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The Ahp As A Tool To Support The Analysis Of The Quality Of Health Services: Systematic Literature Review

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Abstract:
Background*: The provision of health services involves a complex set of stakeholders who seek the quality and effectiveness of these public policies. In this scenario, which involves limited resources, improving the quality of healthcare can expand the range and scope of services provided to citizens. In addition, research has pointed to inefficiencies in health systems at a global level, which involve various factors. Within this context, the Analytic Hierarchy Process (AHP) stands out for its simplicity and ease of understanding as an effective tool for assessing the quality of health services.*
Materials and Methods*: For these reasons, this study saw the need to understand the state of the art of research into the application of the AHP for analyzing the quality of health services. To this end, a bibliometric analysis is presented, carried out in five stages using the Web of Science (WoS) database, using articles published between 2021 and 2024. The areas of application, main themes, institutions and countries, impact of the work, methodologies and contributions were analyzed.*
Results*: A total of 324 publications were found in the period analyzed. The results showed a greater focus on the application of AHP in decisions related to the environment and engineering. On the other hand, eleven papers were identified which focused on evaluating the quality of health care, either applying the AHP purely or in conjunction with other techniques and methodologies. Furthermore, despite the greater number of applications in the hospital area, the methodology proved to be applicable to a variety of health services and systems.*
Conclusion: *As a result, the bibliometric analysis made it possible to identify important authors who have contributed literature on the subject, as well as the journals with their respective impact indicators. This evidence not only highlights the importance of the topic, but also shows the versatility of the approach using the AHP method, which can be used in isolation or in conjunction with other tools.*
Key Word*: Bibliometrics; Web of Science; Analytic Hierarchy Process; Service Quality; Healthcare.*

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I. Introduction

The provision of health services involves a complex set of stakeholders who seek the quality and effectiveness of public policies. This complexity also involves the limited resources available to care for the health of the population[1], and improving public health services is a global challenge[2].

Improving the quality of health services can be done by expanding the supply and scope of health services, or even through the health sector[3]. Among the factors affecting the performance of health services are the excessive or insufficient supply of health services, inadequate health teams, medical errors, poor quality of care, corruption and lack of integration between health units[1].

In this sense, various studies have pointed to significant inefficiencies in social spending, including health-related spending, both in advanced economies and in emerging and developing economies. Even with lower levels of spending in the latter, these inefficiencies result in a considerable and unnecessary use of resources, and reducing this waste can contribute to improving much-needed health indicators[4].

Inefficiency in health systems is a global problem, and around 20% to 40% of all resources allocated to health are wasted[1]. For example, approximately 30% of health spending in the United States is wasted[5]. All countries and regions, regardless of their income, have the capacity to take measures to reduce inefficiency and improve quality in health services. This can be achieved through a local evaluation of the causes involved in this process[6], in order to compare the resources invested in health services and programs with the results measured by the government through indicators[7].

These evaluations require public managers to have the skill and knowledge to choose the right factors. Multicriteria Decision Analysis methods have therefore been increasingly used to aid decision-making, using

mathematical and programming techniques to select the most appropriate solution based on predetermined criteria, with the aim of minimizing errors[8,9].

It is worth noting that among the multi-criteria methods, the Analytic Hierarchy Process (AHP), created by Professor Thomas Lorie Saaty, stands out for its simplicity and ease of understanding[10]. Furthermore, the decisions made using the AHP are highly effective and are expected to contribute to objective decision-making[11]. Furthermore, the AHP can be used in conjunction with different techniques and is often combined with other methods[12].

