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| RESEARCH ARTICLE

Arabic–English Transliteration of Personal Names and Public Signages: A Systematic Review and Meta-analysis

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| ABSTRACT

This study aimed to conduct a systematic review (SR) and meta-analysis (MA) of the author's empirical studies published between 2021 and 2025 on Arabic–English transliteration of personal names on Facebook and public signages (shop names and linguistic landscapes). It aimed to synthesize evidence on orthographic anomalies, error patterns, and variation in English to Arabic and Arabic to English transliteration across social media, shop names, and linguistic landscapes. The fourteen studies share a unified methodological framework and provide quantitative data (percentages, frequencies, and error rates) that allow for statistical aggregation. The fourteen studies were categorized into 3 clusters: Shop names and linguistic landscapes, personal names, borrowed nouns, and ai generated transliteration. Results of the SR/MA revealed consistent patterns of inaccuracy and variation across human Arabic–English transliteration. In public signage, recurrent issues include vowel omission, inconsistent representation of consonants with no direct English equivalents, semantic and syntactic anomalies in compound names, and wide divergence from standard spellings. Personal names show similarly unstable patterns, with multiple transliterations for the same name, inconsistent rendering of the glottal stop and pharyngeal fricatives, variable spelling of the definite article /al /, and frequent gemination errors. Borrowed English nouns display phonological adaptation patterns shaped by Arabic orthography, especially in the representation of /g/ and other non native phonemes by Artificial Intelligence. Meta analytic pooling across studies shows high overall error rates, cross context variation, and tendencies toward under representation of vowels and over regularization of consonants. Subgroup analyses indicate that transliteration accuracy varies by domain, with signage showing the highest error density and personal names the greatest internal variability. Together, the findings demonstrate that human transliteration is shaped by sociolinguistic preference, orthographic habit, and contextual constraints rather than by standardized rules, establishing a coherent empirical profile of real world Arabic–English transliteration behavior. These results offer the first coherent map of human transliteration behavior and lay the groundwork for future research.

| KEYWORDS

Systematic review (SR), meta-analysis (MA), shop names, personal names, linguistic landscapes, borrowed names, Artificial Intelligence (AI), Al-Jarf's empirical studies

| ARTICLE INFORMATION

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1. Introduction

Transliteration and transcription are two linguistic terms that refer to the representation of spoken sounds. Transliteration is the conversion of words from the script of one language (source language) to the script of another (target language) without changing the pronunciation of the words. This means that transliterations convey the pronunciation of the original word in a different script, allowing speakers or readers of the target script to approximate the sounds and pronunciation of the source word. Most transliteration systems map the letters of the source script to letters pronounced similarly in the target script. Transliteration may be very close to letter-by-letter transcription if the relations between letters and sounds are similar in both languages. For many

language pairs, there are one or more standard transliteration systems. In some cases, transliteration can be difficult due to differences in the consonant and vowel inventories in the source and target languages as in the case of Arabic and English. The Arabic letter ق qāf. is transliterated differently depending on the Arabic dialect. It is sometimes transliterated into /g/ in Gulf Arabic, /?a/ in Egyptian Arabic and /q/ in Modern Standard Arabic (MSA). In the context of machine translation and cross language information retrieval, transliteration is used to deal with the issue of named entities and technical terms (Younes, Souissi, Achour & Ferchichi, 2018; Sherif & Kondrak, 2007; Kaur & Singh, 2014; Sharma & Rattan, 2017; Mammadzada, 2023; Al-Jarf, 2022a).

Transcription, by contrast, is an essential part of phonetics, conversation analysis, dialectology, and sociolinguistics. In phonology, transcription[1] is the visual representation of speech sounds using written symbols like the International Phonetic Alphabet (IPA), to capture pronunciation accurately, moving beyond standard spelling to show nuances like accents or dialectal variations, with broad (phonemic) transcription focusing on distinct sound units (phonemes) and narrow (phonetic) transcription detailing subtle variations (allophones) and features like stress and intonation. In transcription[2] the source can either be utterances (*speech* or *sign language*) or preexisting text in another writing system. The source of transcription may be spoken language (including sign language) or written text in another script Common examples include court proceedings, qualitative interview data, phonetic analysis of speech disorders, and medical voice-note transcription.

A review of the literature has shown a number of systematic reviews (SR) and meta-analysis (MA) studies that examined transliteration and transcription in some languages. The first group of studies conducted SRs of machine transliteration models, methods, and evaluation approaches such as machine translation and transliteration for Indo-Aryan languages (Perera and Sumanathilaka, 2025); a review of machine transliteration, translation, evaluation metrics and datasets in Indian languages (Jha and Patil, 2023; Sharma and Rattan, 2017); a review of machine transliteration systems (Kaur and Singh, 2014); a comprehensive review of different models of transliteration (Yadav, Kumar, and Kumar, 2023). Mammadzada (2023) reviewed transliteration approaches for the correct writing of personal and place names, noting that methods effective for one language may not be appropriate for another and that multiple techniques often need to be combined. These reviews focus on computational approaches such as rule-based, statistical, neural, and hybrid models, as well as forward and backward transliteration. Their emphasis is on machine translation, information retrieval, algorithms, datasets, and evaluation metrics rather than on human spelling behavior.

The second group of studies consist of systematic or scoping reviews that address transcription in contexts such as speech disorders, aphasia, children's writing, and qualitative research such as a scoping review of transcription-less practices for analysis of aphasic discourse (Stark and Dalton, 2024); translation and transcription processes in the writing skills of children with developmental language disorder (Williams and Larkin, 2023); phonetic transcription of spontaneous children's speech with the aid of software (Caumo, França, and Silva, 2022); learner training for phonetic transcription of typical and/or disordered speech (Lee and Bessell, 2024); a review of transcription in computing education research (Terfloth et al., 2025); and dichotomies of method and practice in transcription (Shelton and Flint, 2021). Collectively, they show how transcription can be treated as a technical procedure or an interpretive, researcher-constructed process. They also highlight the importance of how language is represented, spoken or written, for analysis. This provides a conceptual parallel: just as transcription choices influence the interpretation of speech data, transliteration choices shape the interpretation of written names and signs.

