Model 1: Both Genders | **Model 2: By Gender** (Female, Male) | **Model 3: Both Genders** (Under Age 1, Age 1-5, Age 5-19)

Siblings of Men with Semen Analysis 1.41 (1.02, 1.95)

Azoospermia

Model 1: Both Genders	Model 2: By Gender	Model 3: Under Age 1	Model 3: Age 1-5	Model 3: Age 5-19
2.69 (1.24, 5.84)	No Sex differences	0.64 (0.09, 4.63)	5.98 (2.28, 15.65)	5.05 (0.57, 44.40)

Concentration

Both Genders	Female	Male	Under Age 1	Age 1-5	Age 5-19
O = 1.71 (0.90, 3.24)	O = 2.90 (1.31, 6.39)	O = 0.82 (0.25, 2.68)	O = 1.28 (0.50, 3.26)	O = 2.90 (1.16, 7.23)	O = 0.00 (0.00, 0.00)
N = 1.34 (0.91, 1.97)	N = 1.74 (1.00, 3.01)	N = 1.05 (0.60, 1.83)	N = 1.54 (0.95, 2.48)	N = 0.97 (0.46, 2.06)	N = 1.28 (0.31, 5.35)
H = 1.27 (0.81, 2.00)	H = 1.84 (0.99, 3.42)	H = 0.89 (0.45, 1.74)	H = 0.86 (0.44, 1.68)	H = 1.91 (0.95, 3.82)	H = 1.86 (0.44, 7.80)

Count

Both Genders	Female	Male	Under Age 1	Age 1-5	Age 5-19
O = 1.43 (0.71, 2.88)	O = 2.21 (0.91, 5.37)	O = 0.85 (0.26, 2.77)	O = 1.05 (0.38, 2.94)	O = 2.46 (0.92, 6.57)	O = 0.00 (0.00, 0.00)
N = 1.37 (0.97, 1.93)	N = 1.97 (1.20, 3.22)	N = 0.94 (0.56, 1.56)	N = 1.37 (0.88, 2.14)	N = 1.33 (0.72, 2.47)	N = 1.45 (0.42, 4.99)
H = 1.19 (0.57, 2.47)	H = 1.10 (0.33, 3.62)	H = 1.25 (0.49, 3.18)	H = 0.74 (0.23, 2.41)	H = 1.84 (0.63, 5.36)	H = 1.88 (0.22, 15.96)

Motility

Both Genders	Female	Male	Under Age 1	Age 1-5	Age 5-19
Q1 = 1.23 (0.73, 2.07)	Q1 = 1.77 (0.88, 3.59)	Q1 = 0.83 (0.37, 1.85)	Q1 = 1.47 (0.78, 2.75)	Q1 = 0.85 (0.29, 2.48)	Q1 = 0.93 (0.11, 8.07)
Q2 = 1.55 (0.95, 2.54)	Q2 = 2.50 (1.31, 4.78)	Q2 = 0.89 (0.40, 1.99)	Q2 = 1.36 (0.70, 2.66)	Q2 = 1.36 (0.70, 2.66)	Q2 = 0.93 (0.11, 8.14)
Q3 = 1.14 (0.66, 1.97)	Q3 = 1.55 (0.73, 3.29)	Q3 = 0.86 (0.38, 1.93)	Q3 = 0.82 (0.37, 1.84)	Q3 = 0.82 (0.37, 1.84)	Q3 = 0.00 (0.00, 0.00)
Q4 = 1.48 (0.94, 2.33)	Q4 = 1.83 (0.97, 3.46)	Q4 = 1.24 (0.64, 2.40)	Q4 = 1.40 (0.77, 2.54)	Q4 = 1.40 (0.77, 2.54)	Q4 = 3.31 (0.93, 11.79)

Vitality

Both Genders	Female	Male
Q1 = 0.95 (0.42, 2.16)	Q1 = 1.15 (0.32, 4.15)	Q1 = 0.86 (0.29, 2.51)
Q2 = 2.53 (1.42, 4.52)	Q2 = 4.72 (2.11, 10.58)	Q2 = 1.22 (0.46, 3.21)
Q3 = 1.42 (0.74, 2.71)	Q3 = 2.67 (1.10, 6.51)	Q3 = 0.77 (0.27, 2.21)
Q4 = 0.78 (0.33, 1.86)	Q4 = 0.72 (0.16, 3.22)	Q4 = 0.85 (0.29, 2.49)

Total Motile Count

Both Genders	Female	Male
Q1 = 1.81 (0.96, 3.38)	Q1 = 2.75 (1.10, 6.88)	Q1 = 1.23 (0.50, 3.06)
Q2 = 0.85 (0.36, 2.02)	Q2 = 1.65 (0.53, 5.11)	Q2 = 0.46 (0.11, 1.94)
Q3 = 1.30 (0.65, 2.62)	Q3 = 2.46 (0.97, 6.23)	Q3 = 0.65 (0.19, 2.21)
Q4 = 1.56 (0.81, 3.00)	Q4 = 2.20 (0.83, 5.86)	Q4 = 1.24 (0.51, 3.04)

Head Morphology

Both Genders	Female	Male
Q1 = 1.92 (1.00, 3.70)	Q1 = 1.92 (1.00, 3.70)	Q1 = 3.47 (1.43, 8.37)
Q2 = 1.83 (0.99, 3.39)	Q2 = 1.83 (0.99, 3.39)	Q2 = 2.51 (1.01, 6.25)
Q3 = 1.03 (0.48, 2.22)	Q3 = 1.03 (0.48, 2.22)	Q3 = 1.72 (0.61, 4.86)
Q4 = 0.96 (0.43, 2.15)	Q4 = 0.96 (0.43, 2.15)	Q4 = 1.44 (0.47, 4.42)

Tail Morphology

Both Genders	Female	Male
Q1 = 1.35 (0.65, 2.81)	Q1 = 2.40 (0.91, 6.33)	Q1 = 0.73 (0.22, 2.46)
Q2 = 0.93 (0.41, 2.10)	Q2 = 0.36 (0.05, 2.72)	Q2 = 1.27 (0.51, 3.16)
Q3 = 1.50 (0.78, 2.90)	Q3 = 2.62 (1.07, 6.42)	Q3 = 0.85 (0.29, 2.47)
Q4 = 1.91 (1.02, 3.59)	Q4 = 3.67 (1.58, 8.50)	Q4 = 0.99 (0.34, 2.88)

Supplementary Figure S2 Hazard Rate Ratios and 95% CIs for the risk of congenital malformation-related mortality in siblings of subfertile men by semen quality category relative to siblings of fertile controls. Model 1 shows the baseline results for males and females combined. Model 2 shows the gender specific estimates. Model 3 shows the non-proportional effects for males and females combined by age group. Model 3 results for total motile count, vitality, head morphology and tail morphology are not shown because these measures are only available for a subset of the sample and cell counts become too small when parsed by semen quality and three categories of age. Azoospermia was included as a separate category in each model. The results are stable across models because they constitute the same group of men. Cells highlighted in blue indicate significant differences between relatives of men with semen analysis and relatives of fertile controls. O = Oligozoospermia; N = Normozoospermia; H = Hyperzoospermia; Q1 = Quartile 1; Q2 = Quartile 2; Q3 = Quartile3; Q4 = Quartile 4.