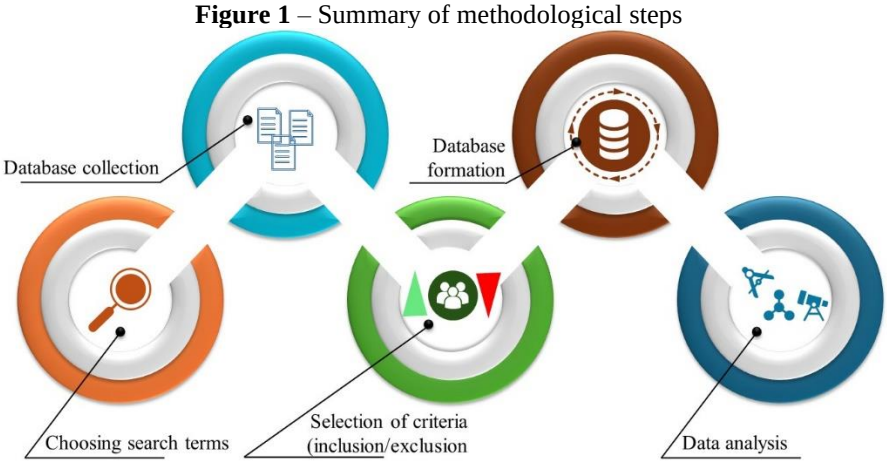
This study therefore aimed to understand how the AHP method is being applied to analyze the quality of health services around the world. In this way, it is hoped that this literature review will reveal to researchers, professionals and managers of organizations the state of the art of the subject, through a comprehensive and up-to-date view of the analysis of the quality of health services.

II. Material And Methods

Work on quality in health services is an important tool for planned and effective management and has been widely carried out around the world[13]. In this sense, some authors state that it is essential to carry out regular monitoring of health services in order to guarantee the continuous evaluation of quality, seeking to promote an improvement in user care[14].

In this way, this research began with a survey of articles that use the AHP method as a tool for evaluating health services. Papers were retrieved from the Web of Science (WoS) - Clarivate Analytics database, using the Capes Periodicals platform. WoS was selected because it is one of the main databases of scientific literature, covering a vast number of scientific domains[15] and therefore relevant for extracting articles related to the state of the art analyzed in this study. Based on this definition, the methodological approach of this study was developed in five stages (Figure 1).

Figure 1 – Summary of methodological steps



Source: Authors (2024).

The stage of gathering keywords is fundamental for a systematic review of the literature[16]. In order to analyze publications on the quality of health services using the Analytic Hierarchy Process, the terms health, healthcare, quality and AHP were selected for search in the Title, Abstract and Keywords fields.

The articles were then collected from the Web of Science database. The following search string was used: TI=((healthcare OR health) AND (quality) AND (AHP)) OR AK=((healthcare OR health) AND (quality) AND (AHP)) OR AB=((healthcare OR health) AND (quality) AND (AHP)).

Articles from the years 2021 to 2024 were then screened, all peer-reviewed to ensure that the publications were of a rigorous academic standard[16]. The search was carried out without delimiting the broad discipline or language, since the results were not too numerous.

In the third stage, the remaining articles were compared with a set of "exclusion criteria"[17], factors that may make an article unsuitable for review (Framework 1).

Framework 1 – Article inclusion and exclusion criteria

Step	Inclusion criteria	Exclusion criteria
1. Category Analysis	Articles from the areas of Occupational Environmental Public Health, Environmental Studies, Management, Health Sciences Services and Health Policy Services.	Articles from the fields of environmental sciences, engineering and technology.
2. Title analysis	Titles related to the theme of quality in health services and systems.	Titles related to the areas of sustainability, sanitation, the environment, logistics, supplies, the conduct of health professionals, people management, education and technology.
3. Summary analysis	Abstracts related to the theme of performance evaluation in health services and systems.	Abstracts related to safety and social relations, people management, education, business and governance.

Source: Authors (2024).

The definition of exclusion criteria was carried out in three stages to reduce the subjectivity of the selection and increase the compatibility of the selected articles with the review[18]. Therefore, articles referring to the areas of environmental sciences, engineering and technology were initially excluded. Then, works whose title was not directly linked to the analysis of the quality of health services were removed. Finally, the abstracts of articles with titles related to the researched topic were read, classifying them into three categories; the first with those whose subject was clearly corresponding to the theme of the review, the second contained those that – also clearly – had no relation to the theme. The third category contained those that required a more careful reading of the article text for classification.

Finally, after the final classification of the articles, the database was formed, which supported the bibliometric data analysis activities. It is worth noting that, to support work management, the Zotero reference manager software was used. On the other hand, the VOSviewer software was used in a complementary way to WoS itself to examine the metadata and operationalize the data analysis.

III. Result

In the initial stage, a survey was carried out in the WoS database of works related to quality assessment in the health area using the AHP method, aiming to identify works related to the subject. The search returned 324 publications between 2021 and 2024, which allowed the construction, through the Wordart tool, of a tags (Figure 2) with the terms most used by authors in a visual form[19].

Figure 2 – Tags of key search terms

Source: Wordart (2024).

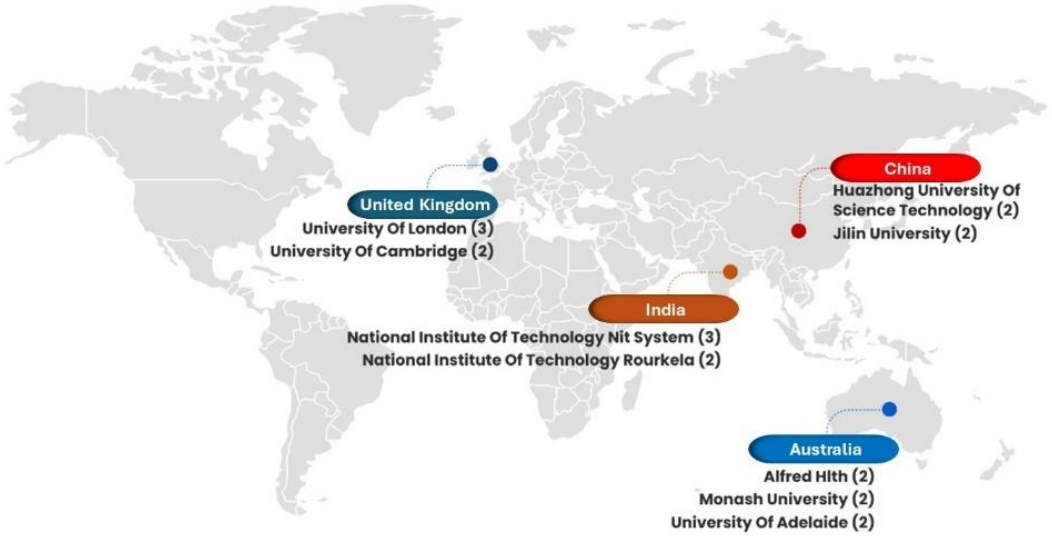
In the initial screening, articles published between 2021 and 2024 were filtered, resulting in 154 works that met the definition. The pre-selection analysis reinforces the scope of the topic, which in the health area has been applied in different areas (Figure 3).

Figure 3 – Treemap chart of main categories

Source: Web of Science (2024).

Certainly, the categories related to environmental sciences, engineering and technology represent the majority of publications, with 73.38% of the articles initially selected. On the other hand, the areas of Public Environmental Occupational Health (18), Environmental Studies (9), Management (7), Health Sciences Services (6) and Health Policy Services (5) are also relevant and denote the diverse use of the Analytic Hierarchy Process to assess quality in health services, representing 29.22% of the works.

