AI big data analysis about Hb in the real hospital setting

Hyonkeun Joh
Medical Director, Medical Affairs
AITRICS Co., Ltd.

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AI-based prediction and diagnosis of anemia, coagulopathy

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Saputra, D. C. E., Sunat, K., & Ratnaningsih, T. (2023). A New Artificial Intelligence Approach Using Extreme Learning Machine as the Potentially Effective Model to Predict and Analyze the Diagnosis of Anemia. *Healthcare (Basel), 11(5). https://doi.org/10.3390/healthcare11050697*

- **An Extreme Learning Machine (ELM)-based AI model achieved over 99% accuracy in differentiating four anemia types (IDA, BTT, HbE, mixed), demonstrating rapid, affordable, and accurate classification from CBC data in resource-limited settings.**

Garduno-Rapp, N. E., Ng, Y. S., Weon, J. L., Saleh, S. N., Lehmann, C. U., Tian, C., & Quinn, A. (2024). Early identification of patients at risk for iron-deficiency anemia using deep learning techniques. *Am J Clin Pathol, 162(3), 243-251. https://doi.org/10.1093/ajcp/aqae031*

- **Deep learning models trained on longitudinal outpatient lab data (LSTM, GRU) successfully predicted iron-deficiency anemia 3–6 months before clinical diagnosis, enabling early intervention opportunities.**

01. AI-based prediction and diagnosis of anemia, coagulopathy

Cakmak, Y., & Pacal, I. (2025). AI-Driven Classification of Anemia and Blood Disorders Using Machine Learning Models. *Computers and Electronics in Medicine, 2(2), 43-52.*

- **Multiple machine learning models were trained to classify types of anemia (IDA, leukemia, thrombocytopenia) using hematological parameters, with Gradient Boosting achieving 99.2% accuracy, illustrating AI's diagnostic precision and value in clinical decision support.**

Chishti, S., Nosheen, F., Fatima, J., Sultan, N., & Khalid, M. (2025). From CBC to clarity: Interpretable detection of beta-thalassemia carriers in imbalanced datasets. *PLoS One, 20(9), e0331985. https://doi.org/10.1371/journal.pone.0331985*

- **A Dominance-based Rough Set Approach (DRSA) was used to develop an interpretable AI model that accurately detects beta-thalassemia carriers using only CBC data, offering a cost-effective, explainable tool for anemia screening in low-resource settings.**

Darshan, B. S. D., Sampathila, N., Bairy, G. M., Prabhu, S., Belurkar, S., Chadaga, K., & Nandish, S. (2025). Differential diagnosis of iron deficiency anemia from aplastic anemia using machine learning and explainable Artificial Intelligence utilizing blood attributes. *Sci Rep, 15(1), 505. https://doi.org/10.1038/s41598-024-84120-w*

- **The study applied explainable AI (XAI) models to differentiate iron deficiency anemia from aplastic anemia using CBC features, enhancing transparency and trust in clinical AI-assisted diagnosis.**

02

Personalized PBM with AI or big data analysis

02. Personalized PBM with AI or big data analysis

Engelke, M., Schmidt, C. S., Baldini, G., Parmar, V., Hosch, R., Borys, K., Koitka, S., Turki, A. T., Haubold, J., Horn, P. A., & Nensa, F. (2023). Optimizing platelet transfusion through a personalized deep learning risk assessment system for demand management. *Blood, 142(26), 2315-2326. https://doi.org/10.1182/blood.2023021172*

- **The article explores machine learning-based approaches to preoperative blood product planning, showing how individualized prediction models can reduce over-ordering and align blood preparation with patient-specific transfusion risk.**

Li, N., & Down, D. G. (2023). Deep learning for platelet transfusion. *Blood, 142(26), 2231-2232. https://doi.org/10.1182/blood.2023022981*

- **The study demonstrates how deep learning models can accurately forecast platelet transfusion needs by integrating patient-specific clinical and laboratory data, offering a pathway to personalized transfusion strategies and reducing unnecessary product use.**

Maynard, S., Farrington, J., Alimam, S., Evans, H., Li, K., Wong, W. K., & Stanworth, S. J. (2024). Machine learning in transfusion medicine: A scoping review. *Transfusion, 64(1), 162-184. https://doi.org/10.1111/trf.17582*

