FORSYS Framework v1.0: A Forensic Systematic Review Framework for Evaluating Validity, Reliability and Bias of Forensic Procedures, Methods, Techniques or Results

Pilot version

Aaron Amankwaa

Forensic Science Policy Network, School of Geography and Natural Sciences, Northumbria University

29 May 2026

Purpose

FORSYS (Forensic Systematic Review Framework) is a bespoke extension of PRISMA [1,2], designed to critically evaluate primary studies and other literature on the validity, reliability, and bias of forensic results, techniques, procedures, or methodologies.

While PRISMA guides transparent reporting, it does not address key justice and forensic interests in understanding the validity, reliability, performance or efficiency of forensic techniques, contextual bias, and interpretive variability. FORSYS addresses this gap by integrating a structured evaluation of the literature on these factors.

FORSYS reports aim to support researchers, practitioners, and forensic stakeholders in assessing the validity, reliability, and bias of a forensic method/technique/process.

Research Framing

FORSYS applies a forensic-specific framework, TECO, replacing the conventional PICO formulations in the PRISMA protocol [2], to structure research questions, eligibility criteria, and data extraction: Trace material, Examination or analysis technique, procedure or method, Context and Outcome.

- **T**race material defines the specific forensic trace under investigation (DNA, fingerprints, etc).
- **E**xamination or analysis describes the specific methods or techniques applied to the defined trace material (e.g., DNA profiling).
- **C**ontext refers to the conditions under which the trace material was examined, such as a laboratory, a simulated or real-world environment, the availability of contextual or case information, and other study design elements.
- **O**utcome specifies the variables measured, such as accuracy, specificity, sensitivity, precision, reproducibility/consistency, robustness, error rates, and qualitative results.

An example TECO question may be framed as: *How accurately do BPA analysts interpret bloodstain patterns (T) using BPA methods (E) under varying contextual conditions (C), and what are the resulting error rates and inter-analyst agreement (O)?*

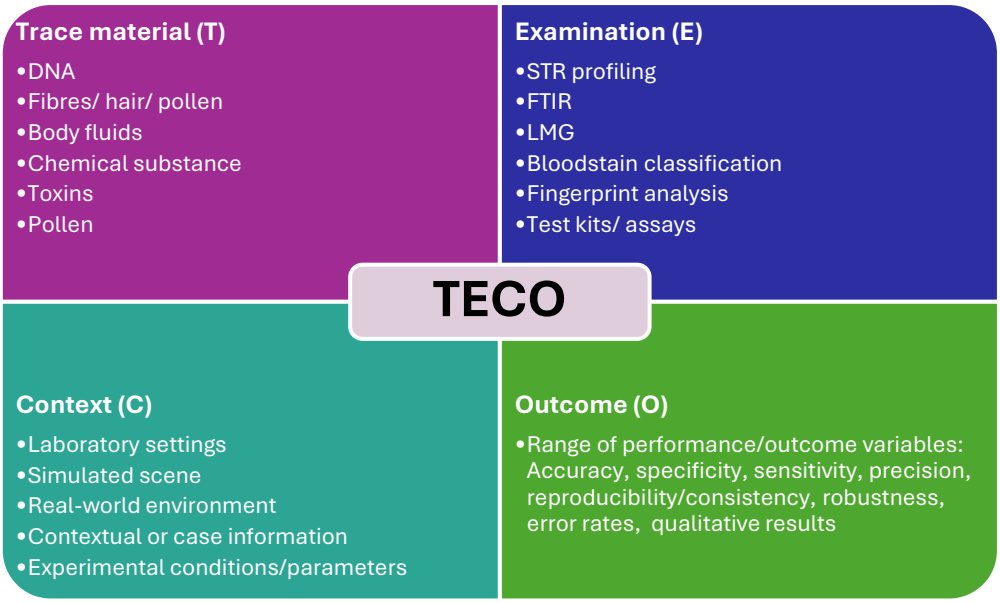

Figure 1.1 Description of the FORSYS TECO framework

FORSYS components

FORSYS incorporates:

1. A structured study appraisal (FORSYS-QA) that rates the internal (appropriate controls, ground truth data), external (real scenarios, application to real casework) and analytical (appropriate methods utilised) validity of a study. A fourth aspect is the assessment of cognitive bias risks in the study.
2. Standardised data extraction of TECO variables from studies (FORSYS-Extract) using a structured form developed by the researcher.
3. Based on the assessment of TECO variables, a qualitative grading system (FORSYS-Grade) may be applied in determining the overall validity and reliability of a particular forensic trace type, technique, procedure or methodology. This may range from low to moderate to high validity/reliability.