Figure 4 – Incidence of publications from main institutions

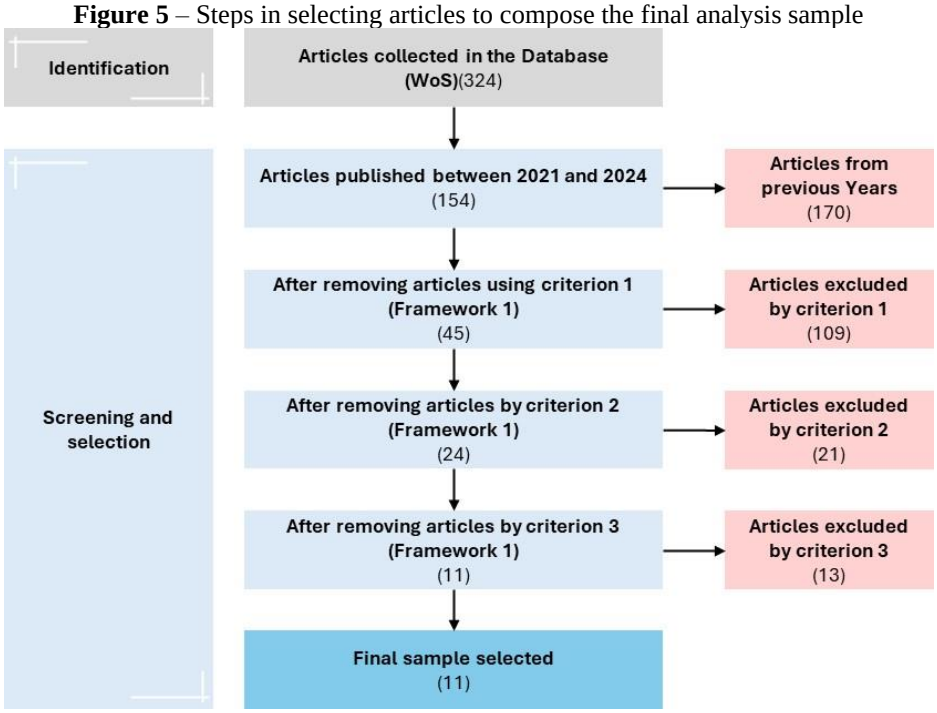


Source: Web of Science (2024).

Furthermore, identifying the institutions and countries with the highest production of publications is important as it helps to understand the contribution and interest in the research topic[20]. In this sense, when analyzing institutions with more than one publication, four countries stand out: Australia with 3 institutions, and the United Kingdom, India and China, with 2 entities each (Figure 4), totaling 44% of publications on the subject.

Subsequently, the works were screened based on exclusion criteria 2 and 3. In effect, articles related to the areas of sustainability, sanitation, environment, logistics, supplies, health professional conduct, people management, education, technology, business, governance, security and social relations. This filter resulted in the exclusion of 21 works based on the title and 13 based on the abstract, resulting in a sample of 11 articles selected for the final sample (Figure 5).

Figure 5 – Steps in selecting articles to compose the final analysis sample



Source: Authors (2024).

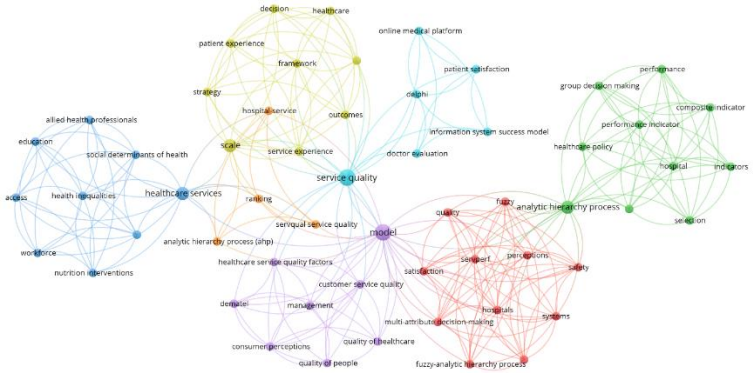
In this way, the analysis of the metadata of the final selected sample was conducted using the VOSviewer software (Figure 6), taking into account the co-occurrence of keywords used by the authors in the articles. This data analysis revealed the association of the Analytic Hierarchy Process (AHP) combined with other tools, such as the Delphi and Decision Making Trial and Evaluation Laboratory (DEMATEL) methods, Fuzzy logic, and the SERVPERF and SERVQUAL instruments, which provide a broader scope of the analyzed perspectives, thus such as considering data obtained from multiple forms and sources[21].

Furthermore, 57 keywords were detected, with a higher incidence of the terms Analytic Hierarchy Process and Healthcare Services, each with two occurrences, and Service Quality and Model, present in three articles. Consequently, the connection of studies with the health field is verified, using the AHP methodology for the development of decision-making models and evaluation of the quality of services in health care.

Quality in the provision of health services can be perceived in several ways and from different perspectives, including the perspectives of professionals, specialists and users, forming different views[22]. In fact, the analyzes indicate a comprehensive use of this methodology, involving the experience, satisfaction and perception of users, the results achieved by health care services, the social determinants of health and the interventions and decisions of professionals.

The keywords also highlight the use of the multi-criteria method for developing assessment frameworks, indicating a trend in its application, especially in the hospital environment. However, it is important to highlight that the possibility of applying AHP in several other areas of health should not be excluded, even being used in broader health systems.

Figure 6 – Steps in selecting articles to compose the final analysis sample



Source: VOSViewer (2024).

