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Title:

INTRODUCTION OF EXPANDED CARRIER SCREENING BY A LARGE SPERM BANK IMPROVES PRECONCEPTUAL CARE WITHOUT ALTERING ACCEPTABILITY OF SPERM DONORS

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Objective:

Expanded carrier screening (ECS) for inherited genetic conditions has become an important aspect of pre-conception planning. ECS provides patients and couples with information regarding their carrier status for a multitude of recessive diseases, and empowers them with the opportunity to minimize the chance of having a child affected with a genetic disease. While gamete banks have for years been screening donors with ACOG's recommended panel or with ethnicity-based testing, some banks have recently expanded their testing to larger pan-ethnic panels. Thus, in addition to having available customary information regarding epidemiologic and phenotypic features (i.e. medical attributes, phenotypic data, educational background, race, and religious beliefs), patients can now integrate additional information such as ECS into their decision-making process. The study aimed to determine whether the addition of ECS panels to routine donor screening is correlated with recipient selection of donor sperm from a large national registry.

Design:

Retrospective cohort study

Materials and Methods:

The study included a selection of donor sperm available to recipients from a large national sperm bank between 2016-2018. Donor characteristics included: height, weight, eye color, hair color and texture, complexion, cytomegalovirus (CMV) status, religion, race, education, ECS status, and ability for donor identity release for future contact (ID-release). ECS was performed for up to 260 recessive disorders and donors were categorized based on their ECS status. The time between vial sales and the total sperm vials released and procured were also recorded and used as metrics for increased donor "desirability." Data were analyzed using a Student's T-test, Chi square, generalized estimating equation model and Random Forest algorithm.

Results:

A total of 176 donors and 33,590 vials of sperm were included in the study. Donors with ECS (n=91) and without ECS (n=85) had similar height, weight, BMI, eye color, hair color and texture, complexion types, CMV status, level of education, religious and racial backgrounds, and ID-release (Table 1). Of the donors who had ECS, 41.8% (38/91) tested negative for all mutations on the panel. More total vials of ECS-tested donor sperm were sold (89.1 ± 80.5, $p = 0.0002$). After adjusting for the time between sales and accounting for multi-co-linearity, the top features that influenced donor selection were height ($g=0.15$), CMV status ($g=0.07$), Jewish Ancestry ($g=0.07$), weight ($g=0.06$), and eye color ($g=0.06$). ECS was the weakest predictor of vial sales ($g=0.002$). Donors were more likely to be selected if they were tall ($\beta=0.13$, $p=0.02$), lacked CMV ($\beta=-0.52$, $p=0.02$), were not Jewish ($\beta=-0.62$, $p=0.18$), and had light-colored eyes ($\beta=-0.52$, $p=0.01$).

Conclusions:

While genomic data can be extremely helpful to minimize disease transmission to future offspring, DNA is only one of many attributes women consider when selecting donor sperm for ART treatment. This study showed that ECS does not limit donor selectability from a large national registry. Although phenotypic information remains a major driver of donor selection, an increasing number of clinicians and well-counseled recipients are incorporating genomic information to identify donors compatible with their own ECS results. In an era of genomic medicine, providers are encouraged to optimize outcomes through the use of genetic testing. Perhaps future screening including ancestry and hereditary panels will further improve the donor gamete selection process and ensure optimal health for the next generation.

Support:

None

References:

1. Brewaeys A, et al. "Anonymous or identity-registered sperm donors? A Study of Dutch recipients' choices." *Hum Reprod* (20) 2014: 820-824.
2. Flores H, et al. "Beauty, brains or health: trends in ovum recipient preferences." *J Womens Health* (10) 2014: 830-833.
3. Mertes H, et al. "Ethical quandaries around expanded carrier screening in third-party reproduction." *Fertil Steril* (109) 2018: 190-194.

Table 1: Patient Characteristics and Semen Parameters by Season

	ECS Testing Performed (n=91)	No ECS Testing Performed (n=85)	P Value
BMI (kg/m^2)	24. 3 ± 2.4	24.7 ± 2.7	0.25
Height (inches)	72.0 ± 2.2	72.0 ± 2.1	0.92
Weight (lbs)	178.9 ± 19.3	182.4 ± 23.0	0.27
Total Vials Sold	48.3 ± 60.2	89.1 ± 80.5	0.0002
Total Vials Sold/#Vials Released	0.24 ± 0.2	0.56 ± 0.4	<0.0001
% CMV Positive	28 (30.8%)	29 (34.1%)	0.64
Eye Color			
- Black	1 (1.1%)	2 (2.4%)	
- Blue	20 (22.0%)	22 (25.9%)	0.85
- Brown	43 (47.3%)	34 (40.0%)	
- Green	12 (13.2%)	13 (15.3%)	
- Hazel	15 (16.5%)	14 (16.5%)	
Hair Color			
- Black	18 (19.8%)	19 (22.4%)	
- Blond	4 (4.4%)	1 (1.2%)	0.63
- Brown	65 (71.4%)	61 (71.8%)	
- Red	4 (4.4%)	4 (4.7%)	
Hair Texture			
- Curly	10 (11.0%)	8 (9.4%)	0.88
- Wavy	37 (40.7%)	33 (38.8%)	
- Straight	44 (48.4%)	44 (51.8%)	
Complexion			
- Dark	1 (1.1%)	3 (3.5%)	
- Medium	44 (48.4%)	42 (49.4%)	0.53
- Fair	46 (50.6%)	40 (47.1%)	
% With Higher Education	40	26	0.07

Beyond Undergraduate Degree	(44.0%)	(30.6%)	
Race - Caucasian - Asian - African American	 63 (90%) 6 (8.6%) 1 (1.4%)	 66 (89.2%) 4 (5.4%) 4 (5.4%)	0.34
Religion - Christian - Jewish - Muslim - Agnostic/Atheist - Other	 43 (47.3%) 2 (2.2%) 0 (0%) 45 (49.5%) 1 (1.1%)	 33 (38.8%) 3 (3.5%) 3 (3.5%) 44 (51.8%) 2 (2.3%)	0.37
Open to Future Contact by Offspring	53 (58.2%)	51 (60.0%)	0.81
Number of Recessive Conditions - 0 - 1 - 2 - 3 - 4	 38 (41.8%) 34 (37.45) 11 (12.1%) 6 (6.6%) 2 (2.2%)	--	--