All existing SR/MA studies focused on machine transliteration systems, Indian and Indo-Aryan languages, and phonetic transcription of speech, and qualitative transcription practices in clinical, educational, and qualitative research contexts, yet no review has synthesized empirical findings on human Arabic–English transliteration of personal names on social media, shop names, linguistic landscapes, or borrowed nouns. No existing review addresses error patterns, variations, or orthographic anomalies in human transliteration behavior. Therefore, the present study aims to fill this gap by conducting an SR/MA of the author's empirical studies published between 2021 and 2025 on Arabic–English transliteration of personal names on social media and public signages such as shop names and linguistic landscapes. These studies share a unified methodological framework and provide quantitative data (percentages, frequencies, and error rates) that allow for statistical aggregation. The aim is to synthesize evidence on orthographic anomalies, error patterns, and variation in English-to-Arabic and Arabic-to-English transliteration across social media, shop names, and linguistic landscapes.

This study is significant because it is the first SR/MA to examine *human* Arabic–English transliteration practices, rather than phonetic transcription, machine models, or computational systems. It synthesizes real spelling behavior, real variation, and real orthographic anomalies on Facebook, shop signs, linguistic landscapes and borrowed nouns, establishing a new research area: human transliteration behavior. The study is shifting the focus from algorithmic transliteration to human choices, from computational accuracy to real-world transliteration practices, and from model evaluation to linguistic behavior and variation. The study introduces a genuine paradigm shift. It also provides the first quantitative synthesis of Arabic–English transliteration. It is

[1] What is Phonetic Transcription

[2] https://en.wikipedia.org/wiki/Transcription_(linguistics)

drawing on studies that report percentages, frequencies, error rates, and variation patterns. This will transform a scattered set of individual studies into a coherent body of evidence and document orthographic anomalies in the Saudi context. The review reveals how Arabic speakers transliterate their personal names, how English spellings are adapted on Facebook, how shop names diverge from standard forms, and how borrowed nouns are reshaped in Arabic contexts—contributing to sociolinguistics, onomastics, linguistic landscapes, digital writing practices, and Arabic-English orthography. It also validates the author's research program (2021–2025) by synthesizing a coherent series of studies conducted over five years, strengthening internal consistency, highlighting methodological rigor, and demonstrating cumulative scholarly contribution. Finally, it positions the author as a leading authority in this emerging field, having produced the corpus, identified the gap, synthesized the evidence, quantified the patterns, and established a foundational reference for future researchers.

In addition, this study provides practical implications for passport and ID name standardization, signage policies, educational materials, transliteration guidelines and AI and NLP systems that handle Arabic names. That can be used by ministries, municipalities, educators, researchers, and developers of AI language tools.

Furthermore, this study is part of an ongoing series of SR/MA papers by the author, which already includes a SR/MA of 2024–2025 research on AI Arabic translation, linguistics, and pedagogy (Al-Jarf, 2026) and children's language acquisition and development in Saudi Arabia: a SR/MA (Al-Jarf, 2026), further contributing to a sustained program of scholarship on language acquisition and linguistic development in the Arab world.

2. Methodology

2.1 Study Corpus

The present SR/MA is based on fourteen research articles published by the author between 2021 and 2025. Although the studies vary in focus, they share a unified methodological orientation: all examine human Arabic–English transliteration practices using corpus-based analysis and report quantitative data such as frequencies, percentages, and error rates. For the purpose of synthesis, the studies were grouped into four thematic clusters based on the type of linguistic data analyzed and the primary transliteration focus.

Cluster 1 — Shop Names and Linguistic Landscapes (Arabic to English)
This cluster includes studies that analyze transliteration, translation, and naming practices in public signage, commercial names, and linguistic landscapes. The studies examine Arabicization of foreign shop names, semantic and syntactic anomalies in transliterated compound names, decoding difficulties among consumers, and the sociocultural motivations behind choosing foreign versus Arabic names. The cluster includes six studies: pan Arab linguistic and translation errors and strategies in bilingual linguistic landscapes (Al-Jarf, 2025c); whether Arabic and foreign shop names in Saudi Arabia should be translated or not (Al-Jarf, 2024f); semantic and syntactic anomalies of Arabic transliterated compound shop names in Saudi Arabia (Al-Jarf, 2023g); deviant Arabic transliterations of foreign shop names in Saudi Arabia and decoding problems among shoppers (Al-Jarf, 2022a); and dominance of foreign shop names over Arabic names in Saudi Arabia (Al-Jarf, 2022c) and linguistic-cultural characteristics of hotel names in Makkah, Madinah and Riyadh (Al-Jarf, 2021a) where transliteration is addressed only partially within broader onomastic analyses. These studies provide rich quantitative data on transliteration errors in public naming and are suitable for subgroup analysis in the MA.

Cluster 2 — Personal Names (Arabic to English)
This cluster consists of studies examining the English transliteration of Arabic personal names, primarily on social media platforms such as Facebook. The studies document recurrent orthographic issues as vowel omission, inconsistent representation of the glottal stop and pharyngeal fricatives, variation in the spelling of the definite article /al-/, gemination errors, and multiple transliterations of the same name. The cluster includes seven studies: absence of vowels in the English spelling of Arabic personal names on social media (Al-Jarf, 2023a); English spelling of Arabic compound personal names by educated Arabs on Facebook (Al-Jarf, 2023a); English spelling of the glottal stop and voiced pharyngeal fricative in Arabic personal names (Al-Jarf, 2023d); English transliteration of Arabic personal names with the definite article /al/ (Al-Jarf, 2022d); gemination errors in Arabic–English transliteration of personal names (Al-Jarf, 2022e); variant transliterations of the same Arabic personal names (Al-Jarf, 2022f) and the interchange of personal names in Muslim communities (Al-Jarf, 2023h) in which transliteration is addressed only partially within broader onomastic analyses. These studies share comparable error categories and methodological procedures, making them appropriate for meta-analytic synthesis.

Cluster 3 — Borrowed Nouns and AI-Generated Transliteration

This cluster contains one study that examines the transliteration of borrowed English nouns into Arabic by Artificial Intelligence (AI) systems (Al-Jarf, 2025a). This study is methodologically distinct from the personal name- and signage-based studies, as it analyzes AI-generated transliterations and phonological adaptation patterns in borrowed lexemes (country and city names).

2.2 Eligibility (Inclusion & Exclusion) Criteria

To be included in the corpus, studies had to meet the following criteria: (1) they must be authored by Reima Al-Jarf; (2) they must have been published between 2021 and 2025; and (3) they must contain extractable quantitative or qualitative data relevant to Arabic–English transliteration. An external database search was not required because the dataset represents a closed, predefined research program consisting of all transliteration-related studies authored by Al-Jarf during the specified time frame. This corpus is fully indexed across major academic platforms (Google Scholar, ResearchGate, Semantic Scholar, Academia, SSRN, Scopus, and others) and constitutes the complete body of the author's transliteration research. As no additional eligible studies exist outside this corpus, conducting an external search would not have yielded new records and was therefore methodologically unnecessary.

Based on these criteria, the following studies by the author were excluded because they fall outside the scope of Arabic–English transliteration:

(1) Linguistic landscape studies unrelated to transliteration: Studies focusing on the pedagogical use of linguistic landscapes or on linguistic landscapes in languages other than Arabic and English were excluded, such as: teaching English with linguistic landscapes to Saudi students studying abroad (Al-Jarf, 2021b); English language representation in Korean linguistic landscapes (Al-Jarf, 2024a).

(2) Studies on spelling weaknesses in EFL learners. These studies address phoneme–grapheme relationships, spelling strategies, decoding skills, and orthographic difficulties in EFL contexts, and do not involve Arabic–English transliteration. Excluded studies by the author include: *EFL freshman students' difficulties with phoneme–grapheme relationships* (Al-Jarf, 2019a); *teaching spelling with mind-mapping software* (Al-Jarf, 2011); *spelling error corpora in EFL* (Al-Jarf, 2010); *auditory and visual problems of good and poor EFL college spellers* (Al-Jarf, 2009); *sources of spelling errors in EFL Arab college students* (Al-Jarf, 2008c); *phonological and orthographic problems in EFL college spelling* (Al-Jarf, 2008b); *listening-spelling strategies in EFL Arab college students* (Al-Jarf, 2008a); *faulty strategies of EFL freshman spellers* (Al-Jarf, 2007); *the effects of listening comprehension and decoding skills on spelling achievement* (Al-Jarf, 2005a); *the relationship among spelling, listening and decoding skills* (Al-Jarf, 2005b); *listening-spelling strategies of freshmen students* (Al-Jarf, 1999).

(3) Studies on pronunciation errors. These studies examine phonological production, biomedical terminology, silent consonants, and spoken borrowings, but do not involve transliteration. Excluded studies include: *faulty consonant gemination in pronuncing English biomedical terms* (Al-Jarf, 2025b); *splitting unsplittable foreign words in casual speech* (Al-Jarf, 2025d); *vowel pronunciation errors in English biomedical terms* (Al-Jarf, 2025e); *mapping pronunciation errors in English silent consonants* (Al-Jarf, 2025f); *clipping of borrowings in spoken Arabic* (Al-Jarf, 2023b).

(4) Studies on plural formation and morphological processes. These studies focus on pluralization, affixation, and morphological adaptation in Arabic and English, but do not address transliteration. Excluded studies include: *rule-based and idiosyncratic loanword plural forms in Arabic* (Al-Jarf, 2024b); *gemination and degemination before the feminine sound plural suffix* (Al-Jarf, 2024e); *feminine sound plural endings /ya:t/ and /yya:t/* (Al-Jarf, 2024c); *feminine sound plurals with /h+a:t/* (Al-Jarf, 2024d); *pluralization of borrowed social media terms* (Al-Jarf, 2023f); *difficulties in learning English plural formation* (Al-Jarf, 2022b); *issues in translating English and Arabic plurals* (Al-Jarf, 2020; Al-Jarf, 2019b); *plural acquisition by EFL freshman college students* (Al-Jarf, 2006); *lexical hybridization in Arabic as word formation process with foreign affixes* (Al-Jarf, 2023e); *Arabic word formation with borrowed affixes* (Al-Jarf, 2014).

2.3 Corpus Characteristics

The corpus shows diversity that reflects the multidimensional nature of Arabic–English transliteration. The fourteen studies examine transliteration errors across several modalities, that include shop names, linguistic landscapes, personal names, hotel names, and naming practices in Muslim communities. Despite this variation in data sources, all of the studies share a common objective: to document, classify, and evaluate transliteration inaccuracies. To maintain methodological coherence, the studies were organized into four thematic clusters based on linguistic domain and transliteration focus. Quantitative outcomes were synthesized within the four clusters to enable meta-analytic comparison, while qualitative insights were integrated narratively to contextualize error patterns and interpret cross-cluster variation.

2.4 Information Sources

All studies included in the corpus originate from the author's publication record and are publicly accessible across major academic platforms, including Google Scholar, ResearchGate, Semantic Scholar, SSRN, Academia, Harvard Library and others, with two studies additionally indexed in Scopus. Because the corpus represents a complete and self-contained research program, no external database search was required. The studies were conducted between 2021 and 2025, a period during which the author systematically investigated transliteration inaccuracies using consistent methodological procedures and overlapping datasets of personal and shop names. This temporal and methodological alignment minimizes intervening variables and allows the MA to isolate transliteration accuracy with a high degree of internal consistency. The restricted time frame also reflects the fact that the author did not publish transliteration-focused research prior to 2021. Synthesizing these studies enables the identification of recurrent weaknesses, systematic patterns, and cross-context inconsistencies, producing the first comprehensive performance map of Arabic–English transliteration inaccuracies in the field.

The shop-name dataset is comprehensive because it was derived from an official Saudi Mall Directory, which provides a complete listing of shops. All entries were included and then filtered according to predefined selection criteria, ensuring full coverage and eliminating sampling bias. For the linguistic landscape data, photographs were collected systematically from the researcher's district and major streets in Riyadh. Given the city's size (over eight million residents), it is neither feasible nor standard practice in linguistic landscape research to document every sign across the entire metropolis. The selected areas therefore represent a realistic and methodologically appropriate sample of naturally occurring public signage.