The analysis of the selected articles showed that the works were published in journals with a high impact factor, with many citations (Framework 2). Thus, it is observed that the studies presented, on average, a citation indicator (JCI) lower than 1, with an average of 2 citations, which denotes the lack of studies on the topic. In this context, the publications by Al Awadh (2022) stand out with 5 citations, and the articles by Senapati and Panda (2023), Gupta, Vrat and Ojha (2022) and Kadoić et al. (2021) with 4 each.

Framework 2 – Periodicals mapped in article selection

Authors	Periodicals	Impact Factor (JCR)	Journal Citation Indicator (JCI)	Total Periodical Citations	Article citations
Yu et al. (2024)	Frontiers in Public Health	5.2	1.19	28.184	0
Liu e Zhang (2023)	Frontiers in Public Health	5.2	1.19	28.184	0
Senapati e Panda (2023)	International Journal of Quality & Reliability Management	2.5	0.53	3.687	4
Liao et al. (2023)	Journal of Multidisciplinary Healthcare	3.3	0.94	3.689	0
Ritmak, Rattanawong e Vongmanee (2023)	International Journal of Environmental Research and Public Health	4.6	0.93	123.105	3
Wu et al. (2022)	BMC Public Health	4.5	1.10	75.282	0
Al Awadh (2022)	Sustainability	3.9	0.67	187.953	5
Zhang et al. (2022)	Global Health Research and Policy	8.7	1.08	1.132	2
Gupta, Vrat e Ojha (2022)	Journal of Health Organization and Management	1.4	0.52	1.368	4
Alp, Yilmaz e Geçici (2022)	International Journal of Occupational Safety and Ergonomics	2.4	0.71	2.670	0
Kadoic et al. (2021)	International Journal of Environmental Research and Public Health	4.6	0.93	123.105	4

Source: Authors (2024).

Furthermore, in a more in-depth analysis of the works, there is a prevalence of hybrid studies, which integrate AHP with other methodologies and techniques (Framework 3), in order to provide greater robustness to the results and, consequently, more success in evaluations[23].

Framework 3 – Final stratum of authors

Authors	Goals	Methodology, parameters and contributions
Yu et al. (2024)	Evaluate the inpatient services of 49 outsourced hospitals, using indicators from the diagnosis-related group payment system.	The AHP was used to evaluate eight indicators in 49 hospitals, which were classified into four grades: excellent, good, regular and poor. The study highlighted significant variations in service levels, and the results obtained helped to optimize resource allocation, improve the payment system and improve the quality and efficiency of inpatient services.
Liu e Zhang (2023)	Design a rating index system for physicians attending virtual consultations.	The AHP and Delphi methods were used to create an evaluation system for virtual medical consultation platforms. The research designed a framework based on bibliographical research and interviews with 23 experts. The result was the construction of an index of quality and capacity of doctors, which comprises three dimensions of quality (system, service and information), three first-level indicators, eight second-level indicators and sixty third-level indicators.
Senapati e Panda (2023)	Evaluate the quality of healthcare in private hospitals based on users' perceptions.	The Fuzzy AHP method was used to evaluate patient experiences in 3 categories of private hospitals: Nursing Homes (Up to 30 beds), Medium Hospitals (Between 30 and 100 beds) and Large Hospitals (Over 100 beds). To this end, the study evaluated the opinions of 244 patients on 6 criteria and concluded that high-level hospitals provide a better experience perceived by patients.
Liao et al. (2023)	Develop a virtual consultation quality assessment system.	AHP and Delphi were used to create a quality assessment system for virtual medical consultations, involving a combination of existing scales, literature review and consultation with fourteen experts to determine the assessment criteria. The result was a framework composed of three main indicators, ten secondary and thirty-two tertiary indicators, related to medical communication and patients' experiences.
Ritmak, Rattana wong e Vongma nee (2023)	Develop a sustainability assessment model that integrates the health dimension with three other dimensions used in sustainable development studies.	The study used the Technique of Order of Preference by Similarity to the Ideal Solution (TOPSIS) and the AHP and included the participation of experts to build a sustainability assessment framework with four dimensions and fifteen criteria, based on the standard of sustainability indicators. health of the World Health Organization and the United Nations for the Sustainable Development Goals.

