USING A MACHINE LEARNING MODEL FOR IDENTIFYING AN INDIVIDUALIZED OPTIMAL STARTING FSH DOSE

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Background
One of the key decisions during ovarian stimulation is determining the starting dose of follicle stimulating hormone (FSH). Previously, an interpretable machine learning model was developed for creating individualized curves relating starting dose of FSH to mature egg (MII) outcomes. For a patient of interest, this model generates a dose-response curve from 100 similar historical patient cycles identified through a K-nearest neighbors model trained on patient age, BMI, anti-Müllerian hormone (AMH), and antral follicle count (AFC).

Objective
To use artificial intelligence (AI) to identify the optimal starting dose of FSH for ovarian stimulation patients and quantify potential dose savings.

Materials and Methods
We performed a retrospective analysis of patients undergoing autologous IVF cycles from 2014 - 2023 (n=20,227) at 4 different IVF clinics in the United States. For each patient, a dose curve was created using a previously-developed machine learning model relating starting FSH to predicted MIIs retrieved (1). Using this curve, an optimal dose was identified for each patient, defined as the lowest dose (out of 150, 225, 300, 375, 450, 525 IUs) that resulted in predicted MIIs within 5% of the maximum of the curve. To validate this approach, we compared cycles that were dosed over the optimal dose (12,943 cycles) to cycles dosed at the optimal dose (4,141). Patients from the two groups were matched using a 1:1 nearest-neighbor approach based on age, BMI, AFC, AMH and predicted optimal dose. We then compared MIIs, starting FSH, and total FSH, between the group dosed at optimal and the matched patients dosed above optimal.

Results
After matching, there was no clinical difference in average patient age, BMI, AMH, or AFC between patients dosed at their predicted optimal dose versus those dosed above. Patients dosed above their predicted optimal dose retrieved 0.69 fewer MII's on average than patients dosed at their optimal dose, saving an average 131.36 IUs of starting FSH and 1217.57 IUs of total FSH (Table 1).

	Patients dosed at optimal (mean)	Patients dosed over optimal (mean)	Difference between matched groups
Starting FSH Dose	329.55	460.92	131.36 ($p<0.001$)
Total FSH Dose	3822.72	5040.29	1217.57 ($p<0.001$)
MIIs	12.14	11.45	0.69 ($p<0.001$)

Conclusions

We used a previously-developed machine learning model relating starting FSH to predicted MIIs retrieved to identify an optimal starting dose of FSH Our retrospective analysis suggests a majority of patients could have saved an average of 130 IUs starting dose and 1200 of total dose while having comparable outcomes had they been given the predicted optimal dose.

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References

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