

Secondary analysis of electronic health records in critical care medicine

Sven Van Poucke¹, Alberto Alexander Gayle², Milan Vukicevic³

¹Department of Anesthesiology, Intensive Care, Emergency Medicine and Pain Therapy, Ziekenhuis Oost-Limburg, Genk, Belgium; ²Department of Immunology, Mie University Graduate School of Medicine, Tsu, Japan; ³Faculty of Organizational Sciences, University of Belgrade, Belgrade, Serbia
Correspondence to: Sven Van Poucke. Department of Anesthesiology, Intensive Care, Emergency Medicine and Pain Therapy, Ziekenhuis Oost-Limburg, Genk, Belgium. Email: svanpoucke@gmail.com.

Submitted Mar 21, 2017. Accepted for publication Mar 26, 2017.

doi: 10.21037/atm.2017.03.100

View this article at: <http://dx.doi.org/10.21037/atm.2017.03.100>

Although mature clinical decision support technology is readily available, the medical community continues to exhibit the most remarkable difference between the diligent, professional attitude towards care of patients and the puberal, oftentimes neglectful attitude towards the value of the data generated by this process (1). This professional dissonance has been attributed to many causes (2,3); however, most would agree that the impact, in terms of patient care (4) and development of improved diagnostic and treatment options (5,6), is far from benign (7). This editorial confronts the sobering reality that we are far from reaching any declaration of victory in this regard—serious efforts are required (8). Take a seat; we trust the questions raised might trigger some introspection!

Which critical care society provides guidelines on the terminology and its relations as proposed following the latest standards in ontology research?

An ontology is defined as “a dictionary of terms formulated in a canonical syntax and with commonly accepted definitions designed to yield a lexical or taxonomical framework for knowledge-representation which can be shared by different information system communities” (9). Applicable in this context are the Human Disease Ontology (doid), Ontology for Biomedical Investigations (obi), Adverse Event Reporting Ontology (aero), as proposed by the OBO Foundry which mission is to develop interoperable ontologies that are both logically sound and scientifically accurate. (<http://www.obofoundry.org/>) More efforts are needed to implement

ontologies in ICU care and research.

What is the quality of your clinical data collection and how is your primary use of clinical data organized?

Which parameters, features or text are considered essential (minimal critical data, MCD) to fully describe the clinical state of each patient? Which policies have been implemented to minimize the amount of unstructured data compared to structured data? Developing “good clinical data practice guidelines” will be a major responsibility for ICU scientific societies.

Additionally, although procedural standards for data mining are available, they are not frequently implemented in medical big data research [e.g., Cross-Industry Standard Process for Data Mining (CRISP-DM)]. The six high-level phases of CRISP-DM represent a good description for the analytics process (<http://www.kdnuggets.com/2017/01/four-problems-crisp-dm-fix.html>).

Will we be able to generate a dashboard visualizing the patients’ data according to timeframes of interest (e.g., last 24 h or past week), where all necessary information is represented as an infographic with highlighting significant trends or changes? Imagine how much time could be saved daily, if rounds were to require only the interpretation of what is preselected and presented on a dashboard that presents both data and therapeutic choices based on the analysis of relevant data trends. Before any such system could be deployed on a large scale, universally recognized clinical phases for ICU treatment would need to be developed along with commonly

recognized criteria for patient similarity analysis.

Are randomized controlled trials, your only (g) old standard? Are we prepared for clinical intelligence and prescriptive analytics yet?

Predictive analytics should be guided by Evidence Based Medicine as defined by the late Dr. Sackett (10): “the conscientious, explicit and judicious use of the current best evidence in making decisions about the care of the individual patient. This means integrating individual clinical expertise with the best available external clinical evidence from systematic research”. Based on this definition, clinical expertise and the best available external clinical evidence from systematic research are essential. The “best” available external clinical evidence from systematic research should be delivered by the result of all our scientific efforts, as far as they are ethically and scientifically sound.

However, the high-dimensionality and high-complexity of the data involved prevents data-driven methods from easy translation into clinically relevant models. Additionally, the application of cutting edge predictive methods and data manipulation require substantial programming skills, limiting its direct exploitation by medical domain experts. This leaves a gap between potential and actual data usage (1).

Are we prepared to deal with the biggest ethical concerns for the use of artificial intelligence (11)?

These are only a fraction of the questions to be resolved in order to better harmonize and exploit evolutions in biomedical science, engineering and data science. This evolution should lead to more personalized healthcare that is better at predicting the most adequate therapy with the least side effects for a specific, given patients. Moreover, improvements can be expected in the quality of care with a simultaneous decrease in cost. Inevitably, the research on ICU related topics will evolve in the direction that includes the customization of healthcare being tailored to the individual patient (12).

Acknowledgements

None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

References

1. Van Poucke S, Zhang Z, Schmitz M, et al. Scalable predictive analysis in critically ill patients using a visual open data analysis platform. *PLoS One* 2016;11:e0145791.
2. Yung A. Adoption of Electronic Health Record System in Community-Based Physiotherapy Clinics: A Pilot Case Study. *Stud Health Technol Inform* 2017;234:395-400.
3. Cifuentes M, Davis M, Fernald D, et al. Electronic Health Record Challenges, Workarounds, and Solutions Observed in Practices Integrating Behavioral Health and Primary Care. *J Am Board Fam Med* 2015;28 Suppl 1:S63-72.
4. Jeffries M, Phipps DL, Howard RL, et al. Understanding the implementation and adoption of a technological intervention to improve medication safety in primary care: a realist evaluation. *BMC Health Serv Res* 2017;17:196.
5. Hu Z, Melton GB, Arsoniadis EG, et al. Strategies for handling missing clinical data for automated surgical site infection detection from the electronic health record. *J Biomed Inform* 2017. [Epub ahead of print].
6. Danner OK, Hendren S, Santiago E, et al. Physiologically-based, predictive analytics using the heart-rate-to-systolic-ratio significantly improves the timeliness and accuracy of sepsis prediction compared to SIRS. *Am J Surg* 2017;213:617-21.
7. Tso GT, Tu SW, Oshiro C, et al. Automating Guidelines for Clinical Decision Support: Knowledge Engineering and Implementation. *AMIA Annu Symp Proc* 2017;2016:1189-98.
8. Ghassemi M, Celi LA, Stone DJ. State of the art review: the data revolution in critical care. *Crit Care* 2015;19:118.
9. Smith B, Ashburner M, Rosse C, et al. The OBO Foundry: coordinated evolution of ontologies to support biomedical data integration. *Nat Biotechnol* 2007;25:1251-5.
10. Sackett DL, Rosenberg WM, Gray JA, et al. Evidence based medicine: what it is and what it isn't. *BMJ* 1996;312:71-2.
11. Available online: <https://www.enterpriseirregulars.com/110053/notes-reality-interview-dr-david-bray-michael-krigsmann-ethics-artificial-intelligence/>
12. Golubnitschaja O, Kinkorova J, Costigliola V. Predictive, Preventive and Personalised Medicine as the hardcore of “Horizon 2020”: EPMA position paper. *EPMA J* 2014;5:6.

Cite this article as: Van Poucke S, Gayle AA, Vukicevic M. Secondary analysis of electronic health records in critical care medicine. *Ann Transl Med* 2018;6(3):52. doi: 10.21037/atm.2017.03.100