Practical and cost benefits of AMH over timed gonadotrophins for fertility assessment

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Objective

- Initial fertility investigations include testing gonadotrophins and progesterone, both requiring precise timing in the menstrual cycle
- AMH (anti-mullerian hormone) is a new biomarker of ovarian reserve and shows minimal inter and intra-cycle variation
- AMH is superior to gonadotrophins (day 2-5 FSH/LH) in predicting ovarian reserve and response to ovarian stimulation
- If gonadotrophins are incorrectly taken at the same time as mid-luteal progesterone, it is not possible to interpret them
- Due to the cost of AMH assay, it is mainly used in women starting IVF treatment
- This study evaluates the cost-effectiveness and practical aspects of performing universal AMH testing in primary and secondary care, instead of conventional timed gonadotrophins and progesterone

Design

- This is a retrospective observational cohort study of cost-effectiveness of universal AMH screening compared to current timed hormone testing, focusing on the interface between primary and secondary care
- We included all women aged 18-51 who had AMH or both gonadotrophins and progesterone tested in our laboratory in 2016
- We excluded progesterone tests for early pregnancy complications, women on ovulation induction, samples from emergency department and non-fertility related requests
- The costs of were obtained from UK National Schedule of Reference Costs
- The cost of repeat clinic appointments was estimated by the number of tests requested by fertility specialists, estimating that one additional appointment was required for each patient to review these results

Results

- In 2016, 2239 women had fertility investigations in our lab, undergoing 4159 blood samples
- 42% of gonadotrophin tests were incorrectly taken on the same day as progesterone, with 93% originating from primary care (Figure 1)

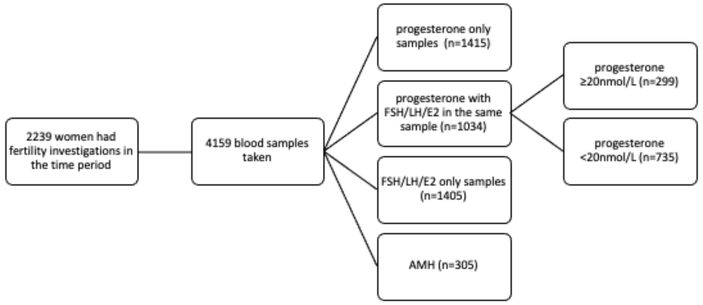

Figure 1: Overview of all blood investigations in our lab in 2016

- The total cost of lab assays with phlebotomy was £37656.40, based on current prices (Table 1)
- As multiple samples were missing or mis-timed, 472 women (21% of all) had further blood tests requested by fertility consultants, increasing the expenditure including repeat clinic appointments to £134416.40
- The universal AMH testing for this cohort would cost £54810.72 leading to a saving of £79605.68, with a spend per patient being £24.48 for universal AMH testing as opposed to £60.03 with standard testing regime including repeat appointments ($p<0.0001$)
- Our proposed investigation pathway includes a single AMH blood test prior to secondary care referral, which does not need to be accurately timed, nor repeated
- Even though the cost of AMH is 66% more than timed gonadotrophins and progesterone, it would allow an overall 59% cost reduction by limiting repeat gynaecology clinic attendance
- Table 2 shows estimated cost saving for hospital units of different size

Biochemical test or clinical service	Number of tests or clinic appointments	Price per item (2021)	Total Cost (2021)
FSH	2430	£1.16	£2818.80
LH	2306	£1.16	£2674.96
E2	1624	£1.19	£1932.56
Progesterone	2449	£1.82	£4457.18
AMH	305	£19.73	£6017.65
Phlebotomy	4159	£4.75	£19755.25
Total cost of biochemical tests and phlebotomy	-	-	£37656.40
Gynaecology clinic (any grade)	472	£205	£96760
Total cost	-	-	£134416.40

Table 1: The cost calculations based on current prices

We propose:

- AMH testing as a baseline investigation for egg reserve and PCOS
- FSH/LH/E2 would be reserved for women with suspected hypogonadotrophic hypogonadism
- Progesterone is unlikely to add any more information in women with normal AMH, regular cycles and positive ovulation prediction kit

Discussion

- AMH is an excellent marker of egg reserve with minimal intra-cycle variance
- AMH test is more costly than current follicular phase gonadotrophin and luteal phase progesterone testing
- Current timed tests are frequently taken at an incorrect time in the menstrual cycle, therefore needing to be repeated
- Multiple appointments can be inconvenient to the woman, cause physical discomfort and create additional costs for transport, time off work and possibly arranging childcare. They also possibly delay the start of treatment.
- When the cost of repeat appointments is added, the cost-analysis favours AMH testing

Number of fertility patients seen in a year	Cost assuming similar degree of repeat blood tests and appointments as in our study cohort	Cost of universal AMH testing (AMH and phlebotomy)	Potential cost saving if universal AMH testing was implemented
Number of fertility patients in our unit: 2239	£134416.40	£54810.72	£79605.68
500	£30017.06	£12240	£17777.06
1000	£60034.12	£24480	£35554.12
2000	£120068.25	£48960	£71108.25
3000	£180102.37	£73440	£106662.37
4000	£240136.49	£97920	£142216.49
5000	£300170.61	£122400	£177770.61

Table 2: Estimated cost saving for different unit sizes, based on our cost calculations

Conclusions

- Universal AMH testing in primary care, instead of timed gonadotrophin and progesterone assays, could provide a cost saving of 59% per patient and reduce the number of fertility clinic appointments.
- This could potentially enable a one stop fertility service, likely improving waiting times and patient satisfaction.