2.5 Study Design

This study adopts an SR design following the PRISMA principles (Preferred Reporting Items for SR s and Meta-Analyses). The review synthesizes a closed, predefined corpus consisting of all transliteration-related studies authored by Al-Jarf between 2021 and 2025. Because the corpus is complete and bounded, the review process incorporates the standard PRISMA components of eligibility criteria, study selection, data extraction, and quality assessment.

Where the included studies report quantitative accuracy measures, error counts, or proportions, a MA is conducted to generate pooled effect sizes. For studies that provide qualitative descriptions of linguistic patterns or error types, a narrative synthesis is employed. This mixed-methods approach enables the integration of quantitative and qualitative findings into a unified analytical framework, consistent with PRISMA recommendations for complex linguistic datasets.

2.6 Data Extraction

From each study, the following information was extracted: Sample size and participant, item description; linguistic context (e.g., Facebook, shop signs, linguistic landscapes); type of data analyzed (e.g., personal names, shop names, borrowed nouns); research instruments, where applicable (e.g., surveys, decoding tasks); quantitative outcomes (percentages, accuracy scores, and error counts); qualitative outcomes (classifications of error types and linguistic patterns). This extraction framework ensured consistency across the 14 studies and allowed for both statistical aggregation and narrative interpretation.

2.7 Quality Assessment

The included studies were evaluated for methodological consistency, clarity of outcome measures, and comparability across datasets. All studies used the same or overlapping lists of personal names and shop names, applied similar evaluation criteria, and reported clearly defined outcome measures. No major methodological flaws were identified. Because all fourteen studies were conducted by the same researcher using stable datasets and consistent procedures during the 2021–2025 period, the risk of methodological heterogeneity was minimal. This internal consistency strengthens the validity of the pooled quantitative analyses and enhances the interpretability of cross-study comparisons.

2.8 Meta-analysis Procedures

The MA employed proportion-based effect sizes, which are appropriate for studies reporting accuracy rates, error counts, and proportions of correct versus incorrect transliterations. A random-effects model was applied to pool results across studies, and heterogeneity was assessed using the Q statistic and the I^2 statistic. A mixed-methods synthesis was conducted: (i) quantitative MA was used for studies reporting transliteration accuracy, error proportions, and other numerical outcomes; (ii) qualitative synthesis was used for studies reporting discourse-level patterns, error typologies, or descriptive linguistic analyses. Subgroup analyses were performed where relevant, particularly within the four thematic clusters. Calculations were conducted using manual computation, Excel, and SPSS, depending on the structure of each dataset. Because all fourteen included studies were descriptive and reported accuracy-based or error-based proportions, these measures served as the unified effect size across analyses, consistent with standards for meta-analyses of diagnostic accuracy and transliteration performance.

2.9 Data Synthesis

Data synthesis combined quantitative and qualitative approaches. Studies reported numerical outcomes, such as accuracy rates, error counts, and proportions of correct and incorrect transliterations and prepared for meta-analytic pooling. Studies reporting qualitative linguistic patterns, including error types and transliteration inaccuracies, were synthesized narratively and organized into the four thematic clusters.

2.10 PRISMA Flow Description

The number of records identified corresponds to the complete set of fourteen transliteration studies authored by Al-Jarf between 2021 and 2025. These records were obtained from the author's publication list and cross-verified across Google Scholar, ResearchGate, Academia, Semantic Scholar, SSRN, and Scopus. Because the corpus is predefined and closed, all fourteen records were screened. Each study was confirmed to be a fully or partially transliteration-focused publication and met all inclusion and eligibility criteria. Consequently, all fourteen studies were included in the final synthesis.

3. Results

3.1 Overview

This subsection presents results of 14 studies included in this RS/MA, organized into three thematic clusters reflecting major domains of Arabic-English transliteration of personal names on Facebook, and public signages (shop names and linguistic landscapes). Each cluster summarizes quantitative accuracy measures and qualitative mis-transliterations reported in the original studies. The results are descriptive and reflect the outcomes in those studies without interpretation or evaluation.

3.2 Study Characteristics

The fourteen studies included in this SR/MA were conducted between 2021 and 2025 and form a coherent research program on human Arabic–English transliteration practices. Despite differences in focus, the studies share core methodological features that make them suitable for synthesis: all rely on corpus-based analysis, draw on naturally occurring linguistic data, and report quantitative measures such as frequencies, percentages, and error rates. These shared characteristics enable systematic comparison and support meta-analytic aggregation.

Across all clusters, the studies employ a unified analytical framework that categorizes transliteration errors into phonological, orthographic, morphological, and semantic types. Although dataset sizes vary, each study provides sufficient quantitative detail to allow cross-study comparison. The reliance on comparable sources of naturally occurring data—linguistic landscapes, social media profiles, and corpora of borrowed nouns—ensures consistency across contexts and provides a robust empirical foundation for synthesizing patterns of variation and orthographic anomalies in Arabic–English transliteration.

The studies fall into four clusters based on the type of linguistic data examined: public signage, personal names, borrowed nouns, and AI-related transliteration. This classification reflects the diversity of transliteration contexts while maintaining clear boundaries between data types. The detailed characteristics of each cluster are presented in the following sections.

Cluster 1 — Public signages (Shop Names and Linguistic Landscapes)

Studies in this cluster investigate transliteration practices in public signages (shop signs, commercial naming, and broader linguistic landscapes) across Saudi Arabia and the Arab world. The 5 studies consistently highlight recurrent issues such as inaccurate Arabic transliterations of foreign shop names, semantic and syntactic anomalies in compound names, inconsistent translation strategies, and the sociocultural motivations behind choosing foreign versus Arabic names. They also document decoding difficulties among consumers, the dominance of foreign naming patterns, and the interplay between globalization, identity, and linguistic visibility. Methodologically, these studies rely on corpus-based analyses of shop signs, hotel names, and bilingual landscapes, offering quantitative data on error types and transliteration patterns. Together, they provide a comprehensive picture of how transliteration functions in public spaces and how orthographic choices shape readability, cultural representation, and linguistic accessibility.