   NB: FORSYS-Grade does not prescribe a fixed scoring or grading system. Researchers are advised to define and justify their own evaluation criteria based on TECO variables and study characteristics. However, the approach must be transparent, adaptable, and methodologically reflexive, ensuring that the evaluation process remains reproducible by other researchers.

4. Where appropriate, quantitative synthesis can be carried out using meta-analysis approaches (FORSYS-Meta), enabling estimation of variables such as aggregate error rates and inter-analyst reliability.

FORSYS report checklist

Recommended items and organisation of FORSYS reports

Section	Item No	Checklist	Checkbox
Title	1	Identify the title of the report, adapting the TECO framework and clearly label as a systematic review	☐
Abstract	2	State the rationale and objective of the study, application of the FORSYS Framework, specifying the variables assessed, major outcomes and implications	☐
Introduction			
Background of study	3	Discuss the context of the research, including an explanation of key terms and concepts/theories, an overview of what is already known and a rationale for undertaking the systematic review	☐
Problem statement/ Significance of study	4	What problem/ issue/ challenge is the report seeking to address; what will be the benefit of the review/ analysis?	☐
Aim and objectives or research questions	5	Outline the overarching aim and specific objectives of the review, mapping these to the TECO framework. Alternatively, may capture these as TECO research questions	☐
Methods			
Review design and eligibility criteria	6	Describe the design of the review and the eligibility criteria based on TECO and FORSYS components, including publication years under consideration, language, types of studies, and outcome parameters	☐
Information sources	7	Outline and justify academic databases and other sources of information	☐
Define keywords & search terms	8	Using the TECO framework, define the search terms to be used in the database search. E.g., **T**: (“bloodstain” OR “blood pattern”) AND **E** (“pattern analysis” OR “pattern classification” OR interpretation OR reconstruction) AND **C**: (context OR bias OR blind OR “contextual information” OR environment OR “crime scene simulation”) AND **O**: (accuracy OR reliability OR validity OR “error rate” OR consistency OR reproducibility)	☐
Selection process	9	Using the eligibility criteria and the TECO screening funnel (Figure 1.2), screen all identified sources and describe the process for determining the included studies with justifications	☐
Forsys-Extract	10	Identify, describe and justify the data/ information to be extracted from papers, including all key variables. A data extraction form can be used by one or more researchers.	☐
Forsys-QA	11	Describe the process of assessing the quality of the studies, covering internal, external and analytical validity, and cognitive risks in the study.	☐
Data synthesis	12	Identify the methods for analysing the data generated. May be qualitative using thematic synthesis or an alternative approach. Quantitative synthesis can be carried out using meta-analysis approaches where appropriate (FORSYS-Meta)	☐
Forsys-Grade	13	Describe the process of determining the overall validity and reliability of a particular forensic trace type, technique, procedure or methodology in individual studies and across studies	☐
Results			
FORSYS flow chart	14	Flow chart (Figure 1.2) showing screening process, justifications for exclusion and final included studies	☐
Description of findings	15	Description of the key findings from the studies, highlighting any trends or patterns across studies, including overall results from FORSYS-QA and FORSYS-Grade. May use charts and tables	☐
Discussion			
Evaluate findings in the context of broader existing literature	16	Critique of the findings from included papers, implications of review findings	☐
Synthesis of new insights	17	Evaluate new insights from studies, including researchers' own theoretical perspectives.	☐
Limitations of review	18	Identify and acknowledge limitations of the review and any impact on the interpretation of the findings	☐

Future research proposals	19	Identify any gaps and proposals in the field based on the FORSYS-TECO analysis	☐
Appendix			
Supplementary table(s)	20	Table listing all the included papers with a concise overview of the data extracted and evaluation of major findings	☐

