Despite the many possible shortcomings, we believe there is value in the present report. Herein, we have demonstrated a reproducible, accurate, fast method of appraising a prenatal HN dataset, which is applicable in everyday clinical use, with deployment of a key that can be introduced in webpages or applications, thus offering a predictive tool that could be employed and validated worldwide. The same techniques we have described could be used to predict other important outcomes (such as UTI risk and likelihood or timing of spontaneous resolution) in this population of infants, which is the matter of ongoing research efforts at our centers.

CONCLUSION

This powerful, cloud-based, ML technology allows easy building, deployment, and sharing of predictive analytics solutions. Using PHN as an example, we propose an opportunity to address current challenges with data analysis, with a creative solution that moves beyond the current standard, allowing for the creation and updating of predictive models based on large amounts of information.

References

1. Ghiassi M, Zimbra D, Lee S. Targeted twitter sentiment analysis for brands using supervised feature engineering and the dynamic architecture for artificial neural networks. *J Manag Inf Syst*. 2016;33:1034–1058.
2. Obermeyer Z EE. Predicting the future-big data, machine learning and clinical medicine. *N Engl J Med*. 2016;375:1216–1219.
3. Blount M, Ebling MR, Eklund JM, et al. Real-time analysis for intensive care: development and deployment of the artemis analytic system. *IEEE Eng Med Biol Mag*. 2010;29:110–118.
4. Ni Y, Beck AF, Taylor R, et al. Will they participate? Predicting patients' response to clinical trial invitations in a pediatric emergency department. *J Am Med Inform Assoc*. 2016;23:671–680.
5. Darcy A, Louie AK, Roberts LW. Machine learning and the profession of medicine; JAMA. 2016;315:551–552. https://jamanetwork.com/journals/jama/fullarticle/2488315
6. Arora S, Yadav P, Kumar M, et al. Predictors for the need of surgery in antenatally detected hydronephrosis due to UPJ obstruction – A prospective multivariate analysis. *J Pediatr Urol*. 2015;11.248.e1-5.
7. Tipping Michael BC. Probabilistic principal component analysis. *J R Stat Soc*. 1999;21:611–622.
8. Fernbach SK, Maizels M, Conway JJ. Ultrasound grading of hydronephrosis: Introduction to the system used by the society for fetal urology. *Pediatr Radiol*. 1993;23:478–480.
9. Vickers AJ, Kent M, Scardino PT. implementation of dynamically updated prediction models at the point of care at a major cancer center: Making nomograms more like Netflix. *Urology*. 2017;102:1–3.
10. Hao S, Jin B, Shin AY, et al. Risk prediction of emergency department revisit 30 days post discharge: A prospective study. *PLoS One*. 2014;9 e112944.
11. Cooper JN, Wei L, Fernandez SA, Minneci PC, Deans KJ. Pre-operative prediction of surgical morbidity in children: Comparison of five statistical models. *Comput Biol Med*. 2015;57:54–65.
12. Odeh R, Noone D, Bowlin PR, Braga LHP, Lorenzo AJ. Predicting risk of chronic kidney disease in infants and young children at diagnosis of posterior urethral valves: Initial ultrasound kidney characteristics and validation of parenchymal area as forecasters of renal reserve. *J Urol*. 2016;196:862–868.
13. Fischer K, Li C, Wang H, Song Y, Furth S, Tasian GE. Perinatal urology renal parenchymal area growth curves for children 0 to 10 months old. *J Urol*. 2016;195:1203–1208.
14. Rickard M, Lorenzo AJ, Braga LH. Renal parenchyma to hydronephrosis area ratio (PHAR) as a predictor of future surgical intervention for infants with high-grade prenatal hydronephrosis. *Urology*. 2017;101:85–89.
15. Kern AJM, Schlomer BJ, Timberlake MD, Peters CA, Hammer MR, Jacobs MA. Simple visual review of pre- to post-operative renal ultrasound images predicts pyeloplasty success equally as well as geometric measurements: A blinded comparison with a gold standard. *J Pediatr Urol*. 2017;14:401.e1–401.e7.
16. Rickard M, Braga LH, Oliveria J-P, Romao R, Demaria J, Lorenzo AJ. Percent improvement in renal pelvis antero-posterior diameter (PI-APD): Prospective validation and further exploration of cut-off values that predict success after pediatric pyeloplasty supporting safe monitoring with ultrasound alone. *J Pediatr Urol*. 2016;12:228.e1–228.e6.
17. Rickard M, Lorenzo AJ, Braga LH, Munoz C. Parenchyma-to-hydronephrosis area ratio is a promising outcome measure to quantify upper tract changes in infants with high-grade prenatal hydronephrosis. *Urology*. 2016;104:166–171.
18. Babu R, Sai V. Pelvis/cortex ratio: An early marker of success following pyeloplasty in children. *J Pediatr Urol*. 2010;6:473–476.
19. Logvinenko T, Chow JS, Nelson CP. Predictive value of specific ultrasound findings when used as a screening test for abnormalities on VCUG. *J Pediatr Urol*. 2015;11:176.e1–176.e7.
20. Cerrolaza JJ, Peters CA, Martin AD, Myers E, Safdar N, Linguraru MG. Quantitative ultrasound for measuring obstructive severity in children with hydronephrosis. *J Urol*. 2016;195:1093–1099.
21. Murdoch TB, Detsky AS. The inevitable application of big data to health care. *JAMA*. 2013;309:1351–1352.
22. Hu P, Wu F, Peng J, Bao Y, Chen F, Kong D. Automatic abdominal multi-organ segmentation using deep convolutional neural network and time-implicit level sets. *Int J Comput Assist Radiol Surg*. 2017;12:399–411.
23. Esteva A, Kuprel B, Novoa RA, et al. Dermatologist-level classification of skin cancer with deep neural networks. *Nature*. 2017;542:115–118.