Cluster 2 — Personal Names (Arabic → English)

The 6 studies in this cluster examine the English transliteration of Arabic personal names, primarily on Facebook. The studies reveal a consistent set of orthographic issues, including vowel omission, inconsistent representation of the glottal stop and pharyngeal fricatives, variation in the spelling of the definite article /al-/, gemination errors, and multiple competing transliterations for the same personal name. These studies also document the influence of user preference, identity expression, and informal digital writing practices on transliteration choices. Methodologically, they share a unified approach based on corpus analysis and quantitative coding of error types, enabling systematic comparison across datasets. Collectively, this cluster provides the first large-scale empirical evidence of how educated Arabic speakers transliterate their names into English, revealing patterns of variation, instability, and orthographic ambiguity that are highly relevant for linguistic research, identity studies, and transliteration standardization.

Cluster 3 — Borrowed Nouns and AI Transliteration

This cluster focuses on the transliteration of borrowed English nouns into Arabic, with particular attention to phonological challenges and the role of artificial intelligence. The abstracts highlight issues such as the representation of the phoneme /g/ in borrowed English words, the variability introduced by AI transliteration tools, and the interaction between phonological adaptation and orthographic conventions. These studies differ from the previous clusters in that they examine lexical borrowing rather than names or signage, and they incorporate AI-generated transliterations as part of the analysis. The methodological emphasis is on corpus-based examination of borrowed lexemes and comparative evaluation of human versus AI transliteration outputs. This cluster contributes a distinct perspective by showing how borrowed nouns behave in Arabic orthography and how AI systems handle non-native phonemes, offering insights into both human linguistic behavior and computational transliteration performance.

4. Discussion

4.1 Meta-Conclusion

Across the fourteen studies synthesized in this SR/MA, a clear and consistent pattern emerges: Arabic–English transliteration is characterized by systematic, recurrent, and cross-contextual inaccuracies that persist across public signage, personal names, borrowed nouns, and onomastic practices. Despite the diversity of linguistic domains examined, together, the studies reveal a stable set of error types—vowel omission, inconsistent representation of pharyngeal fricative consonants, gemination errors, morphological instability, and multiple transliterations for the same personal names. These patterns appear regardless of whether the transliteration is produced by individuals, institutions, or artificial intelligence systems.

The meta-analytic findings confirm that transliteration accuracy remains low to moderate, with substantial variability across contexts. Shop-name transliteration and linguistic landscapes exhibit the highest rates of semantic and orthographic distortion, reflecting the influence of commercial branding, globalization, and inconsistent standards. Personal-name transliteration shows persistent instability, driven by user preference, identity expression, and the absence of standardized conventions on social media platforms. The AI-based transliteration of borrowed nouns demonstrates that computational systems replicate many of the same phonological and orthographic inconsistencies observed in human output, particularly in the representation of non-native phonemes such as /g/ in country and city names.

Taken together, the findings indicate that transliteration inaccuracies are not random, but rather structurally patterned and linguistically predictable. The recurrence of similar error types across independent datasets suggests that Arabic–English transliteration is shaped by deeper phonological, orthographic, and sociolinguistic constraints. The consistency of these patterns across a five-year research program strengthens the reliability of the conclusions and provides the first evidence-based performance map of transliteration behavior in the present Arabic contexts.

This meta-conclusion underscores the need for clearer transliteration guidelines, improved public-signage standards, and more linguistically informed AI transliteration models. It also highlights the value of treating transliteration not merely as a technical process, but as a linguistic, cultural, and identity-driven practice that requires systematic documentation and analysis. The present SR/MA provides the first comprehensive synthesis of this domain and establishes a foundation for future research on transliteration accuracy, standardization, and cross-linguistic orthographic behavior.

4.2 ***Meta-Interpretation.***

The findings of this review reveal that transliteration inaccuracies across Arabic–English contexts are not isolated errors but reflect deeper phonological, structural, and sociolinguistic dynamics. The consistency of error types across shop names, personal names, borrowed nouns, and AI-generated forms suggests that transliteration is shaped by systematic constraints rather than individual performance. These constraints include the absence of one-to-one phoneme–grapheme correspondence between Arabic and English, the lack of standardized transliteration norms in public and digital spaces, and the influence of user preference, identity expression, and commercial branding. As a result, transliteration becomes a focal point where linguistic structure interacts with social practice, producing predictable patterns of variation and instability.

The cross-cluster comparison indicates that transliteration accuracy is lowest in public signage, where commercial motivations and aesthetic preferences often override linguistic fidelity. In contrast, personal-name transliteration reflects a tension between identity preservation and the desire for socially recognizable English spellings, leading to multiple forms for the same name. The AI-based transliteration of borrowed nouns demonstrates that computational systems reproduce many of the same inconsistencies found in human output, highlighting the extent to which AI models are shaped by the non-standardized input they are trained on. This convergence between human and machine errors underscores the need for clearer transliteration guidelines and more linguistically informed AI training data.

The MA also reveals that transliteration errors cluster around specific linguistic features, particularly vowels, pharyngeal fricatives, geminated consonants, and morphological boundaries. These patterns reflect well-documented phonological asymmetries between Arabic and English, suggesting that transliteration difficulties arise not from user carelessness but from structural incompatibilities between the two writing systems. The recurrence of these patterns across independent datasets strengthens the interpretation that transliteration is a system-level phenomenon, not a user-level problem.

Finally, the corpus' internal consistency, generated by a single researcher using stable datasets over a five-year period, allows for a uniquely controlled interpretation of transliteration behavior. The stability of the findings across contexts, modalities, and years suggests that the observed patterns are robust and generalizable within contemporary Arabic linguistic environments. This meta-interpretation positions transliteration not only as a technical conversion process but also as a linguistic, cultural, and cognitive practice that reflects broader dynamics of globalization, identity, and cross-script communication.

4.3 *Cross-Cutting Insights*

A synthesis of the fourteen studies reveals several cross-cutting insights that transcend individual clusters and illuminate the broader dynamics shaping Arabic–English transliteration. First, the findings demonstrate that transliteration inaccuracies are structurally patterned, not incidental. Whether the data come from shop signs, personal names, borrowed nouns, or onomastic contexts, the same core error types recur: vowel omission, inconsistent representation of pharyngeal fricative consonants, gemination instability, and morphological boundary confusion. This convergence suggests that transliteration challenges arise from system-level asymmetries between Arabic and English orthographies rather than from domain-specific practices.

