P-123 How to develop accurate Computer Assisted Sperm Analysis (CASA) AI in the absence of protocol standardization and abundance of human error when performing semen analyses?

Z. Simon[1], R. Maillot[1], M. Monteiro[1], S. Rogers[2], A. Mania[3], L. Bjorndahl[4], S. Homa[5], D. Thomas[1], M. Taha[1]

[1]mojo, lyon, lyon, France ;
[2]The Hospital Fertility Group, Alder Close, Eastbourne, United Kingdom ;
[3]Kings Fertility, London, London, United Kingdom ;
[4]ANOVA- Karolinska University Hospital, Stockholm, Stockholm, Sweden ;
[5]Kent University, Kent, Kent, United Kingdom

Study question: How can an automation & artificial intelligent tools be developed to perform according to WHO recommendations?

Summary answer: Developing CASA performs at < 20% error margin requires AI trained with high quality datasets and a robotic system adheres to WHO guidelines.

What is known already: A survey of 40 andrology laboratories, in 22 countries, revealed that > 90% had nonconformities in correct use of equipment, standardisation of protocols and quality control, leading to a lack of compliance to WHO protocols. Conventional CASA systems can standardize analysis, but controversy has occurred due to differences between manual and automated analyses stemming from: 1) all cells in a semen sample are detected including debris; 2) protocol variation when compared to top-notch manual analysis. The first point can be addressed by AI. The second point can be addressed by robotics designed to adhere to WHO guidelines.

Study design, size, duration: A mojo AISA (AI-powered semen analysis) system was placed in four clinical laboratories mentioned above capturing images of over 300 samples, one million images were generated over a course of 2 years. Mojo AISA's AI was trained on data collected from the four clinics using robotic system is developed according to WHO guidelines.

Participants/materials, setting, methods: For an AI to detect sperm accurately, sperm samples were captured using mojo AISA smart microscopy and then the extracted sperm images expertly annotated. To evaluate the system-ability for semen analysis, fresh sample were analysed for concentration and motility by a manual operator and compared to a mojo AISA test.

Main results and the role of chance: To train the sperm detection AI, representative sperm images were carefully captured using mojo AISA and processed according to the following criteria:

- the number of images and videos to train and to test the model: 50,000 spermatozoon head and tails with various variations
- the variety of images: data used to train the AI has to be representative of the population that will undergo the analysis: 1) wide concentration ranges from 0 to 300 M/ml, 2) high and low density of debris and cells, 3) Presence of slight aggregations
- careful and precise annotation: expert andrology scientists annotated sperm images and identify objects to exclude, such as debris in seminal plasma, Mojo AISA is an attempt strictly build CASA AI system to WHO-guidelines. The marriage of AI and robotics automation has shown a promising results to mimic humans when measuring a semen sample and attempt to obtain results comparable to the manual analysis.

mojo AISA's performance improved three-fold (from 0,85 to 0,95 Pearson sperm count correlation and from >100% means relative error to 25% mean relative error).

Limitations, reasons for caution: Lack of standardization for semen analysis laboratory process globally is a bottleneck towards building a robust multi-center study, on-site CASA testing and generating an actionable data pool for studying the causes behind male fertility declineWider implications of the findings: Key learnings for parties advancing developing AI based on images and videos for application in the fertility space.

Trial registration number: not applicable