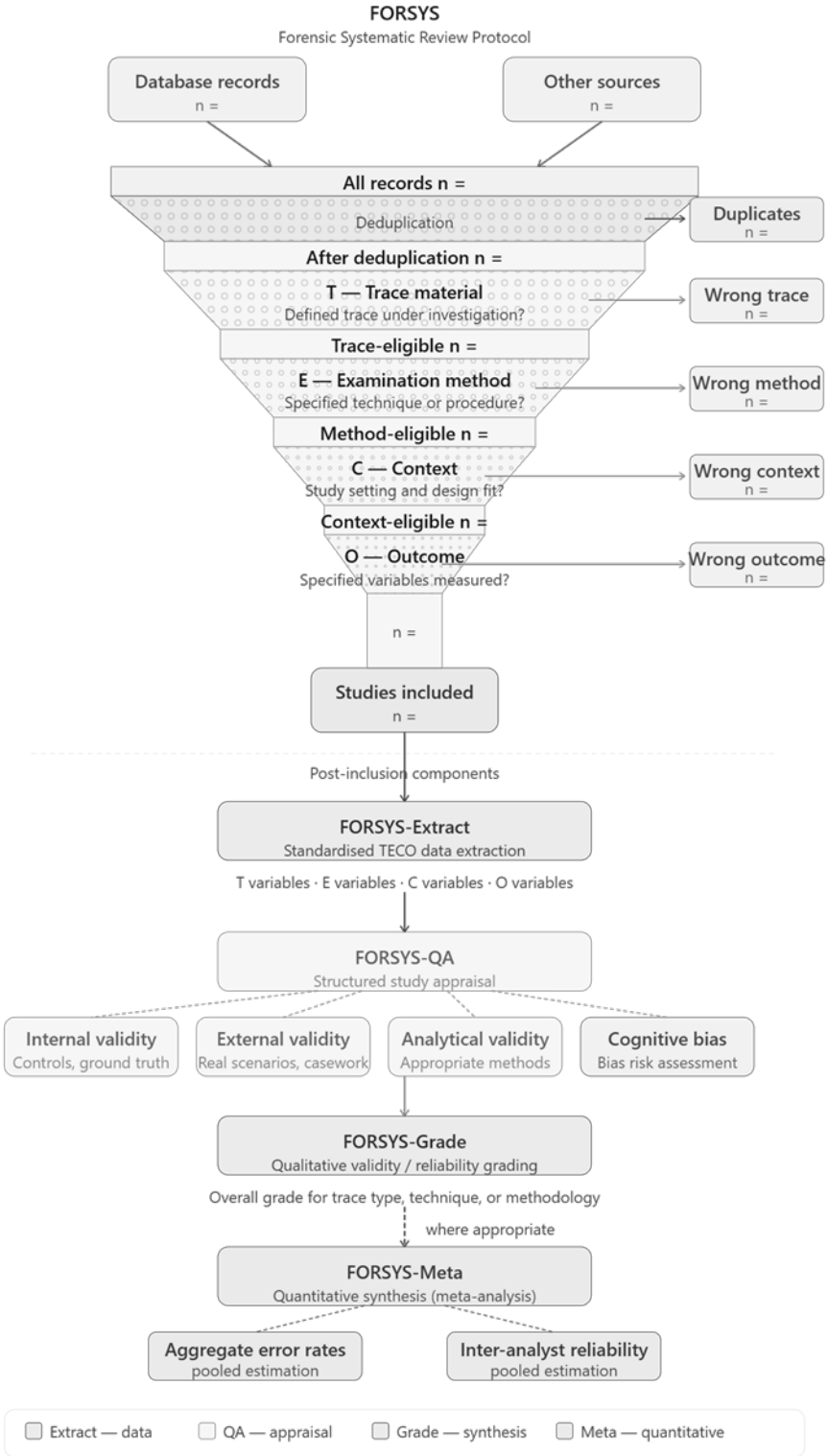

Figure 1.2 FORSYS forensic systematic review protocol

References

[1] Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. https://doi.org/10.1136/bmj.n71.

[2] Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLOS Medicine 2009;6:e1000097. https://doi.org/10.1371/journal.pmed.1000097.