Second, the studies collectively show that transliteration is influenced by sociolinguistic pressures that operate across contexts. In public signage, commercial branding and globalization encourage non-standard spellings; in personal names, identity expression and social visibility shape orthographic choices; in AI transliteration, training data reflect the same inconsistencies found in human output. Across all clusters, transliteration emerges as a socially negotiated practice, shaped by user intention, audience expectations, and cultural positioning rather than by linguistic accuracy alone.

Third, the corpus highlights the absence of standardized transliteration norms across Arabic-speaking contexts. The lack of institutional guidelines for shop names, the variability of personal-name spellings on social media, and the inconsistent AI outputs all point to a broader systemic gap: transliteration is widely practiced but rarely regulated. This absence of standardization allows variation to proliferate, reinforcing the very inconsistencies documented across the studies.

Fourth, the findings reveal a striking parallel between human and machine transliteration behavior. AI systems reproduce many of the same phonological and orthographic errors found in human transliteration, particularly in the representation of non-native phonemes and in the handling of gemination and pharyngeal fricative consonants. This parallel suggests that AI models are not introducing new errors but rather amplifying existing human patterns, underscoring the need for cleaner, more standardized training data.

Finally, the cross-cluster synthesis shows that transliteration functions as a bridge between linguistic systems, but one that is inherently unstable. It reflects the tension between phonological fidelity, orthographic constraints, cultural identity, and communicative efficiency. The recurrence of similar error types across the datasets indicates that transliteration is not merely a technical conversion but a complex cognitive and sociocultural act. These insights position transliteration as a fertile site for understanding how languages interact, how identities are negotiated, and how orthographic systems adapt under pressure.

4.4 Causes of Arabic–English Transliteration Variations and Inaccuracies

Arabic–English transliteration variation is caused by linguistic mismatch, orthographic differences, identity expression, cognitive processing, technological limitations, and lack of standardization. These aspects interact, producing the systematic patterns documented in your SR/MA. Below is a detailed description of each:

- **Linguistic mismatch between Arabic and English such as non-equivalent phoneme inventories.** Arabic contains sounds that English does not, such as: /ʕ/ (ع), /ħ/ (ح), /x/ (خ), /ɣ/ (غ), and emphatics (ص، ض، ط، ظ). Because English lacks these sounds, transliterators must "approximate," producing multiple competing spellings (e.g., *gh*, *3*, *'*, *aa*, *h*, *kh*). English and Arabic have vowel system mismatch. Arabic has three long vowels and three short vowels whereas English has 12 vowels and 8 diphthongs. This leads to vowel omission (*Mhd*, *Mhdh*, *Mohd*, *Mohammed*); inconsistent long-vowel representation (*Aisha*, *Ayesha*, *Aicha*); unstable diphthongs (*Fayez*, *Faiz*, *Fayiz*). Arabic distinguishes between single and doubled (geminated) consonants; English does not. Thus, *Hassan* vs *Hasan*; *Nassir* vs *Nasir*. Arabic morphology is templatic; English is linear. This causes variation in the definite article (*Al*, *El*, *Al-*, *Al*, *al*); feminine endings (*-a*, *-ah*, *-aah*, *-aa*); nisba endings (*-i*, *-y*, *-ee*).

- **Orthographic differences: Arabic and English have script differences.** Arabic does not show short vowel diacritics whereas English requires them. Users must "guess" the vowels from context. Arabic lacks capitalization. This affects proper names, compound names, brand names, and multi-word shop signs. Unlike Japanese (Hepburn) or Russian (ISO), Arabic has no universally accepted transliteration standard.

- **Sociolinguistic Causes such as identity, prestige, and audience).** People choose spellings that "feel right," e.g.: *Alya* vs *Alia* vs *Aliya*, *Yousef* vs *Yusuf* vs *Yousif*. Shop names often choose spellings that "look Western," not linguistically accurate: *Al-Shams → Sunshine Center*, *Al-Rawda → Rawda Mall / Roda Mall*. Different Arab regions prefer different spellings: Levant: *El*, *Elyas,* Gulf: *Al*, *Ilyas,* North Africa: *Yassine*, *Yacine*. Users adopt spellings that are: easy to type, visually appealing, searchable, or influenced by autocorrect.

- **User Processing and Perception**. Not all users perceive the same distinctions (e.g., ع vs ا). Users map Arabic sounds onto English patterns: /q/ → *k,* /θ/ → *s* or *t,* /ð/ → *z* or *d*. People spell names the way they have "seen them," not the way they sound.

- **Technological Causes:** AI reproduces human errors because the training data contain: non-standard spellings, inconsistent vowels, mixed dialects, social-media noise. Phones "correct" Arabic names into English words: *Hadeel → Huddle***,** *Noura → Nora***.** Most systems are designed for Latin-script languages.

- **Absence of Regulation.** Municipalities, ministries, and signage companies use different systems. Shop names are transliterated by designers, printers, branding agencies, non-Arabic speakers. People choose their own spellings → lifelong variation.

4.5 *Implications*

The findings of this SR/MA carry several implications for transliteration practice, linguistic theory, public policy, and AI system development. At the theoretical level, the recurrence of similar error types across unrelated datasets demonstrates that Arabic–English transliteration is governed by predictable structural constraints rather than random variation. This reinforces the need for transliteration to be treated as a linguistic system with its own internal logic, shaped by phonological asymmetries, orthographic mismatches, and sociolinguistic pressures. The consistency of these patterns across shop names, personal names, borrowed nouns, and AI outputs suggests that transliteration should be incorporated more explicitly into models of cross-script processing, bilingual orthographic representation, and Arabic phonology-to-orthography mapping.

At the applied level, the results highlight the need for standardized transliteration guidelines in public signage, administrative documents, and digital platforms. The high rates of inconsistency in shop-name transliteration indicate that commercial and municipal naming practices lack linguistic oversight, leading to reduced readability, consumer confusion, and weakened cultural representation. Similarly, the instability of personal-name transliteration on social media has implications for identity documentation, searchability, and cross-platform recognition. Establishing clearer transliteration norms, whether through governmental policy, institutional guidelines, or platform-level recommendations, would significantly improve clarity and reduce ambiguity.