Wu et al. (2022)	Develop a framework of indicators to evaluate the performance of primary Tuberculosis control institutions.	The Delphi method was used to establish a structure of indicators to evaluate performance in primary Tuberculosis control institutions and the AHP was used to determine the weights of the indicators. The research involved fourteen experts with at least ten years of experience, who carried out two rounds of consultations, resulting in a table that included two first-level indicators, ten second-level indicators and 37 third-level indicators.
Al Awadh (2022)	Identify criteria for improving hospital health services.	The AHP technique was used to model the five dimensions of SERVQUAL along with two dimensions and 31 sub-criteria. Three health service organizations were selected for evaluation based on the performance of service quality, based on patients' perceptions.
Zhang et al. (2022)	Develop a set of indicators for China's surgical tourism sector.	The research was based on the Donabedian model and used AHP with a two-round Delphi consultation with thirteen experts. A literature review and focus group interviews were carried out, which identified three dimensions, nine criteria and 39 quality sub-criteria to improve the safety and quality of healthcare.
Gupta, Vrat e Ojha (2022)	Identify priority factors that impact the quality of health services.	The study used a hybrid model with different tools, the AHP, Analytic Network Process (ANP), Stepwise and DEMATEL methods. The research included the participation of 22 experts and considered eight different factors, concluding that the five priority factors for quality in health services are: Doctor Quality, Doctor Availability, Quality of Support Staff, Quality of Nursing Staff and Availability of Support Personnel.
Alp, Yilmaz e Geçici (2022)	Evaluate the quality of occupational health and safety services from the perspective of experts.	The SERVPERF instrument, AHP and Fuzzy AHP were used. The study included the participation of 382 occupational health and safety experts and evaluated five criteria and 22 sub-criteria. The results confirmed the relevance of incorporating expert assessments into the evaluation process and showed that safety and empathy are the most relevant criteria.
Kadoic et al. (2021)	Identify the best performing public acute care hospitals in Croatia.	The study applied a multi-criteria approach to create a method for ranking the best hospitals in Croatia. The research used a combination of composite indicators and the AHP, focusing on three hospital clinical areas: acute myocardial infarction, cerebrovascular insult and antimicrobial prophylaxis in colorectal surgery. The study considered 20 criteria and had the participation of 36 experts. The results showed that the composite indicators, together with the AHP, are effective in assessing the quality of healthcare at a strategic level.

Source: Authors (2024).

Studies have maintained the initial essence of the AHP, based on consultation of academic and technical bibliographies, associating literature criteria with the opinions of experts and stakeholders[24]. Although the work has shown a greater focus on hospital institutions, considered one of the most important and demanded public services in public health in general[23,25], the possibility of application in the most diverse health services is also observed.

IV. Conclusion

Bibliometric analysis is an effective tool for obtaining a holistic view of a specific area of research. In this sense, the objective of this work is to elucidate the state of the art in health quality research using AHP, through the identification of trends, approaches, application and other relevant factors. Thus, these analyzes provide the possibility of applying the AHP method to assess quality in different areas of healthcare, offering guidelines for future work.

The results showed that AHP is widespread in the areas of environment and engineering. However, its importance for the management and provision of health services cannot be ruled out. Furthermore, it is possible to highlight a concentration of publications in four countries: Australia, the United Kingdom, India and China, which denotes greater concern with the quality of healthcare in these places.

Furthermore, the methodology proposed by Prof. Thomas Lorie Saaty[24], seeks to solve problems through the conceptualization and structuring of the understanding of the human mind and the works highlighted the possibility of applying AHP in a hybrid way, with other techniques and methods, in order to increase the tool's ability to solve problems. In this way, the use of the multi-criteria method allows the creation of quality assessment frameworks for different health services.

Additionally, the selected works were published in journals with a high impact factor and a large number of citations. On the other hand, the research topic proved to be lacking in the area, with few publications and citations, when compared to journals in general. It is worth noting, however, that these numbers do not reveal the importance of the publications, which showed promise for application in different areas of health, with the capacity to evaluate systems and improve services.

Finally, it is worth highlighting that this work was limited to analyzing publications in the WoS database, from the period between 2021 and 2024 and the results may change in the future, considering that new topics may arise and other bases for research may be included. In any case, the results of this bibliometric analysis highlight

the possibility of new applications, since the methodology proved to be versatile and with the possibility of integration with other techniques.

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