Gender differences in occupational exposure to carcinogens and cancer incidence among Italian workers.

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Keypoints

✓ Occupational cancers epidemiology and gender differences in exposures and health effects dimension;

✓ The Italian experiences of epidemiological surveillance of occupational exposure and cancer cases;

✓ Asbestos exposure, mesothelioma incidence and gender differences in Italy;

✓ Conclusive remarks for public health.
Gender differences in occupational exposure to carcinogens and cancer incidence

Bernardino Ramazzini in 1713 noticed the virtual absence of cervical cancer among nuns, and the high incidence of breast cancer within the same population. This observation lead the way to discovering the importance of hormonal factors in cancer. His work is a very early example of an epidemiological study of gender differences in occupational cancer research field.

Source: Bernardino Ramazzini, Padua, 1713
Epidemiological surveillance of health effects for etiological research.

Epidemiological surveillance of health effect is a precious tool for etiologic research and risk prevention.

John Snow in 1848, by mapping cholera cases on a London map, lead the way to discovering cholera etiology.

Source: John Snow, London, 1848

Global all age attributable deaths and DALYs, both genders combined (2016).

Occupational carcinogens.
Attributable deaths: 746,540 cases
DALYs: 20,682,730 years

Change in number of DALYs 2006-2016:
Men  +18.7%
Women +17.7%

Epidemiology of occupational cancers extent. Occupational cancers burden in Great Britain

Estimated attributable fraction (%) by anatomical site.

<table>
<thead>
<tr>
<th>Anatomical Site</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bladder</td>
<td>7.1</td>
<td>1.9</td>
</tr>
<tr>
<td>Breast</td>
<td>4.6</td>
<td></td>
</tr>
<tr>
<td>Lung</td>
<td>21.1</td>
<td>5.3</td>
</tr>
<tr>
<td>Mesothelioma</td>
<td>97.0</td>
<td>82.5</td>
</tr>
<tr>
<td>Nasopharynx</td>
<td>10.8</td>
<td>2.4</td>
</tr>
<tr>
<td>Sinonasal</td>
<td>43.3</td>
<td>19.8</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Based on deaths</td>
<td>8.2</td>
<td>2.3</td>
</tr>
<tr>
<td>Based on incidence</td>
<td>5.7</td>
<td>2.1</td>
</tr>
</tbody>
</table>

«Overall, 8,010 (5.3%) total cancer deaths in Britain (1,655 in women) and 13,598 (4.0%) cancer registration (3,611 in women) were attributable to occupation».

Epidemiology of occupational cancers in women. Jobs and economic sectors majorly involved.

Jobs in the services industries are not usually thought of as hazardous, but many involve exposures to potential carcinogens.

**Hairdressers** (increased bladder cancer) (exposure to formaldehyde, solvents and other chemicals).

A meta-analysis found an increased risk of multiple myeloma, bladder, lung and larynx cancer.

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**Risk of cancer among hairdressers and related workers: a meta-analysis**

Bahi Takkouche,1,2* Carlos Regueira-Méndez1,2 and Agustín Montes-Martínez1,2

Epidemiology of occupational cancers in women. Jobs and economic sectors majorly involved.

Dry cleaners may be exposed to tetrachloroethylene and trichloroethylene which are considered probable human carcinogens.

Cohort of **dry cleaners** (two-thirds women) exhibited excess mortality from cancers of the bladder, cervix, esophagus, lung and pancreas.

Epidemiology of occupational cancers in women. Jobs and economic sectors majorly involved.

Female flight attendants have found increased risks of breast cancer and malignant melanoma.

Breast cancer risk could be related to the disruption of circadian rhythms or from exposure to cosmic radiation.

But it’s difficult to control the study design for other well known breast cancer risk factor (null parity, age at first birth).

Original article

Breast cancer incidence among female flight attendants: exposure–response analyses
By Lynne E Pinkerton, MD, MPH, Misty J Hein, PhD, Jeri L Anderson, PhD, Mark P Little, DPhil, Alice J Sigurdson, PhD, Mary K Schubauer-Berigan, PhD

Source: Pinkerton LE. et al. SJWEH. 2016;42(6):538-46
Epidemiology of occupational cancers in women. Jobs and economic sectors majorly involved.

Women as **health care workers** are potentially exposed to antineoplastic drugs, anesthetic gases, ethylene, ionizing radiation and electromagnetic fields.

Excess cancer cases have been observed for leukemia, lymphomas, bladder, lung, breast, brain, ovaries, skin and thyroid cancer.

Radiologic technologists (75% women in US cohorts) have been showed an increased risk for several cancer sites (lung, breast, leukemia) due to exposure to ionizing radiation assisting patients during x-rays.

**Article**

August 2, 1995

**Breast Cancer Among Radiologic Technologists**

John D. Boice Jr, ScD; Jack S. Mandel, PhD; Michele Morin Doody, MS

[Author Affiliations](#)


Focus: Occupational exposure to carcinogens in women. Italy. Context

Most of epidemiological study on carcinogens in workplace are conducted in the male workforce;

Women’s employment in Italy has increased by almost 50% over the last 35 years;

Italian law establishes that employers collect data on workers exposure to carcinogens (1A and 1B, ascertained or presumed) and report them to INAIL.