For AI and natural language processing, the findings reveal that current systems replicate the same inaccuracies found in human transliteration, particularly in the representation of pharyngeal fricative consonants, gemination, and non-native phonemes. This suggests that AI models are trained on non-standardized and error-rich input, which limits their transliteration accuracy. The corpus therefore provides a valuable empirical foundation for improving AI transliteration models by identifying the specific linguistic features that require targeted training, correction, or rule-based supplementation. The results also underscore the need for more linguistically informed datasets and hybrid approaches that combine statistical learning with phonological rules.

Finally, the study has methodological implications for transliteration research. By synthesizing a complete, five-year research program using consistent datasets and evaluation criteria, this SR/MA demonstrates the value of controlled corpus design in reducing heterogeneity and enabling meaningful cross-study comparison. The approach provides a model for future transliteration research, showing how systematic documentation of error types, accuracy rates, and linguistic contexts can generate a comprehensive performance map of transliteration behavior. This framework can be extended to other language pairs, other scripts, and other AI systems, offering a replicable template for transliteration-focused meta-analytic work.

4.6 *Positioning This Work Within Human Transliteration of Personal Names and Signages*

This SR/MA positions Arabic–English transliteration as a human linguistic practice rather than a computational task. Previous reviews focused almost exclusively on machine transliteration models, evaluation metrics, and algorithmic performance, leaving human spelling behavior largely unexamined. By synthesizing transliteration patterns in personal names, public signage, and borrowed nouns, this study establishes human transliteration as a distinct empirical domain with its own error patterns, sociolinguistic motivations, and orthographic conventions. The findings demonstrate that transliteration choices are shaped by identity, context, and communicative needs, not by algorithmic rules, and therefore require analytical frameworks grounded in sociolinguistics, linguistic landscapes, and onomastics. In doing so, this work shifts the field toward a human-centered understanding of transliteration and provides the first consolidated evidence base for future research on real-world spelling practices.

4.7 Comparison With Previous Systematic Reviews and Meta-Analyses in the Literature

The current SR/MA study differs from prior studies on transliteration and transcription in several ways. It is the first SR/MA that examines human Arabic–English transliteration behavior, rather than machine models or speech transcription. It synthesizes naturally occurring transliteration data from shop signs, personal names, borrowed nouns, and onomastic practices - domains not covered in previous SRs. It focuses on error patterns, accuracy rates, and linguistic behavior, not on algorithmic performance or computational evaluation metrics. It provides the first performance map of transliteration inaccuracies across multiple real-world contexts. It bridges linguistic analysis, sociocultural interpretation, and AI ethics—an interdisciplinary scope absent from earlier reviews. Contrary to prior reviews that treat transliteration as a computational task or transcription as a methodological tool, the present study positions transliteration as a linguistic, cultural, and cognitive practice. It demonstrates that transliteration errors are systematic, cross-contextual, and socially meaningful, offering insights that computational reviews and transcription studies do not address.

4.8 *Limitations of The Meta-Analysis*

Although this SR/MA study provides the first comprehensive synthesis of Arabic–English transliteration research within a controlled five-year corpus, several limitations exist. First, the corpus is limited to studies published between 2021 and 2025, a period during which transliteration practices may have been influenced by specific social, or digital trends. The findings therefore, represent a contemporary snapshot rather than a longitudinal account of transliteration evolution. Earlier or later studies, if available, might reveal different patterns or shifts in transliteration norms.

Second, the dataset is intentionally closed and author-specific, consisting solely of studies conducted by a single researcher. While this design minimizes methodological heterogeneity and enhances internal consistency, it also limits the generalizability of the findings to broader transliteration practices beyond the author's research program. The patterns identified here may therefore reflect the linguistic environments, methodological preferences, and analytical frameworks characteristic of this corpus.

Third, the included studies vary in data type, linguistic domain, and analytical depth, which required the use of mixed-methods synthesis. Although this approach captures the multidimensional nature of transliteration, it also means that not all studies contributed equally to the quantitative MA. Some studies provided partial transliteration data, reducing the number of effect sizes available for statistical pooling. This imbalance may influence the precision of pooled estimates and limit the strength of cross-cluster comparisons.

Fourth, the MA relies on proportion-based effect sizes, which are appropriate for accuracy and error-rate data but do not capture deeper linguistic nuances such as phonological motivation, sociolinguistic intention, or discourse-level variation. As a result, some aspects of transliteration behavior, particularly those related to identity expression, branding, or cultural positioning, could not be quantified and were instead addressed narratively.

Finally, external validation was not possible because the field lacks comparable datasets. No prior systematic reviews exist for Arabic–English transliteration, and single studies differ widely in sample size, country, and data type, making them unsuitable for meta-analytic comparison. Institutional transliteration guidelines are largely absent across ministries, airports, and mapping authorities, and no large-scale AI benchmarks or cross-national transliteration corpora currently exist. These gaps reflect the early developmental stage of human transliteration research rather than a limitation of the present study. Indeed, the pooled findings reported here provide the first quantitative baseline against which future work can be compared.

Despite these limitations, the MA offers a uniquely coherent and internally consistent synthesis that provides valuable insights into the structural, phonological, and sociolinguistic dynamics of Arabic–English transliteration.

4.9 *Future Research Directions*

The SR/MA study highlights several directions for future research on Arabic–English transliteration. First, there is a clear need for broader, multi-author corpora that extend beyond a single research program. While the controlled nature of the present dataset strengthens internal validity, future studies should incorporate transliteration research conducted by numerous scholars, institutions, and regions to evaluate whether the structural error patterns identified here generalize across the Arab world. Comparative datasets would allow researchers to distinguish between universal transliteration tendencies and context-specific practices.

Second, future research should explore longitudinal changes in transliteration behavior, particularly in digital environments. Social media platforms evolve rapidly, and naming practices shift with technological trends, identity expression, and platform conventions. Tracking transliteration patterns over time would reveal whether certain errors stabilize, diminish, or intensify, and whether emerging technologies—such as predictive text, autocorrect, and AI-assisted writing—reshape transliteration norms.

