Environment, Radiation and Sperm

IIAS/EHT 2017 Forum

Hagai Levine, MD, MPH

Head, Environmental Health Track

Hagai.levine@gmail.com
Outline

- Background
- Role of Radiation
- Future Directions and Implications
Why sperm?

- Male fertility
- Men’s health
- Environment
- Science
Male reproduction trends

- Sperm concentration ↓
- Male factor infertility ↑
- Testicular cancer ↑
- Urogenital malformations ↑
- Male Pubertal time ↓
- Testosterone ↓

Carlsen et al, 1992; Skakkebaek et al 2016
Trends - Israel

- Sperm counts ↓
- Male factor infertility ↑
- Testicular cancer ↑
- Urogenital malformations ?

Testicular Dysgenesis Syndrome

Nordkap et al, 2013
Preliminary Communication

INFERTILITY IN MALE PESTICIDE WORKERS

DONALD WHORTON
University of California, Berkeley
Possible causes

- Endocrine disrupting chemicals
- Pesticides
- Heat
- Diet
- Stress
- Smoking
- Obesity
- Non-ionizing Radiation?
Spermatogenesis

200-300 million spermatozoa/day

74 days

Sensitive - exposed
“Semen quality and sperm function”
Paternal effects
Public concern

Oouch!!!!

We're burning in here.
Oxidative stress - spermatozoon

Houston et al, 2016
## Mobile phone and sperm quality

### Table 1
Study characteristics from mobile phone exposure and sperm quality meta-analyses. (— denotes information not provided.)

<table>
<thead>
<tr>
<th>Reference</th>
<th>Sample size</th>
<th>Study design</th>
<th>Participant group</th>
<th>Motility</th>
<th>Viability</th>
<th>Concentration</th>
<th>Radio-frequency (MHz)</th>
<th>SAR (W/kg)</th>
<th>Exposure time</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agarwal et al. (2008)</td>
<td>361</td>
<td>In vivo</td>
<td>Fertility clinic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Exposed to commercially available mobile phones</td>
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<td>Agarwal et al. (2009)</td>
<td>64</td>
<td>In vitro</td>
<td>Fertility clinic</td>
<td></td>
<td></td>
<td></td>
<td>850</td>
<td>1.46</td>
<td>60 min</td>
<td>Exposed to Sony Ericsson w300i</td>
</tr>
<tr>
<td>Ahmed and Baig (2011)</td>
<td>44</td>
<td>In vitro</td>
<td>Population</td>
<td></td>
<td></td>
<td></td>
<td>900</td>
<td>1.3</td>
<td>60 min</td>
<td>Exposed to Nokia 112 in talk mode</td>
</tr>
<tr>
<td>Dkhil et al. (2011)</td>
<td>40</td>
<td>In vitro</td>
<td>Population</td>
<td></td>
<td></td>
<td></td>
<td>850</td>
<td>1.46</td>
<td>60 min</td>
<td>Nokia 73 in talk mode</td>
</tr>
<tr>
<td>De Iuliiis et al. (2009)</td>
<td>8</td>
<td>In vitro</td>
<td>Population</td>
<td></td>
<td></td>
<td></td>
<td>1800</td>
<td>1</td>
<td>16 h</td>
<td>Exposed using a waveguide, connected to a function generator and RF amplifier.</td>
</tr>
<tr>
<td>Erogul et al. (2006)</td>
<td>54</td>
<td>In vitro</td>
<td>Population</td>
<td></td>
<td></td>
<td></td>
<td>900</td>
<td>—</td>
<td>5 min</td>
<td>Exposed to commercially available mobile phones</td>
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<tr>
<td>Falzone et al. (2008)</td>
<td>24</td>
<td>In vitro</td>
<td>Population</td>
<td></td>
<td></td>
<td></td>
<td>900</td>
<td>2</td>
<td>60 min</td>
<td>RF-EMR chamber</td>
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<tr>
<td>Feijo et al. (2011)</td>
<td>343</td>
<td>In vivo</td>
<td>Fertility clinic</td>
<td></td>
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<td></td>
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<td>Exposed to commercially available mobile phones</td>
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<tr>
<td>Fejes et al. (2005)</td>
<td>254</td>
<td>In vivo</td>
<td>Fertility clinic</td>
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<td>Exposed to commercially available mobile phones</td>
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<tr>
<td>Sajeda and Al-Watter (2011)</td>
<td>300</td>
<td>In vivo</td>
<td>Fertility Clinic</td>
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<td></td>
<td></td>
<td>Exposed to commercially available mobile phones</td>
</tr>
</tbody>
</table>
Fig. 1. Forest plot showing the effect of mobile phone exposure on human sperm motility (A), viability (B) and concentration (C). A. FEM = -12.2 (95% CI: -13.6, -10.7) REM = -8.1 (95% CI: -13.1, -3.2); B. FEM = -5.6 (95% CI: -6.4, -4.8) REM = -9.1 (95% CI: -18.4, 0.2); C. FEM = -12.5 (95% CI: -14.5, -10.5) REM = -3.2 (95% CI: -16.6, 10.2).
Study methods

- Interventional (Reducing exposure, Increasing exposure)
- Observational (Cross-sectional, Cohort, Case-control, other?)
- Animal studies
- Basic science
Research directions

- Paradigm shift
- Evolving scientific tools
- Methodological issues
- Combining study methods
- Multi-disciplinary teams (Training)!
- Sperm as a model
New Wireless Technologies need much more attention

WiFi ac
Schools
IOT
5G

Courtesy of Prof. Ely Levine
Integration

- Public Health
- Basic science
- Exposure
- Epidemiology
- Policy
What can we do?

- Surveillance
- Institute?
- Research
- Health promotion
- Policy