Received: 29 August 2023 | Accepted: 9 October 2023

DOI: 10.1111/1556-4029.15409

JOURNAL OF FORENSIC SCIENCES AAFS

ORIGINAL PAPER

Anthropology

The over-citation of *Daubert* in forensic anthropology

Kate M. Lesciotto JD, PhD[1] | Angi M. Christensen PhD[2]

[1]University of North Texas Health Science Center, Fort Worth, Texas, USA

[2]Federal Bureau of Investigation, Laboratory Division, Quantico, Virginia, USA

Correspondence
Kate M. Lesciotto, University of North Texas Health Science Center, 3500 Camp Bowie Blvd, Fort Worth, TX 76107, USA.
Email: kate.lesciotto@unthsc.edu

Funding information
National Science Foundation, Division of Social and Economic Sciences, Grant/Award Number: 2214747; National Institute of Justice, Grant/Award Number: DOJ-NIJ-22-RO-0007

Abstract

The 1993 US Supreme Court decision *Daubert v. Merrell Dow Pharmaceuticals, Inc.* presented new guidance for the judicial assessment of expert witness evidence and testimony in the determination of admissibility. Despite the rarity of admissibility challenges to forensic anthropology evidence, *Daubert* is frequently cited in published forensic anthropology research. This study undertook a qualitative thematic analysis of forensic anthropology articles published in the *Journal of Forensic Sciences* to assess why authors continue to cite *Daubert* and express concerns over potential exclusion. The results show a significant increase in the number of articles that cite legal admissibility standards over time ($p < 0.001$). Authors frequently cite these standards to contextualize their results within the *Daubert* framework or to justify the need for their research. Notably, many articles present *Daubert* as a constraining force, misinterpreting the guidelines as rigid criteria or that they require methods to be strictly quantitative. However, *Daubert* was intended to be a flexible tool for judges—not a standard or instruction for scientists. While it was reasonable to reflect on the scientific rigor of methods in the wake of the *Daubert* decision, a new perspective is warranted in which forensic anthropologists shift their focus from trying to "satisfy" admissibility guidelines to adopting quality assurance measures that minimize error and ensure confidence in analytical results, and developing and using methods that are grounded in good science—which is important regardless of whether or not the results are ever the subject of a trial.

KEYWORDS
Daubert, expert witness evidence, forensic anthropology, legal admissibility standards, qualitative data, quality assurance, quantitative data

Highlights

- Approximately 10% of forensic anthropology articles in *JFS* reference an admissibility standard.
- Authors began citing *Daubert* to justify the need for their research starting in 2005.
- *Daubert* has been misinterpreted as requiring certain factors or the use of only quantifiable data.
- Forensic anthropologists should focus on principles of good science and quality assurance.

Portions of this research were presented at the 74th Annual Scientific Conference of the American Academy of Forensic Sciences, February 21–25, 2022, in Seattle, WA, and at the 92nd Annual Meeting of the American Association of Biological Anthropologists, April 19–22, 2023, in Reno, NV.

1 | INTRODUCTION

Forensic practitioners should be aware of the laws, rulings, and legal procedures related to forensic science practice and testimony for the jurisdictions in which they work. One ruling highly relevant to forensic science expert testimony in the United States is the Supreme Court decision *Daubert v. Merrell Dow Pharmaceuticals, Inc.* (1993) [1], which set forth guidelines for judicial evaluation of the admissibility of scientific expert witness evidence and testimony. Prior to 1993, federal and many state courts followed *Frye v. US* (1923) [2], which directed judges to base their admissibility determination on whether the expert witness used methods that enjoyed "general acceptance" within the relevant scientific field. In *Daubert*, the Court clarified Federal Rule of Evidence 702 (1975) [3] and held that "general acceptance" was not a prerequisite. Rather, through *Daubert* and several subsequent decisions, the Court provided a flexible set of guidelines for judicial evaluation of expert evidence admissibility. Factors that could be taken into account included assessments of whether the expert's methods were validated, had known error rates, and conformed to relevant standards. The result of these Supreme Court decisions was ultimately to provide the potential for the admission of relevant expert testimony that, while based upon reliable research, may not have yet gained wide acceptance or adoption within the field. More in-depth discussions of *Daubert* and the relevant subsequent Supreme Court decisions can be found within the legal literature (e.g., [4–7]).

Admissibility of scientific evidence within legal contexts remains, and certainly should be, a subject of great interest among forensic practitioners. Beginning in 2004, forensic anthropologists began drawing attention to the *Daubert* guidelines and commenting on the need for greater objectivity, standardization, and more rigorous testing in forensic anthropology, specifically in methods of personal identification [8, 9]. As part of the medicolegal field, this self-reflection and striving for a more empirical basis for anthropological methods were positive outcomes of contemplating admissibility criteria. Three decades later, however, forensic anthropologists continue to be preoccupied with perceived problems of admissibility of forensic anthropology evidence, frequently citing *Daubert* in the context of their research. Between 2005 and 2014, there were 537 references to *Daubert* in the annual Proceedings of the American Academy of Forensic Sciences, of which 23% were from the Physical Anthropology section [10]. Additionally, within the *Journal of Forensic Sciences*, nearly 150 articles published between 1993 and 2014 referenced *Daubert*, with 43% of those articles discussing issues related to forensic anthropology [10]. This preoccupation seems inconsistent with the actual impact of *Daubert* on the field—in the two decades that followed the *Daubert* decision, only a single instance of judicial exclusion of forensic anthropological expert witness evidence was located in a study of published judicial opinions [11]. This decision dealt with a photographic comparison between video surveillance footage and a defendant [12], a topic that would not generally be considered within the modern scope of forensic anthropology.