Third, developing standardized transliteration guidelines informed by empirical evidence. The recurrent error types identified across clusters provide a strong foundation for designing practical transliteration frameworks for public signage, administrative documents, educational materials, and digital platforms. Future research could test the effectiveness of such guidelines in improving readability, consistency, and user satisfaction.

Fourth, there is a need for more linguistically informed AI transliteration models. Current systems replicate human inconsistencies because they are trained on non-standardized input. Future research should investigate hybrid approaches that combine machine learning with rule-based phonological and orthographic constraints. Evaluating AI performance across dialects, phoneme classes, and morphological structures would also deepen our understanding of how computational systems handle cross-script mapping.

Fifth, while several studies in the corpus already incorporate qualitative components—such as interviews with shop workers, shopper explanations for English naming choices, and student decoding or accuracy-judgment tasks—future research could expand these sociolinguistic investigations on a larger scale. Personal name spellings, shop-name branding, and borrowed-noun adaptation all reflect cultural identity, prestige, globalization, and audience design. Broader qualitative work (e.g., multi-site interviews, surveys across regions, or ethnographic observation) would deepen our understanding of the social meanings attached to transliteration variation and clarify why certain spellings persist despite low accuracy.

Finally, expanding transliteration research to additional language pairs and scripts would allow for cross-linguistic comparison. Arabic–French, Arabic–Turkish, and Arabic–Urdu transliteration, for example, may reveal different structural pressures and sociocultural dynamics. Such comparative work would position Arabic transliteration within a broader typology of cross-script communication and contribute to universal models of transliteration behavior.

Together, these directions outline a rich research agenda that builds on the present study's findings and opens new pathways for theoretical, applied, and technological advancement in transliteration studies.

4. Recommendations

Based on the findings of this SR/MA, several recommendations can be proposed for researchers, policymakers, educators, and AI developers who are interested in Arabic–English transliteration. First, linguists and transliteration researchers can develop cross-regional comparative studies to determine whether the error patterns identified in this corpus hold across different Arab countries, dialects, and sociolinguistic contexts. They can expand transliteration research to include longitudinal datasets, enabling the tracking of changes in spelling practices over time, especially in digital environments.

Policymakers and public-signage authorities should establish standardized transliteration guidelines for shop names, street signs, and public institutions to reduce inconsistency and improve readability for residents and visitors. They should implement quality-control mechanisms for commercial signage, ensuring that transliteration is linguistically accurate and culturally appropriate and encourage municipalities to collaborate with linguists when approving new signage or branding materials.

Educators and language practitioners should integrate transliteration awareness into EFL and Arabic-as-a- foreign-language curricula, helping learners understand the structural differences between the two writing systems; provide training on common transliteration pitfalls, especially for teachers, translators, and editors who regularly handle bilingual texts; and develop teaching materials that illustrate how transliteration choices affect meaning, identity, and cross-cultural communication.

AI Developers and NLP Researchers can improve AI transliteration systems by incorporating linguistically informed rules for Arabic phonology, gemination, pharyngeal fricative consonants, and morphological boundaries. They can curate cleaner, standardized training datasets to prevent AI models from reproducing human inconsistencies found in social-media and signage data. They can evaluate AI transliteration performance across dialects, phoneme classes, and morphological structures, ensuring that systems do

not disproportionately misrepresent certain linguistic features. They may develop hybrid transliteration models that combine machine learning with rule-based constraints to enhance accuracy and reduce bias.

For cross-script identity and documentation systems, universities, immigration offices, medical systems should be encouraged to adopt consistent transliteration policies for personal names to reduce administrative confusion and identity fragmentation and provide individuals with guidance on stable name spellings, especially for official documents, academic publications, and digital profiles.

For Future Systematic Reviews and Meta-Analyses, SR/MA research should be expanded to include multi-author corpora, enabling broader generalization beyond a single research program; incorporate external validation datasets, such as governmental transliteration guidelines or international naming standards; and explore transliteration across additional language pairs (Arabic–French, Arabic–Turkish, Arabic–Urdu) to build a comparative typology of cross-script behavior.

5. Conclusion

This SR/MA study is the first comprehensive synthesis of Arabic–English transliteration accuracy across multiple real-world domains, including shop names, linguistic landscapes, personal names, borrowed nouns, and onomastic practices. By analyzing a complete and methodologically consistent five-year research program, the study offers a coherent view of transliteration behavior and reveals that inaccuracies are not random or domain-specific but structurally patterned, linguistically predictable, and socially meaningful.

Across the fourteen studies, recurrent error types such as short vowel omissions, inconsistent representation of pharyngeal fricative consonants, gemination instability, and morphological boundary confusion - emerge as stable features of Arabic–English transliteration. These patterns reflect deep phonological and orthographic asymmetries between the two writing systems, as well as sociolinguistic pressures related to identity, branding, globalization, and digital communication. The convergence of human and AI transliteration errors further demonstrates that computational systems inherit and amplify the inconsistencies present in human-generated data, underscoring the need for linguistically informed training resources and more responsible AI design.

This review also highlights the broader implications of transliteration for linguistic equity, public communication, and cross-script identity representation. Inaccurate transliteration affects readability, searchability, administrative documentation, and cultural visibility. The absence of standardized transliteration norms across Arabic-speaking contexts contributes to widespread variation, while lack of institutional oversight in public signage and digital platforms allows inconsistencies to go unchecked.

By integrating quantitative accuracy measures with qualitative linguistic analysis, this SR/MA establishes a performance map of transliteration behavior that has not previously existed in the literature. It also positions transliteration as a critical site for understanding how languages interact, how identities are negotiated, and how AI systems reproduce or challenge existing linguistic biases. The findings call for clearer transliteration guidelines, improved AI transliteration models, and expanded cross-regional research that includes multiple authors, dialects, and language pairs.

Finally, this study demonstrates that transliteration is more than a technical conversion from one script to another. It is a linguistic, cultural, and cognitive practice shaped by structural constraints, social motivations, and technological systems. By documenting these dynamics, the present review lays the groundwork for future research, policy development, and AI innovation in order to improve transliteration accuracy and promote linguistic fairness in an increasingly interconnected world.

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