Detection of the fertile window using a wearable medical device and the calendar method: A comparative study

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Introduction

- The calendar method remains a popular Natural Family Planning (NFP) method among conception-seeking women for its relative ease of use.\textsuperscript{1,2} However, it makes erroneous assumptions about a woman’s cycle, rendering it imprecise.\textsuperscript{3-5}
- Tracking several physiological parameters simultaneously, wearable sensor technology learns each woman’s cycle and detects the fertile window with up to 90% accuracy.\textsuperscript{6}
- Research aim: To compare the performance of traditional NFP calendar methods to an individualized, AI-driven wearable device in predicting the fertile window (FW)

Methods

- Design: Retrospective analysis of data from a clinical sample where women (n=34) wore Ava Fertility Tracker daily for up to 1 year or through pregnancy and recorded 23 cycles.
- Ava Fertility Tracker measures:
  - Wrist skin temperature
  - Pulse rate
  - Respiratory rate
  - Skin perfusion
  - Heart rate variability (HRV)
- Predicted FW for each cycle using the following calendar methods:
  - Standard Days Method\textsuperscript{a,b,e,f}: Cycle days 8-19
  - Rhythm Method\textsuperscript{a,b,e,f}: Begins day \(x-18\) and ends day \(y-11\), where \(x\) and \(y\) represent the shortest and longest cycle durations, respectively, in the last 3 months
  - Alternate Rhythm Method\textsuperscript{a,b,e,f}: Begins cycle day \(x-5\) and lasts for \(y-x+8\) days, where \(x\) and \(y\) represent the shortest and longest cycle durations, respectively, in the last 3 months
- Calculated each method’s accuracy, precision, and specificity based on its predicted FW compared to a reference standard (LH-determined FW)
  - Accuracy: Percentage of correct predictions, regardless of cycle day
  - Precision: Percentage of days predicted as fertile that were actually fertile
  - Specificity: Percentage of days predicted as infertile that were actually infertile

Conclusion

- Wearable technology can provide more accurate, precise predictions of the FW than traditional calendar methods.
- Our findings have implications for women across the reproductive lifespan; whether trying to conceive or minimize the number of days requiring back up contraception, wearable technology represents a significant step forward in individualized, AI-driven healthcare.

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Results

![Figure 1. Ava Fertility Tracker and its mobile application.](image)

![Figure 2. Boxplot distribution representing the 25/50/75% percentiles of the fertile window start and end for each method.](image)

![Figure 3. Tradeoff between specificity and precision for each method.](image)

<table>
<thead>
<tr>
<th>Method</th>
<th>Accuracy</th>
<th>Precision</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ava Fertility Tracker</td>
<td>88.1%</td>
<td>73.0%</td>
<td>91.5%</td>
</tr>
<tr>
<td>Standard Days</td>
<td>76.4%</td>
<td>48.1%</td>
<td>71.5%</td>
</tr>
<tr>
<td>Rhythm</td>
<td>75.3%</td>
<td>48.6%</td>
<td>61.6%</td>
</tr>
<tr>
<td>Alternate Rhythm</td>
<td>73.0%</td>
<td>45.9%</td>
<td>59.5%</td>
</tr>
</tbody>
</table>

Table 1. Performance statistics for each method

Note: Mean values reported, with standard deviations in parentheses.

References: