Title:

ELEVEN YEAR LONGITUDINAL STUDY OF U.S. SPERM DONORS DEMONSTRATES DECLINING SPERM COUNT AND MOTILITY

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Objective:

Physicians and public health experts worldwide have been investigating whether there is global evidence of deterioration in sperm quality.[1,2,3] Investigators who believe there is a decline point to associations with the concomitant increase in the incidence of genitourinary abnormalities such as testicular cancer, cryptorchidism, and hypospadias. [3,4,5] Others have focused attention on increased exposure to environmental endocrine disruptors, and changes in diet and BMI. One obstacle to understanding male fertility is the possibility of geographic variations in semen quality, which could be attributable to differences in climate, pollution, occupational exposure to industrial agents or heavy metals, lifestyle, and social habits. This study sought to investigate whether there was a decrease in sperm quality from a geographically diverse set of US sperm donors.

Design:

Multi-center, retrospective cohort study

Material and Methods:

Semen analyses (SA) from sperm donors aged 19-38, with 2-5 days abstinence, from 6 different geographic regions from 2007-2017 were examined. The sperm donors originated from one of the following regions: Los Angeles (CA), Palo Alto (CA), Houston (TX), Boston (MA), Indianapolis (IN), and New York City (NY). Donation date, BMI, and geographic region were recorded. Data was analyzed as a whole as well as by individual region. Primary outcomes were total sperm count (M), average concentration (M/mL), and total motile count (M). Data was analyzed using a general estimate equation (GEE) model with an exchangeable working correlation structure to account for repeated measures.

Results:

A total of 124,107 SA specimens (from 2,586 unique donors) were analyzed. Controlling for BMI, there was a significant decline in total sperm count (β=-2.9, $p<0.0001$) average concentration (β=-1.76, $p<0.0001$), and total motile sperm (β=-2.45, $p<0.0001$), count over the 11-year study period. There were significant decreases in SA parameters within all geographic regions except for New York City, which showed no change in total sperm count, sperm concentration, or total motile sperm count over the course of the study (Table 1). Boston, which showed no significant difference in total sperm count, displayed a decline in concentration and total motile sperm count over the study period (Table 1).

Conclusions:

Changes in our modern environment—exposures to chemicals or increasingly sedentary lifestyles—may be exerting a negative effect on spermatogenesis. In one of the largest US

studies ever performed on non-infertile males, we demonstrated a significant time-related decline in sperm quality. Given that this is an elite group of donors that was chosen for their higher than average sperm count, these trends would likely be magnified in the general population. If confirmed, these findings would serve as a serious public health warning, particularly as there has been a simultaneous increase in other male disorders, including testicular cancer.[5] Variation in geographic region showed differences in the magnitude of semen quality decline, with only samples from men living in New York City appearing to be consistent throughout the time period. To further investigate these geographical differences, future studies should be designed prospectively, and must be poised to investigate potential causes for this decline. Identifying modifiable risk factors is the first step in determining what preventative steps can be taken to reverse these trends.

Table 1:

Parameter estimates (β) by region (p-values in parentheses)

	Total Sperm count (M)	Sperm Concentration (M/mL)	Total Motile Sperm (M)
All regions (N=124,107 samples; 2586 donors)	-2.94 (<0.0001)	-1.76 (<0.0001)	-2.45 (<0.0001)
Boston (N=29,862 samples; 653 donors)	-2.35 (0.1069)	-1.41 (0.0006)	-2.58 (0.0155)
New York City (N= 13,399 samples; 379 donors)	+2.75 (0.3369)	-0.17 (0.8984)	3.39 (0.1500)
Palo Alto (N= 26,368 samples; 478 donors)	-3.97 (0.0003)	-1.57 (<0.0001)	-2.96 (0.0004)
Los Angeles (N= 504,62 samples; 969 donors)	-3.73 (0.0001)	-2.08 (<0.0001)	-3.11 (<0.0001)

References:

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