

# INTERNATIONAL ASSOCIATION OF FIRE FIGHTERS INTERNATIONAL ASSOCIATION OF FIRE CHIEFS



**Wellness-Fitness Initiative Task Force Meeting**  
**December 12-13, 2022**

# Firefighter Reproductive Health and Child Outcomes

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**IAFF-IAFC WFI Meeting**

**Washington D.C.**

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# Environmental exposures and reproductive outcomes



## Ambient temperatures

Preterm birth, low birthweight, stillbirths, ovarian reserve, sperm function and production, male fertility<sup>1,2,3</sup>



## Stress

Infertility and sub-fertility, sperm quality, reproductive hormone levels, low birthweight, preterm birth<sup>4,5</sup>



## Air pollution/smoke

Preterm birth, low birthweight, male infertility, menstrual disruption<sup>6,7,8</sup>



## Shift work

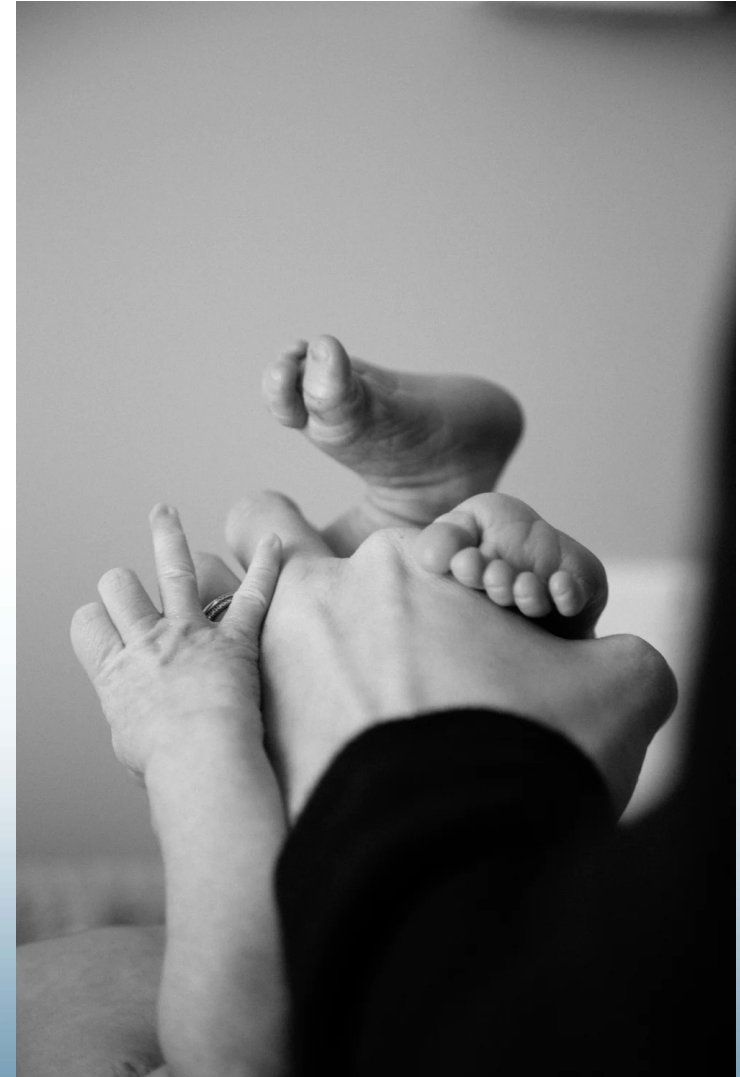


Menstrual disruption, infertility, miscarriages<sup>9</sup>

- |                             |                         |
|-----------------------------|-------------------------|
| 1. Keuhn 2017               | 4. Schliep 2019         |
| 2. Chersich 2020            | 5. Nkansah-Amankra 2010 |
| 3. Gaskins 2021             | 6. Abdo 2019            |
| 7. Merklinger-Gruchala 2017 |                         |
| 8. Sheridan 2019            |                         |
| 9. Stocker 2014             |                         |

# MAJOR concern among female firefighters

- **5 key themes:**
  - 1) Department variation regarding pregnancy policy
  - 2) Decision-making by firefighters for disclosure of a pregnancy
  - 3) Lack of education, research, and information for firefighters on reproductive health
  - 4) Reproductive health concerns impact female recruitment and retention
  - 5) Innovation within the fire service



# Male firefighters: Infertility and sperm abnormalities

## **Among Danish firefighters, full-time firefighters had<sup>1</sup>:**

- 46-53% greater risk of male-factor infertility compared to non-firefighters
- 36-40% greater risk compared to military members

## **Exploratory study of 20 Australian firefighters<sup>2</sup>:**

- Firefighter semen parameters below World Health Organization reference values for fertility
- Younger firefighters (<45) had decreased average sperm quality
- Increased rank and use of protective equipment/behaviors improved sperm quality
- Increased frequency of fire exposure associated with reduced sperm quality