This apparent disconnect between the actual and the perceived impact of *Daubert* may have stemmed, in part, from a fear that forensic anthropology methods were viewed as more subjective, since many are qualitative rather than quantitative, as compared to other disciplines such as DNA analysis. Some practitioners have advocated for a shift to more quantitative methods in forensic anthropology (e.g., [13, 14]), but non-quantitative does not necessarily mean subjective or invalid; both qualitative and quantitative data can be evaluated empirically and statistically. Nothing in *Daubert* or any subsequent Supreme Court decision mandates methods to be quantitative or purely objective in order to be admissible.

There also may have been a concern that revealing error rates might appear to lessen the method's relevance or render it inadmissible (e.g., [15]). Some researchers have interpreted *Daubert* as having an implied minimum level of accuracy for methods to be admissible [16, 17], while others have created standards, stating that a method must have an accuracy rate of at least 80% and observer error rates less than 10% in order to be admissible under *Daubert* [18], or that 90% coverage for an age estimate meets the reliability standard outlined in *Daubert* [19]. These are over-interpretations of the *Daubert* guidelines, which do not address acceptable limits for accuracy or error rates (which may vary depending on the discipline, the method, or even the context of a particular case). Rather, a demonstration or description of *how* reliable the method is will likely be taken into consideration by a judge ruling on admissibility. Information regarding a method's accuracy rate or observer error rates can be communicated to a jury, who can then consider how much weight to attribute to the evidence being presented by the expert witness [20].

The *Daubert* guidelines ultimately reflect a desire for admitted expert testimony to have a basis in good science. Good-quality research resulting in scientifically valid methods combined with clearly communicated limitations is sufficient for a secure foundation for forensic anthropologists in the courtroom [21]; admissibility standards are not a necessary pretext for doing good research, which should be considered the desirable end unto itself [22]. Nonetheless, the *Daubert* guidelines continue to preoccupy forensic anthropologists, with authors frequently citing *Daubert* or other admissibility standards as motivation or justification for their research.

This research takes a qualitative approach to examining how *Daubert* has been discussed within the forensic anthropological literature in order to better understand why researchers continue to formulate their experimental design and/or results within the *Daubert* framework. With this data, we hope to initiate a dialogue as to whether (mis)interpretations of legal admissibility standards may actually be constraining advances in the discipline of forensic anthropology.

2 | MATERIALS AND METHODS

To assess how *Daubert* and other relevant legal standards for the admissibility of expert witness evidence have been discussed within the forensic anthropology literature, a bibliometric approach was

used to curate a corpus of data, which was then subjected to qualitative thematic analyses. The *Journal of Forensic Sciences (JFS)* was selected for this study as it is the official publication of the American Academy of Forensic Sciences and for its long history of publishing forensic anthropological research. Volumes 18–65 were included in this study; volumes 1–17 of *JFS* were not readily available in digital format and were therefore excluded.

An initial corpus of data, consisting of all forensic anthropology articles published by *JFS* between 1972 and 2020, was curated by conducting several searches (Figure 1). Volumes published from 1972 through mid-2002 did not include categories of forensic specialties (e.g., "Anthropology" or "Toxicology"); therefore, articles published in these volumes were evaluated by (1) reviewing the titles of all articles for relevance to forensic anthropology and (2) focused keyword searching of the full text of all articles for the terms "anthropology," "bone," "skeletal," or "skeleton." From mid-2002 to 2020, *JFS* included forensic specialty categories within the Table of Contents of each volume. Any article published under the categories of "Anthropology" or "Physical Anthropology," including articles cross-listed with additional specialties, was included in the initial dataset. Letters to the editor, author responses, and book reviews were excluded. This initial body of data contained 1257 articles.

A secondary review was conducted to confirm relevance to forensic anthropology through either a full-text (for articles published prior to 1980 that lacked a published abstract) or abstract-only (for articles published after 1980) review. Each article's general topic within forensic anthropology was recorded based on the coding strategy of Bethard and DiGangi [23]. Articles focused on forensic odontology or dental anthropology were excluded, as were other topics deemed to be outside of the traditional bounds of forensic anthropology (e.g., forensic entomology, forensic botany, forensic hair analysis). This screening process excluded 115 articles, yielding a final dataset of 1142 published forensic anthropology articles.

A final keyword search was conducted to create a subset of articles that cited or referred to either *Daubert* or another legal standard relating to the evidentiary admissibility of an expert witness's testimony. Articles were searched for any of the following terms: *Frye*, *Daubert*, *Kumho*, court, judicial, judge, legal, testimony, or witness. The full text of any article that used any of these terms was reviewed to assess the context of those terms. As it was impossible to know the author's original intent, the inclusion criteria were applied broadly. For example, an article that used the term "witness" in reference to witnessing a crime would be excluded, but an article that used the term "witness" to refer to a forensic anthropologist acting as an expert witness and providing some type of evidence in a court of law would be included. As a result, the final dataset encompassed articles with wide variability in terms of both how explicitly (e.g., a specific citation to a legal decision such as *Daubert* versus a more vague reference to "scientific principles that are acceptable in courts of law" [24]) and how in-depth (e.g., an article providing detailed discussion of how a specific method may or may not be admissible versus a single citation to *Daubert*) legal standards were discussed.

Based on these criteria, 123 articles were coded as referencing, discussing, or citing some type of legal admissibility standard. These articles were further categorized according to whether they specifically cited or discussed *Daubert*. A chi-square test of trend in proportions, also known as a Cochran–Armitage test, was conducted to determine whether there had been a significant change over time in the proportion of published articles that cited legal admissibility standards. Statistical analyses were performed using R Studio.