EDITORIAL COMMENT

The authors report a thought-provoking, preliminary exploration of the application of artificial intelligence (AI) and machine learning (ML) to predict the need for surgical intervention in children with prenatally-detected hydronephrosis.

The growing potential for AI applications in medicine is a reality. Nonetheless, a careful assessment of the AI literature in healthcare will reveal an almost exclusive focus on diagnostics; in other words, AI and ML are usually employed to advance interpretation, improve accuracy and outreach of diagnostic tests. The examples cited by the authors in the "discussion" section illustrate this point well.

With that in mind, the main question that arises is: what is the role of AI in treatment-related decisions, particularly those involving surgery? As the authors correctly mention, the indication for surgery in patients with prenatal hydronephrosis and possible ureteropelvic junction obstruction (UPJO) is not clear-cut and significant controversy still exists. In that way, single-center validation of ML as presented might pose a problem; as long as there is minimal consistency amongst practitioners working as part of the same group, indications for surgery "learned" by the model may prove to be faulty when applied to other institutions that follow a different set of criteria to operate. In this setting, a step where multicentric validation is performed is clearly needed.

The burden to generate good-quality evidence and establish best practices in the management of patients with prenatally-detected hydronephrosis is on our community of pediatric urologists; through careful study design and robust analysis procedures, we will hopefully have the ability to identify the variables that will populate future generalizable AI tools. This article is a great first step in that direction and the authors should be congratulated for it.

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AUTHOR REPLY

We sincerely appreciate the thoughtful comment accompanying our manuscript. We wholeheartedly agree that this is an exciting time for medicine, with sophisticated technology becoming more and more user friendly as well as increasingly accessible.

As highlighted, choosing an outcome such as surgical intervention may be perceived as surgeon or institution dependent. Nevertheless, we feel that our surgical indications, especially for pyeloplasty, are similar to many other pediatric institutions. We acknowledge that surgical indications may vary, as can be seen with related conditions such as uretero-vesical junction obstruction or vesicoureteral reflux. It is unlikely that advanced analytics will be able to standardize the multifactorial decision to proceed with surgery in the near future. It can, however, risk stratify patients while taking into account variability between providers or institutions. As models are perfected and databases grown, so will our ability to harness this technology to improve patient care.

We are grateful for the opportunity to publish this experience as one of the first in our sub-specialty. We hope that this information will spark interest in this technology and actively engage other in exploring further, introducing more sophisticated tools and fostering collaboration between experts in computer science and the growing artificial intelligence field with clinical experts in pediatric urology and radiology. While this technology can never replace informed clinical decision-making by experienced clinicians, we hope to be able to enhance patient, family and health care provider experience by fine tuning and training user-friendly models capable of consuming and quickly analyzing vast amounts of valuable clinical data to ultimately assist real-time decisions in every day practice.

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