- **The comprehensive review maps how machine learning is being deployed across transfusion medicine to predict transfusion needs, optimize product use, and tailor decisions to individual patient profiles, underscoring its central role in future personalized PBM frameworks.**

03

AI in perioperative PBM

Lou, S. S., Liu, H., Lu, C., Wildes, T. S., Hall, B. L., & Kannampallil, T. (2022). Personalized Surgical Transfusion Risk Prediction Using Machine Learning to Guide Preoperative Type and Screen Orders. *Anesthesiology, 137(1), 55-66. https://doi.org/10.1097/aln.0000000000004139*

- **A gradient boosting model using patient- and surgery-specific data significantly outperformed traditional methods in predicting intraoperative transfusion risk, optimizing preoperative type and screen decisions for more efficient PBM.**

Lang, F. F., Liu, L. Y., & Wang, S. W. (2023). Predictive modeling of perioperative blood transfusion in lumbar posterior interbody fusion using machine learning. *Front Physiol, 14, 1306453. https://doi.org/10.3389/fphys.2023.1306453*

- **Using XGBoost, the study accurately predicted transfusion needs in lumbar spine surgeries, identifying key features like intraoperative blood loss and fusion levels to guide perioperative blood management.**

Sun, Z. D., Fang, Y. M., Lin, Y. L., Pei, M. Q., Liu, C. Y., & He, H. F. (2025). Construction and validation of a perioperative blood transfusion model for patients undergoing total hip arthroplasty with osteonecrosis of the femoral head based on machine learning. *Front Med (Lausanne), 12, 1471746. https://doi.org/10.3389/fmed.2025.1471746*

- **Machine learning models and a nomogram based on perioperative variables accurately predicted transfusion risk in hip arthroplasty patients, supporting precise blood preparation strategies in orthopedic PBM.**

Xiong, X., Fu, H., Xu, B., Wei, W., Zhou, M., Hu, P., Ren, Y., & Mao, Q. (2025). Ten Machine Learning Models for Predicting Preoperative and Postoperative Coagulopathy in Patients With Trauma: Multicenter Cohort Study. *J Med Internet Res, 27, e66612. https://doi.org/10.2196/66612*

- **This study developed and validated ten machine learning models—highlighting random forest as most accurate—to predict pre- and postoperative traumatic coagulopathy (PPTIC), enabling earlier intervention and improved outcomes in trauma-related perioperative PBM.**

04

AI based early warning system(AI-EWS) calculated with patient information including laboratory data

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04. AI based early warning system(AI-EWS) calculated with patient information including laboratory data

Sim, T., Cho, E. Y., Kim, J. H., Lee, K. H., Kim, K. J., Hahn, S., Ha, E. Y., Yun, E., Kim, I. C., Park, S. H., Cho, C. H., Yu, G. I., Ahn, B. E., Jeong, Y., Won, J. Y., Cho, H., & Lee, K. B. (2025). Prospective external validation of a deep-learning-based early-warning system for major adverse events in general wards in South Korea. *Acute Crit Care, 40(2), 197-208. https://doi.org/10.4266/acc.000525*

- **The VitalCare-MAES significantly outperformed traditional EWSs in predicting adverse events in general ward patients, and the performance suggests that broader adoption of the VC-MAES may improve clinical efficiency and resource allocation in general wards.**

Kim, J. H., Lee, K., Kim, K. J., Ha, E. Y., Kim, I. C., Park, S. H., Cho, C. H., Yu, G. I., Ahn, B. E., Jeong, Y., Won, J. Y., Sim, T., Cho, H., & Lee, K. B. (2025). Validation of an artificial intelligence-based algorithm for predictive performance and risk stratification of sepsis using real-world data from hospitalised patients: a prospective observational study. *BMJ Health Care Inform, 32(1). https://doi.org/10.1136/bmjhci-2024-101353*

- **A deep learning algorithm, VC-SEPS, integrated with EMR and laboratory results, was prospectively validated to predict sepsis onset 68 minutes earlier than clinical diagnosis, outperforming conventional tools like SOFA and qSOFA in both accuracy and early risk stratification.**

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E-mail hkhjoh1103@aitrics.com

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