A thematic analysis of the articles citing or discussing relevant legal standards was conducted following qualitative research methods [25, 26]. Thematic analysis is a flexible qualitative research method that allows for the identification, organization, and analysis of themes within a text-based dataset [25]. An inductive approach was taken, allowing patterns to emerge from the data, rather than approaching the data with a preconceived theory or hypothesis [27].

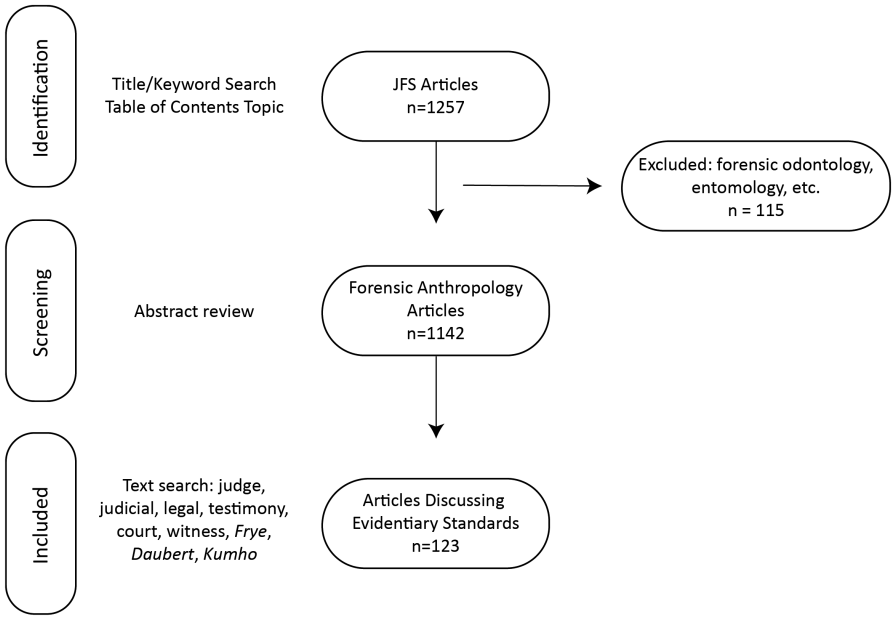

FIGURE 1 Identification and screening process for articles published in the *Journal of Forensic Sciences* from 1972 to 2020.

The initial analysis for this research was an iterative process (Figure 2). The full text of the 123 articles identified as referencing, discussing, or citing a legal admissibility standard was reviewed to identify where in the text these standards were mentioned. These sections of text were further examined, noting why and how these legal standards were being discussed in order to generate an initial set of codes. These initial codes were then reviewed for commonalities, refined, and standardized by referring back to the original text of the articles. Natural groupings of similar codes emerged as themes. The dataset was then re-reviewed a final time to confirm the appropriate matching of article text, initial codes, and identified themes. Themes were not mutually exclusive, so articles could be coded as containing more than one theme.

3 | RESULTS

The data were first examined to detect trends in how frequently forensic anthropology articles discussed legal admissibility standards.

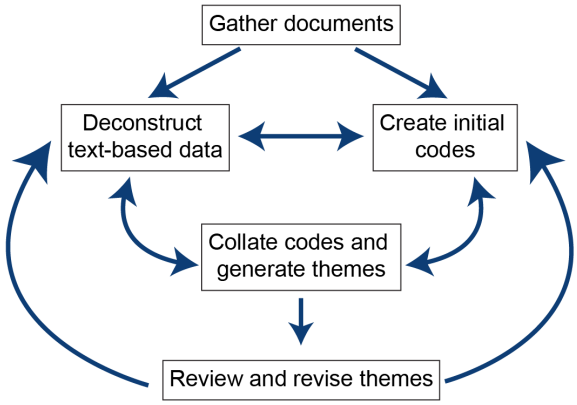

FIGURE 2 Process of qualitative thematic analyses of forensic anthropology articles that cited or discussed legal admissibility standards.

Out of the 1142 forensic anthropology articles that were reviewed, 123 articles cited or discussed standards related to the judicial determination of admissibility for expert witness evidence, including 85 articles that specifically cited or discussed *Daubert* (Figure 3). The other legal admissibility standards that were referenced included, among others, *Frye*, the US Federal Rules of Evidence, or general references to "judicial scrutiny" or "demanding legal requirements."

The number of forensic anthropology articles that discussed legal admissibility standards represented approximately 10% of the total number of articles, and the chi-square test of trend in proportions detected a significant increase over time in the proportion of these articles ($p < 0.001$). Notably, the first specific reference to *Daubert* did not occur until 2004, more than 10 years after the *Daubert* decision was issued by the US Supreme Court.

During the thematic analysis, a total of eight themes emerged (Table 1). Articles most frequently referenced legal standards to provide a general background of the framework that governs the admissibility of expert witness evidence, without providing any explicit connection to the research being described. Authors also frequently cited legal admissibility standards to provide context for the reported results, such as describing how the reported method might meet certain *Daubert* factors. In other publications, legal standards were referenced to provide a reason or justification for why the research being described in an article was needed. Authors also framed previously published research or the state of the field within legal admissibility standards, perhaps to point out potential or hypothetical deficiencies in existing methods that might not be viewed as admissible under judicial scrutiny. Less frequently, articles described legal admissibility standards to advocate for the need for future research on particular topics, in relation to the use of a method in a specific court case, as part of a theoretical analysis of *Daubert* or other standard and the potential impact on forensic anthropology, or with respect to the training or role of forensic anthropologists. Brief examples of text representing each theme are provided in Table 1.

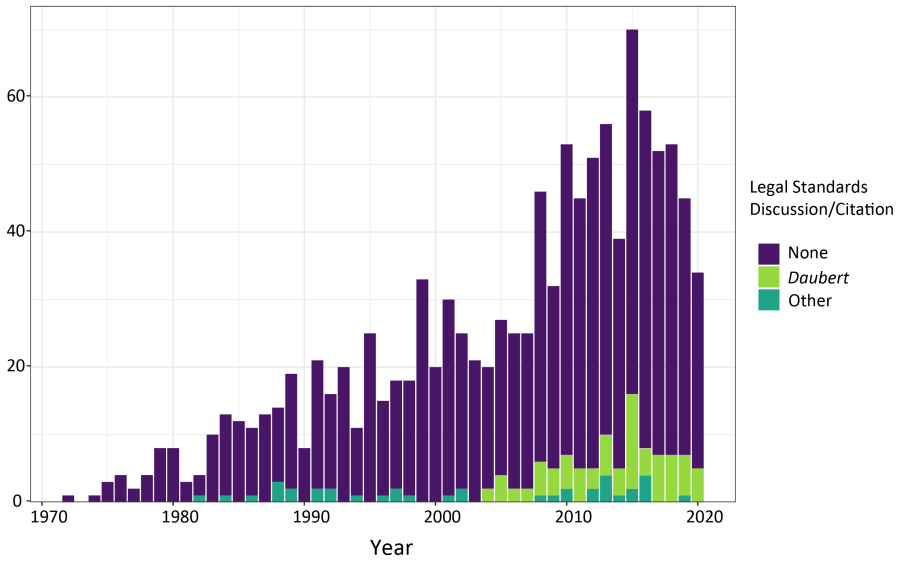

FIGURE 3 Number of forensic anthropology articles published in the *Journal of Forensic Sciences* each year, color-coded according to whether the article cited *Daubert* (light green), another legal admissibility standard (teal), or no legal admissibility standard (purple).

TABLE 1 Themes identified during the qualitative analysis from each article's discussion of *Daubert* or other legal admissibility standard. A representative example is provided for each theme.

Theme	*n*	Example (internal references omitted)
General background of legal framework	62	"The *Daubert* ruling provided the following as guidelines for use by the courts in evaluating expert testimony, that: (i) the theory is testable by the scientific method; (ii) it has been peer-reviewed; (iii) it is associated with an established reliability with a known error rate; and (iv) it is generally accepted within the relevant scientific community." [28]
Contextualizing the reported research results	43	"This method appears to satisfy the requirements of *Daubert's* guidelines of scientific validity by establishing a standard methodology for hand radiograph analysis, testing the technique, and noting rates of error." [29]
Justification for current research	23	"As with the development of any new technique in the forensic sciences and forensic anthropology, body mass estimation methods must be rigorously tested to meet standards for admissibility of scientific evidence in medicolegal investigations. The purpose of this paper is to investigate the accuracy and fidelity of a recent ST-BIB method proposed by Schaffer from a large dataset of modern young adult individuals with healthy body fat percentages in the Third National Health and Nutrition Examination Survey (NHANES III) 1988–1994." [30]
Framing previous research/state of the field	13	"In particular, Hefner critiques Rhine by arguing that the trait lists exclude a significant amount of human variation by relying heavily on a typological, experience-based approach that is dependent on extreme trait expressions, which is problematic in light of the high-caliber science and methodological standardization required by the *Daubert* rulings." [31]
Advocating for future research	7	"While historically age estimation was regarded as 'ultimately an art, not a precise science', in the face of *Daubert* and our current era of validation and scientific rigor, these issues need to be addressed." [32]
Prior use of a method in a specific court case	6	"The photographic superimpositions and composite tracings we prepared as evidence in the case of *Crown v. Lain* were accepted as positive identifications by counsel for the defense and the prosecution in the High Court of Hong Kong." [33]
Theoretical analysis of *Daubert* or other legal standard	6	Articles coded as containing this theme generally discussed *Daubert* or legal standards extensively throughout the text. Examples include [9, 21, 34]
Training/role of forensic anthropologists	3	"Given the variety of training formats and content as revealed by this survey, questions must arise about comparability, which in turn, give rise to questions regarding the definition of a 'forensic anthropologist'. This may eventually have consequences in the judicial arena regarding the awarding of expert witness status." [35]

The occurrence of these themes was also examined over time (Figure 4). Notably, the theme of using a legal admissibility standard to justify the described research was only recognized in articles published after 2004, when *Daubert* began being specifically cited within the forensic anthropological literature.

Articles discussing parameters of the biological profile (e.g., estimations of age, sex, ancestry/population affinity, or stature) represented 36% of the total number of forensic anthropology articles examined in this study (Table 2). When examining the number of articles that referred to legal admissibility standards by topic within forensic anthropology, biological profile articles also represented the highest raw number of articles referencing these legal standards; however, proportionally, articles relating to methods of positive identification (e.g., frontal sinus comparison), osteometrics or laboratory procedures (e.g., observer error studies for skeletal measurements), and isotopes or elemental analyses (e.g., isotopic composition of bone or cremains) also frequently included discussion of admissibility standards. Articles focused specifically on legal issues within forensic anthropology or the ethics or theory of practicing forensic anthropology also frequently (and not unexpectedly) discussed admissibility standards.

Articles that focused on taphonomy, postmortem interval estimation, skeletal trauma, or toolmark analysis were less likely to explicitly recognize or discuss legal admissibility standards. As an example, 132 articles were coded as relating to taphonomy or the postmortem interval, yet only 4 of these articles discussed *Daubert* or issues of admissibility standards. Even focusing on articles published after 2004, only 3 out of 91 taphonomy or postmortem interval articles discussed legal standards. Similarly, 128 articles in the overall dataset discussed skeletal trauma or toolmark analysis, but only 10 (all of which were published after 2004) discussed admissibility standards, with 7 specifically referencing *Daubert*.

4 | DISCUSSION

Admissibility rules and guidelines within the United States, such as the Federal Rules of Evidence and the *Daubert* decision, are meant to serve as guidance for legal practitioners as they relate to the judicial evaluation of evidence. These rules and guidelines were never intended to set standards for or instruct scientists on how to perform research. The use of *Daubert* as a standard for framing research

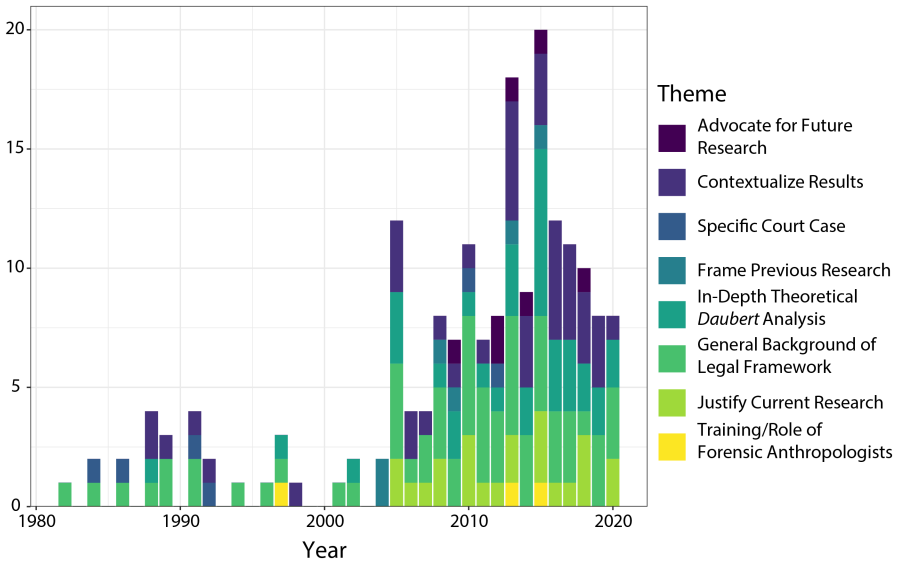

FIGURE 4 Thematic analysis of forensic anthropology articles published in the *Journal of Forensic Sciences* from 1972 to 2020.

TABLE 2 Frequency of topic categories of forensic anthropology articles, and the number of articles within each topic that cite *Daubert* or other admissibility standard.

Topic	Total (%)	Number discussing an admissibility standard (% of total)
Biological Profile	411 (36.0)	58 (14.1)
Taphonomy/Postmortem Interval	132 (11.5)	4 (3.0)
Trauma/Toolmarks	128 (11.2)	10 (7.8)
Positive Identification	103 (9.0)	15 (14.6)
Facial Approximation	99 (8.7)	13 (13.1)
History	36 (3.2)	1 (2.8)
Field Methods/Forensic Archaeology	35 (3.1)	0 (0)
Osteometrics/Laboratory Procedures	31 (2.7)	7 (22.6)
Isotopes/Elemental Composition	27 (2.4)	4 (14.8)
Skeletal Pathology/Variation	27 (2.4)	0 (0)
Histology/Bone Anatomy/Bone Identification	25 (2.2)	2 (8.0)
DNA Analyses	19 (1.7)	0 (0)
Commingling	19 (1.7)	1 (5.3)
Human Rights/Humanitarian Issues	13 (1.1)	0 (0)
Processing/Maceration	13 (1.1)	0 (0)
Legal Issues	11 (1.0)	5 (45.5)
Ethics/Theory	9 (0.8)	3 (33.3)
Secular Change	4 (0.4)	0 (0)
Total	1142	123

design or arguing that results show that a method would be admissible under *Daubert* shows a general misunderstanding of the ruling and how the guidelines were meant to be applied. *Daubert* acts as binding precedent on judges; it does not dictate the boundaries of scientific research for forensic anthropologists or any other practitioners. Perhaps more importantly, *Daubert* was always intended as a flexible inquiry, and the factors enumerated in the opinion are only examples of what judges might find useful in determining whether the expert evidence or testimony at issue was based on reliable scientific principles.

Forensic anthropologists were clearly aware of legal admissibility standards well before the *Daubert* decision was issued. The first reference to these legal standards in a forensic anthropology article published in *JFS* occurred in 1982 (Figure 3); however, discussion of legal admissibility standards remained sporadic through the early 2000s. It was not until 2004 that citations to *Daubert* first appeared and that the overall number of articles discussing *Daubert* or other admissibility standards began to rise. The results of this study showed a significant increase in the proportion of forensic anthropology articles in *JFS* that cite admissibility standards

over time, and this trend appears to be continuing. Even after the publication of data showing that admissibility challenges to forensic anthropology expert witness evidence or testimony are exceedingly rare [11], concern over *Daubert* remains prevalent within *JFS* publications. Temporal differences seen in the thematic analysis also reveal interesting trends. While most themes were identified in articles published chronologically early in the dataset, authors only began discussing admissibility standards to justify the need for their research after *Daubert* was specifically cited by forensic anthropologists. It seems likely that this perceived need to justify research is related to a fundamental misunderstanding of how *Daubert* was intended to be applied in judicial inquiries.