1. Petersen, 2019

2. Engelsman, 2021



# Children of male firefighters: Birth defects

- National Birth Defects Prevention Study (1997–2011 data)<sup>1</sup>
- **Compared to general population,\* children of male firefighters more likely to have:**
  - **Total anomalous pulmonary venous return (OR 3.1; 95%CI 1.1–8.7)**
  - **Cleft palate (OR 1.8; 95%CI 1.0–3.3)**
  - **Cleft lip (OR 2.2; 95%CI 1.2–4.2)**
  - **Transverse limb deficiency (OR 2.2; 95%CI 1.1–4.7)**
- **Compared to police,† children of male firefighters more likely to have:**
  - **Cleft palate (OR = 2.4; 95%CI=1.1–5.4)**
- Potential mechanisms preconception toxicity (chemicals, heat or shiftwork) or transfer of chemical contamination from workplace to home

1. Siegel et al., Birth defects associated with paternal firefighting in the National Birth Defects Prevention Study Am J Ind Med. 2022

\*Adjusted for study site, maternal age, race/ethnicity, smoking status and education; †Adjusted for race/ethnicity

Data from 10 states (Arkansas, California, Georgia, Iowa, Massachusetts, New Jersey, New York, North Carolina, Texas, and Utah).





# Female firefighters: Infertility

- **30% of women firefighters reported previously experiencing infertility (manuscript in preparation) vs 12.5% of US women<sup>1</sup>**
- **Length of time working as firefighter (>15 years) associated with modest, non-significant increased risk of infertility (vs working <5 years; relative risk 1.39, 95% CI 0.86-2.24), adjusted for age**



<https://healthcare.utah.edu/fertility/getting-started.php>

1. Kelley, 2019

# Female firefighters: Miscarriage and preterm birth

- **Miscarriage rates 2.3 times higher among female firefighters than national average<sup>1,2</sup>**
  - On average, firefighters reported pregnancy at end of 1<sup>st</sup> trimester
  - Most did not restrict duties until 2<sup>nd</sup> or 3<sup>rd</sup> trimester
  - **10%** did not restrict duties at all
- **Preterm birth rates 1.57 times higher among female firefighters compared to non-firefighters<sup>3</sup>**
  - US nurses (1993-2000): 8.4%<sup>4</sup>
  - US birth certificates (2018): 10.02%<sup>5</sup>
  - **Firefighters who started work restrictions during the 2<sup>nd</sup> trimester lower risk PTB than those who started in the 3<sup>rd</sup> trimester or didn't restrict (RR 0.67, 95% CI 0.84-1.03)<sup>3</sup>**

1. Jahnke, 2018

2. Jung, 2021

3. Jung, In press

4. Lawson 2009

5. Martin 2019



# Anti-Müllerian Hormone (AMH)

- **Clinical marker of ovarian reserve** (reproductive potential of ovaries)<sup>1</sup>
- **Associated with fertility, age at menopause, miscarriage and preterm birth**<sup>2-5</sup>
- Biomarker for environmental/occupational exposures that could affect the ovary
  - Inhaled toxicants (tobacco smoke, indoor fuel burning and pesticide use) and stress<sup>6-8</sup>
- **33% lower in firefighters than non-firefighters**<sup>9</sup>
- Similar differences in smokers v. non-smokers<sup>10,11</sup>

1. Weenan, 2004

2. Freeman, 2012

3. Dewally, 2014

4. Lyttle Schumacher, 2018

5. Stegmann, 2015

6. Plante, 2010

7. White, 2016

8. Dong, 2017

9. Davidson, 2022

10. Seifer, 2011

11. Plante, 2010

**NORMAL OVARY  
FOLLICULAR DEVELOPMENT  
OVULATION**

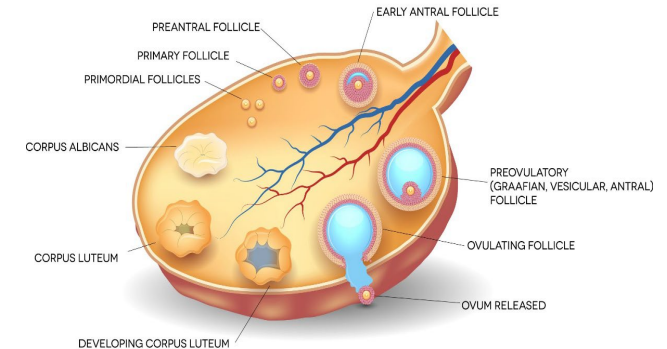


Image: Adobe Stock #62492693



Image: [www.anshlabs.com/](http://www.anshlabs.com/)

# Summary



**Male firefighters at increased risk of sperm abnormalities, infertility and birth defects in their children compared with non-firefighters**



**Female firefighters at increased risk of miscarriage, preterm birth, infertility and reproductive reserve compared with non-firefighters**



**Exposures increasing cancer risk can affect reproductive health**

- Exposure reduction may also improve reproductive health
- Reproductive health and exposure reduction could be addressed in WFI

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