Use of Artificial Intelligence to Support Chart Review Studies: A Scoping Review

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Background

- Manual chart review is a traditional method of data collection in which trained individuals abstract all clinical data required for a study from electronic or paper charts into a purpose-built electronic case-report form (eCRF).[1]
- Manually abstracting medical records is a labor-intensive process and can become expensive, especially when dealing with large numbers of charts. This can detrimentally impact timelines and cost of the study and reduce productivity of available staff at clinical sites like hospitals.[2]
- The recent advancements in artificial intelligence (AI) technologies bring up the question how these technologies can support chart review studies.

Objective

- The objective was to conduct a scoping review of the recent literature to evaluate the use of AI to support elements of chart review.

Methods

- The following targeted search strategy was designed to identify potentially relevant citations in PubMed: (chart review[tiab] OR chart abstraction[tiab] OR chart extraction[tiab]) AND (innovation[tiab] OR innovative[tiab] OR artificial intelligence[tiab] OR machine learning [tiab] OR natural language[tiab]).
- The search was restricted to recent literature from 2020. The PubMed search was conducted on 17 June 2024. All abstracts were downloaded.
- Abstracts were transferred to a Word document for review. Both authors reviewed an equal number of abstracts. Although inter-rater reliability between the two authors was not formally assessed, authors discussed their assessments until a consensus was reached.

Cited Literature

1. Bellary S, Krishnankutty B, Latha MS. Basics of case report form designing in clinical research. Perspect Clin Res. 2014;5(4):159-66.
2. Alzu'bi AA, Watzlaf VJM, Sheridan P. Electronic Health Record (EHR) Abstraction. Perspect Health Inf Manag. 2021;18(Spring):1g.
3. Moore CR, Jain S, Haas S, Yadav H, Whitsel E, Rosamand W, Heiss G, Kucharska-Newton AM. Ascertaining Framingham heart failure phenotype from inpatient electronic health record data using natural language processing: a multicentre Atherosclerosis Risk in Communities (ARIC) validation study. BMJ Open. 2021;11(6):e047356.

- Use case categories were established during data abstraction, with authors having multiple meetings to ensure alignment on the usage.

Results

Number of citations identified

- The PubMed search identified 363 citations.
- A total of 85 citations (23%) described original research cases of AI in supporting chart review research. A complete list of these citations can be obtained by contacting the authors.

Use cases of AI technology

- The use cases of the 85 identified citations were grouped into "automated data collection", "case identification", and "case ascertainment". Case ascertainment was defined as evaluating the accuracy of case identification with AI based on other clinical data; for instance, one study demonstrated that using natural language processing (NLP) to free-text clinical notes effectively identified Framingham heart failure phenotypes, showing good performing compared to manual chart abstraction results.[3]
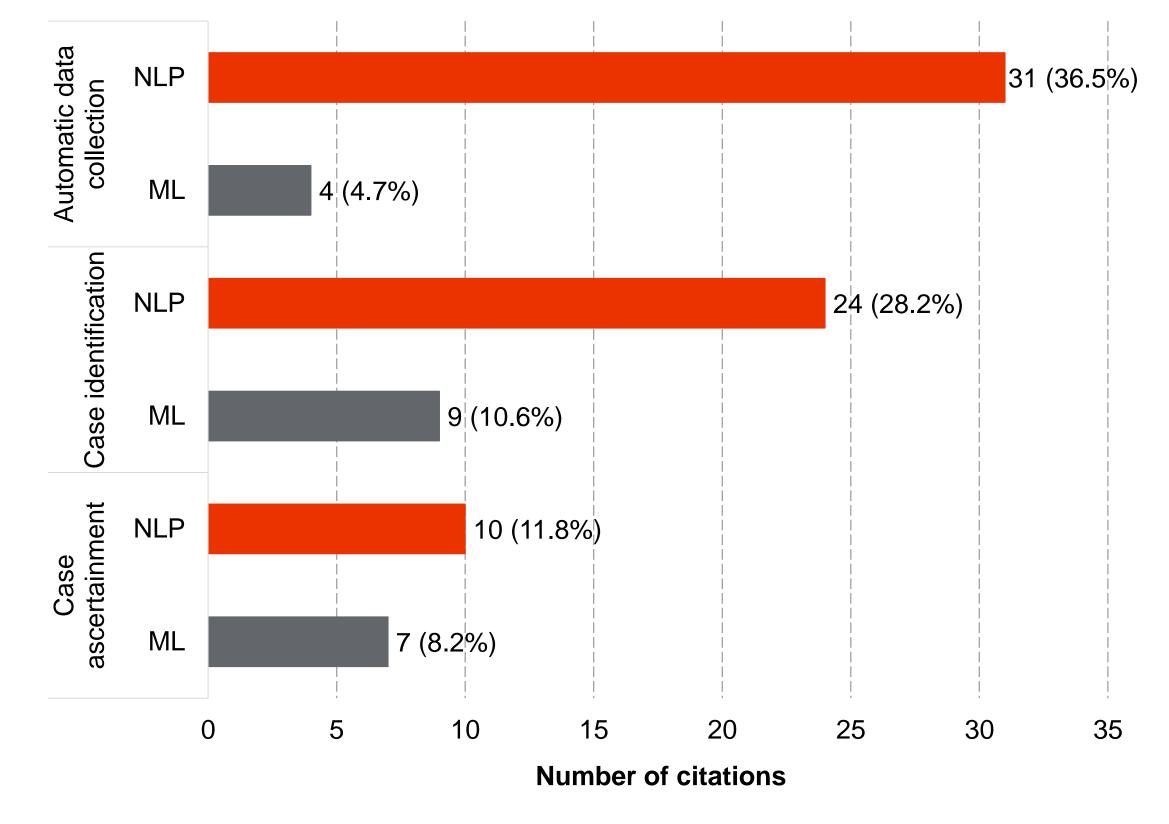- 41% of citations (35/85) used AI technology for automatic data collection, 39% (33/85) for case identification, and 20% (17/85) for case ascertainment.

Used AI technologies

- NLP was the AI technology most often used (76%, 65/85), either alone or in combination with other AI technologies, followed by machine learning was 24% (20/85). **Figure 1** shows the breakdown of AI technologies by use case.

Therapeutic areas

- The most common therapeutic area was oncology with 24% of citations (20/85), followed by neurology with 11% of citations (9/85).

Conclusion

- AI technologies are being applied to support different elements of chart review research. This includes automatic data collection, an area that has potential to positively impact time and cost of chart abstraction. While still in early stages, the use of AI is surging and has potential to support certain chart review activities.

Figure 1: Used AI technologies by use case
Each bar represents a unique use case and AI technology combination, corresponding to the number of citations in the identified literature. Percentages between parentheses are based on all 85 publications as the denominator. Abbreviations: ML, machine learning; NLP, natural language. processing.