Examples of this misunderstanding within forensic anthropology are demonstrated by the use of language that exceeds that of the *Daubert* ruling. Approximately half of the articles that cited *Daubert* did so using constraining language, referring to the factors or guidelines as "criteria" or stating that one or more factors were "required," often in the introduction sections of the paper when providing a general background of the relevant legal framework (e.g., [15, 36–41]). Some authors went further in their interpretations, implying or expressly stating that purely objective or quantitative methods were required by *Daubert* (e.g., [36, 42–44]). Joubert and colleagues stated that "[t]he *Daubert* criteria **require** … methods to be scientifically tested, reliable and replicable, and therefore, **objective and quantitative**" (emphasis added) [36]. Similarly, Casado and colleagues asserted that testifying forensic anthropologists "must show that their methods are **empirical, objective** techniques" to pass *Daubert* (emphasis added) [42].

Following this belief that *Daubert* provided a checklist of requirements for analytical methods, authors frequently contextualized their results within the *Daubert* framework, concluding that their method would "satisfy" *Daubert* or be deemed admissible by a judge (e.g., [15, 29, 41]) or alternatively stating that existing methods would fail to satisfy *Daubert* (e.g., [40, 45]). However, judges are the final arbiters of admissibility, not scientists. A basis in good science, including structured research design, standardized and well-defined methods, and evaluations of accuracy and precision, will help ensure that a method is determined to be reliable, and therefore admissible, by a judge, see also [22]. Moreover, admissibility also depends on the expert's qualifications and the relevance of the proffered evidence or testimony, so even the most valid and reliable of methods may be deemed inadmissible for other reasons.

The fact that studies addressing aspects of biological profile estimation comprised the highest proportion of papers citing admissibility standards is curious in light of the fact that this type of anthropological analysis is the least likely to be at issue during a legal proceeding. Biological profiles are typically estimated as a means of generating leads in the search for a potential match and are not a form of personal identification (nor do they make any connections between victim–suspect–scene). Typically, by the time a case reaches the courtroom, the decedent has already been identified. This fact does not, however, diminish the importance of biological profile analyses. Rather, this further highlights the need for valid and reliable methods whether or not the results ever see a courtroom.

While citation of *Daubert* is common within the biological profile literature, articles discussing estimation of the postmortem interval, skeletal trauma analysis, or taphonomic influences on human remains are less likely to cite admissibility standards. This finding is particularly interesting, as these topics are the most likely to be the subject of court testimony [11, 46]. This disassociation may be related to the continued use of descriptive or qualitative methods to analyze decomposition or skeletal trauma and taphonomy, versus more quantified approaches.

The perceived need for greater quantification may be tied to a desire for the discipline of forensic anthropology to be recognized as more of a "hard" versus "soft" science [47] or in response to challenges to its legitimacy as a standalone scientific field [48]. The general call for a paradigm shift away from qualitative methods in favor of quantitative methods may have been a defensive response, as forensic anthropologists sought to shore up the field's reputation as a "hard science," under the assumption that "good science" and being "scientists" require objective, quantitative data. Forensic anthropology is a science that deals in large part with observations of human variation (i.e., biological profile information) and interpretation (i.e., trauma analysis), in which there will always be uncertainty and some degree of subjectivity. In many cases, this cannot be overcome with better technology or more robust statistics. What it does necessitate is that results are presented clearly, including potential error rates and limitations. Most jurors will understand the limitations of forensic anthropological analyses if they are clearly communicated.

It is not necessary that the discipline of forensic anthropology becomes completely quantified or that all methods are strictly objective. While quantitative methods are often more amenable to certain statistical analyses, qualitative does not mean unreliable, and there is neither a need nor would it be possible to completely quantify the discipline [21]. One proposed approach is a "mitigated objectivity" [47], in which inherent biases and subjectivities are recognized and mitigated. While quantitative data and analyses can help constrain subjective biases, forensic anthropologists do not need to forego qualitative techniques, so long as those techniques are still based on good scientific principles [47]. Moreover, the incorporation of quality assurance measures into casework practices can help minimize the risk of errors [21, 22]. These measures should include method validation, appropriate education and training, adherence to professional standards and best practices, instrument calibration and maintenance, and independent peer/technical reviews of casework. It is also important that the limitations of methods are clearly documented and communicated to avoid any mis- or over-interpretation of results. Rather than maintaining a hyper-focus on quantification and fear of perceived admissibility challenges, we suggest that researchers and practitioners embrace both quantitative and qualitative data, observational and experimental studies, and methods based on metric and morphological characteristics when founded on the use of appropriate scientific principles.

5 | CONCLUSION

While a reasonable impetus for evaluating the scientific rigor of forensic anthropology methods, *Daubert* does not need to be invoked to justify doing good science. We suggest that a new perspective is warranted in which forensic anthropologists shift their focus from trying to "satisfy" admissibility guidelines to developing and using methods that are grounded in good science, as well as adopting quality assurance measures to ensure that practitioners, customers, stakeholders, and the judicial system have confidence in analytical results. While forensic anthropologists should be aware of legal standards that apply to expert witness evidence and testimony, these standards do not need to be such a concern that they constrain research and advancement of the field. Instead, the focus should be on ensuring that methods are grounded in good science, which should be the goal regardless of whether the results are ever the subject of expert testimony. Such a perspective will both advance the field of forensic anthropology and ensure its continued viability within medicolegal investigations.

ACKNOWLEDGMENTS

Thank you to Dr. Jonathan Bethard and Dr. Elizabeth DiGangi for generously sharing the raw data and coding strategy used in their 2019 publication on the topics of forensic anthropology articles published in the *Journal of Forensic Sciences*.

FUNDING INFORMATION

This research was funded in part by National Science Foundation Grant No 2214747 (co-funded by the National Institute of Justice DOJ-NIJ-22-RO-0007).

CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to declare.

