lexicale par Contexte d'un Ensemble de Segments de Texte*, was created in France in the 1970s and is considered one of the pioneering computing resources for content analysis.⁵

It was from ALCESTE that the concern with the recovery of the context of the textual data was elucidated, so that, in addition to the vocabulary, the text segments in which this vocabulary was inserted were considered in the statistical analysis, which made important contributions regarding the reliability of interpretations of lexical analyzes.⁹

NVivo is owned by QSR International, one of the world's largest producers of qualitative research software.⁸ Among the peculiarities of this software is its desktop. It is designed with Microsoft® interface guidelines that provide most users with fluidity and ease of understanding their mechanisms and shortcuts.²²

The diversity of CAQDAS available may represent a difficulty for the qualitative researcher to choose. Therefore, a careful analysis of each software is imperative, so that there is coherence between the objective and the research design. Each software has different features and adapts to different study designs, so this should be known to the researcher who decides to use CAQDAS.¹⁵⁻¹⁶

It is emphasized that the results presented do not represent the totality of Brazilian nursing research. They should not, therefore, be generalized, but understood as representative of the database used, with the specificity of the time limit and access established by the database in which the search was performed.

It is expected to contribute to the conscious and grounded use of software in qualitative investigations. The results presented may support, above all, the planning of formative moments within the scope of graduate nursing programs. However, there is an imperative need to prepare future researchers for CAQDAS use.

CONCLUSION

It was found that Brazilian nursing has appropriated the use of CAQDAS in their research. Eleven different qualitative data analysis software were used in the dissertations and theses evaluated, especially Atlas.ti, ALCESTE, NVivo, IRAMUTEQ, and EVOC.

Studies from academic masters and developed in the southern region of Brazil predominated. The descriptive studies with a qualitative approach highlighted software use in data analysis.

CAQDAS, when effectively used as tools to support qualitative research, contribute to data organization, enable different types of analysis and, given the large textual volume, optimize the analysis time.

As difficulties in using the software, the researcher's long time demand and the risk of misleading analysis due to mismanagement were highlighted. This emphasized the central role of the researcher, who should use CAQDAS with literacy and understand it as a strategy to support data management. This does not exclude, but may contribute to the effective data analysis with the investigator's critical eye.

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NOTES

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CONFLICTS OF INTEREST

There are no conflicts of interest.

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