DISCLAIMERS

This is publication number 23.18 of the Laboratory Division of the Federal Bureau of Investigation. Names of commercial manufacturers are provided for information only, and inclusion does not imply endorsement by the FBI or the US Government. The views expressed are those of the authors and do not necessarily reflect the official policy or position of the National Science Foundation, the National Institute of Justice, FBI, or the US Government.

ORCID

Kate M. Lesciotto https://orcid.org/0000-0001-9537-5750

REFERENCES

1. Daubert V. Merrell Dow Pharmaceuticals, Inc. 509 U.S. 579. 1993.
2. Frye v. United States. 293 F. 1013. 1923.
3. Federal Rule of evidence, Rule 702. 1975.
4. Vickers AL. *Daubert*, critique and interpretation: what empirical studies tell us about the application of *Daubert*. USFL Rev. 2005;40:109–48.
5. Cheng EK, Yoon AH. Does *Frye* or *Daubert* matter—a study of scientific admissibility standards. Va L Rev. 2005;91:471–514.
6. Saks MJ, Faigman DL. Expert evidence after *Daubert*. Annu Rev Law Soc Sci. 2005;1:105–30.
7. Groscup JL, Penrod SD, Studebaker CA, Huss MT, O'Neil KM. The effects of *Daubert* on the admissibility of expert testimony in state and federal criminal cases. Psychol Public Policy Law. 2002;8(4):339–72. https://doi.org/10.1037/1076-8971.8.4.339
8. Christensen AM. The impact of *Daubert*: implications for testimony and research in forensic anthropology (and the use of frontal sinuses in personal identification). J Forensic Sci. 2004;49(3):1–4. https://doi.org/10.1520/JFS2003185
9. Rogers TL, Allard TT. Expert testimony and positive identification of human remains through cranial suture patterns. J Forensic Sci. 2004;49(2):203–7. https://doi.org/10.1520/JFS2003095
10. Lesciotto KM. The impact of *Daubert* on the admissibility of forensic anthropology expert testimony. Proceedings of the 67th Annual Scientific Meeting of the American Academy of Forensic Sciences. Volume 2015. Orlando, FL. Colorado Springs, CO: American Academy of Forensic Sciences; 2015. p. 218.
11. Lesciotto KM. The impact of *Daubert* on the admissibility of forensic anthropology expert testimony. J Forensic Sci. 2015;60(3):549–55. https://doi.org/10.1111/1556-4029.12740
12. US v. Dorsey. 45 F.3d 809. 1995.
13. Ross AH, Kimmerle EH. Contribution of quantitative methods in forensic anthropology: a new era. In: Blau J, editor. Handbook of forensic anthropology and archaeology. New York, NY: Routledge; 2016. p. 479–89.
14. Dirkmaat DC, Cabo LL, Ousley SD, Symes SA. New perspectives in forensic anthropology. Am J Phys Anthropol. 2008;137(S47):33–52. https://doi.org/10.1002/ajpa.20948
15. Cox M, Malcolm M, Fairgrieve SI. A new digital method for the objective comparison of frontal sinuses for identification. J Forensic Sci. 2009;54(4):761–72. https://doi.org/10.1111/j.1556-4029.2009.01075.x
16. Spiros MC, Hefner JT. Ancestry estimation using cranial and postcranial macromorphoscopic traits. J Forensic Sci. 2020;65(3):921–9. https://doi.org/10.1111/1556-4029.14231
17. Clark MA, Guatelli-Steinberg D, Hubbe M, Stout S. Quantification of maxillary dental arcade curvature and the estimation of biological ancestry in forensic anthropology. J Forensic Sci. 2016;61(1):141–6. https://doi.org/10.1111/1556-4029.12910
18. Colarusso T. A test of the Passalacqua age at death estimation method using the sacrum. J Forensic Sci. 2016;61:S22–9. https://doi.org/10.1111/1556-4029.12967
19. Hens SM, Godde K. New approaches to age estimation using palatal suture fusion. J Forensic Sci. 2020;65(5):1406–15. https://doi.org/10.1111/1556-4029.14485
20. Slobogin C. The structure of expertise in criminal cases. Seton Hall L Rev. 2003;34:105–26.
21. Christensen AM, Crowder CM. Evidentiary standards for forensic anthropology. J Forensic Sci. 2009;54(6):1211–6. https://doi.org/10.1111/j.1556-4029.2009.01176.x
22. Holland T, Crowder C. "Somewhere in this twilight": the circumstances leading to the National Academy of Sciences' report. In: Fulginetti L, Hartnett-McCann K, Galloway A, editors. Forensic anthropology and the United States judicial system. Hoboken, NJ: John Wiley & Sons, Inc; 2019. p. 19–40.
23. Bethard JD, DiGangi EA. From the laboratory to the witness stand: research trends and method validation in forensic anthropology. In: Fulginetti L, Hartnett-McCann K, Galloway A, editors. Forensic anthropology and the United States judicial system. Hoboken, NJ: John Wiley & Sons, Inc; 2019. p. 41–52.
24. Vanezis P, Lu D, Cockburn J, Gonzalez A, McCombe G, Trujillo O, et al. Morphological classification of facial features in adult Caucasian males based on an assessment of photographs of 50

subjects. J Forensic Sci. 1996;41(5):786–91. https://doi.org/10.1520/JFS13998J
25. Nowell LS, Norris JM, White DE, Moules NJ. Thematic analysis: striving to meet the trustworthiness criteria. Int J Qual Methods. 2017;16(1):1–13. https://doi.org/10.1177/1609406917733847
26. Yin RK. Qualitative research from start to finish. 2nd ed. New York, NY: Guilford Publications; 2016. p. 137–62.
27. Taylor SJ, Bogdan R, DeVault M. Introduction: Go to the people. In: Taylor SJ, Bogdan R, DeVault M, editors. Introduction to qualitative research methods: a guidebook and resource. Hoboken, NJ: John Wiley & Sons, Inc; 2015. p. 3–28.
28. Love JC, Derrick SM, Wiersema JM, Peters C. Validation of tool mark analysis of cut costal cartilage. J Forensic Sci. 2012;57(2):306–11. https://doi.org/10.1111/j.1556-4029.2011.01977.x
29. Koot MG, Sauer NJ, Fenton TW. Radiographic human identification using bones of the hand: a validation study. J Forensic Sci. 2005;50(2):263–8. https://doi.org/10.1520/JFS2004229
30. Schaffer WC, Dunn TE. Accuracy and reliability of total body mass estimation techniques from stature and bi-iliac breadth in non-Hispanic U.S. whites from the bass donated skeletal collection. J Forensic Sci. 2018;63(5):1486–91. https://doi.org/10.1111/1556-4029.13720
31. Hefner JT. Cranial nonmetric variation and estimating ancestry. J Forensic Sci. 2009;54(5):985–95. https://doi.org/10.1111/j.1556-4029.2009.01118.x
32. Garvin HM, Passalacqua NV. Current practices by forensic anthropologists in adult skeletal age estimation. J Forensic Sci. 2012;57(2):427–33. https://doi.org/10.1111/j.1556-4029.2011.01979.x
33. McKenna JJI, Jablonski NG, Fearnhead RW. A method of matching skulls with photographic portraits using landmarks and measurements of the dentition. J Forensic Sci. 1984;29(3):787–97. https://doi.org/10.1520/JFS11737J
34. Grivas CR, Komar DA. Kumho, Daubert, and the nature of scientific inquiry: implications for forensic anthropology. J Forensic Sci. 2008;53(4):771–6. https://doi.org/10.1111/j.1556-4029.2008.00771.x
35. Galloway A, Simmons TL. Education in forensic anthropology: appraisal and outlook. J Forensic Sci. 1997;42(5):796–801. https://doi.org/10.1520/JFS14210J
36. Joubert LC, Briers N, Meyer A. Evaluation of the enhanced computational methods of estimating age-at-death using the pubic symphyses of a White South African population. J Forensic Sci. 2020;65(1):37–45. https://doi.org/10.1111/1556-4029.14180
37. Corron L, Marchal F, Condemi S, Telmon N, Chaumoitre K, Adalian P. Integrating growth variability of the ilium, fifth lumbar vertebra, and clavicle with multivariate adaptive regression splines models for subadult age estimation. J Forensic Sci. 2019;64(1):34–51. https://doi.org/10.1111/1556-4029.13831
38. Fleischman JM. Radiographic identification using midline medical sternotomy wires. J Forensic Sci. 2015;60(Suppl 1):S3–S10. https://doi.org/10.1111/1556-4029.12610
39. Besana JL, Rogers TL. Personal identification using the frontal sinus. J Forensic Sci. 2010;55(3):584–9. https://doi.org/10.1111/j.1556-4029.2009.01281.x
40. Liebenberg L, Stull KE, L'Abbé EN, Botha D. Evaluating the accuracy of cranial indices in ancestry estimation among South African groups. J Forensic Sci. 2015;60(5):1277–82. https://doi.org/10.1111/1556-4029.12770
41. Tallman SD, Go MC. Application of the optimized summed scored attributes method to sex estimation in Asian crania. J Forensic Sci. 2018;63(3):809–14. https://doi.org/10.1111/1556-4029.13644
42. Casado AM. Quantifying sexual dimorphism in the human cranium: a preliminary analysis of a novel method. J Forensic Sci. 2017;62(5):1259–65. https://doi.org/10.1111/1556-4029.13441
43. Murphy RE, Garvin HM. A morphometric outline analysis of ancestry and sex differences in cranial shape. J Forensic Sci. 2018;63(4):1001–9. https://doi.org/10.1111/1556-4029.13699
44. Decker SJ, Davy-Jow SL, Ford JM, Hilbelink DR. Virtual determination of sex: metric and nonmetric traits of the adult pelvis from 3D computed tomography models. J Forensic Sci. 2011;56(5):1107–14. https://doi.org/10.1111/j.1556-4029.2011.01803.x
45. Brooks TR, Bodkin TE, Potts GE, Smullen SA. Elemental analysis of human cremains using ICP-OES to classify legitimate and contaminated cremains. J Forensic Sci. 2006;51(5):967–73. https://doi.org/10.1111/j.1556-4029.2006.00209.x
46. Murray EA, Anderson BE. Forensic anthropology in the courtroom: trends in testimony. Proceedings of the 59th Annual Scientific Meeting of the American Academy of Forensic Sciences. San Antonio, TX. Colorado Springs, CO: American Academy of Forensic Sciences; 2007. p. 322–3.
47. Winburn AP. Subjective with a capital S? Issues of objectivity in forensic anthropology. In: Boyd CC Jr, Boyd DC, editors. Forensic anthropology: theoretical framework and scientific basis. Hoboken, NJ: John Wiley & Sons Ltd; 2018. p. 21–37.
48. Boyd CC Jr, Boyd DC. The theoretical and scientific foundations of forensic anthropology. In: Boyd CC Jr, Boyd DC, editors. Forensic anthropology: theoretical framework and scientific basis. Hoboken, NJ: John Wiley & Sons Ltd; 2018. p. 1–18.

How to cite this article: Lesciotto KM, Christensen AM. The over-citation of *Daubert* in forensic anthropology. J Forensic Sci. 2023;00:1–9. https://doi.org/10.1111/1556-4029.15409