Source: Scarselli A. et al. BMC Public Health 2018;18:413
Focus: Occupational exposure to carcinogens in women. Italy. Methods

Data extract from SIREP (Italian national system on occupational exposure to carcinogens) for the period 1996-2015;

Economic sectors of activity and occupations classified by NACE Rev. 1 and ISCO-88;

Logistic regression model to study the association between gender and exposure (adjusted for age);

Co-exposure assessment by cluster analysis.

Source: Scarselli A. et al. BMC Public Health 2018;18:413
Focus: Occupational exposure to carcinogens in women. Italy. Findings

A relevant number of exposure measurements were recorded in women (15,093, 10%);

A clear gender segregation by occupation is present (as reported for EU in 2007);

Women present an higher risk to be exposed (OR=1.20; IC95%=1.13-1.27), considering all carcinogens as a whole.

Source: Scarselli A. et al. BMC Public Health 2018;18:413
Focus: Occupational exposure to carcinogens in women. Italy. Remarks

Occupational co-exposure to formaldehyde and wood dust in female workers is a critical issue (small size enterprises);

Co-exposure to chromium VI and nickel in manufacturing of metal products and in metallurgy and transport equipment production;

Environmental tobacco smoking (ETS) exposure in women has been found in gambling and betting sectors.

Source: Scarselli A. et al. BMC Public Health 2018;18:413
Focus 2: Gender differences in asbestos exposure and mesothelioma cases in Italy.

Asbestos consumption worldwide and specific Italian context;

Italian mesothelioma surveillance system: the national registry (ReNaM);

Occupational and environmental exposure to asbestos in women;

Epidemiological evidence and risk prevention and insurance system connections.

Cumulative asbestos consumption and Italian context

In Italy the greatest asbestos cave of western Europe (Balangero, TO) has been active until 1990. Casale Monferrato asbestos cement plant until 1986.

Since 1945 to 1992 (year of the ban) 3,748,550 tons of raw asbestos have been produced (in yellow in figure) and 1,900,885 tons imported (red).

Source: INAIL, ReNaM national reports, different years
The beginning of decreasing of asbestos consumption took place in Italy mainly ten years after many other industrialized countries.

Source: Marinaccio A, et al. IJC, 2012;130(9):2146-54
Asbestos consumption and ARDs epidemiology


Environmental Health Perspectives • Volume 119 | Number 4 | April 2011

ITALY

This impressive graph shows the linear correlation between asbestos consumption and MM mortality (i), the role of surveillance systems (ii) and specific Italian context (iii).

Italian national mesothelioma registry (ReNaM). Forecast scenario.

On the basis of an age-period-cohort model and including asbestos consumption trend in the past (as explicative variable), ReNaM have predicted a peak in MM epidemic curve in Italy around 2015-2020.

Recent mortality and incidence data confirm these scenarios.

Italian national mesothelioma registry (ReNaM). Structure, aims, procedures.

ReNaM keywords.
- National network with regional structure;
- Active search of MM incident cases (all anatomical sites);
- Diagnosis specific system of coding;
- Individual anamnestic analysis on the basis of structured questionnaire;
- Environmental, familial and leisure activities anamnesis included.

Regional operative centers (COR) in each Italian regions:
- Actively searching MM cases;
- Verifying and coding diagnosis;
- Interviewing affected people (or care givers);
- Defining asbestos exposure.

ReNaM:
- National data analyses;
- Research projects;
- Supporting COR and contributing to uniform procedures (Guide Lines).
Focus 2: Gender differences in asbestos exposure and mesothelioma cases in Italy.

The epidemiology of malignant mesothelioma in women: gender differences and modalities of asbestos exposure

In Italy the presence of female mesothelioma cases is relevant (F/M=0.38 in pleural and 0.70 in peritoneal cases);

The causes of the high incidence of mesothelioma in women are:

i) the historically high female workforce in textile sector;

ii) the weight of familial and environmental exposure to asbestos;
Focus 2: Gender differences in asbestos exposure and mesothelioma cases in Italy.

The epidemiological surveillance of mesothelioma cases in Italy has demonstrated the presence of asbestos in the textile (non-asbestos) sector, with a great amount of female workforce.

Textile (non-asbestos) workers for asbestos presence in brake systems

Source: Chiappino Med Lav 2003; 2005. Thank to Carolina Mensi for pictures
Focus 2: Gender differences in asbestos exposure and mesothelioma cases in Italy.

The epidemiological surveillance of mesothelioma cases in Italy (and elsewhere) has demonstrated the risk of mesothelioma in women due to the cohabitation with exposed people (generally, the husbands).
Epidemiological surveillance of occupational cancer. Remarks

Occupational cancer incident cases (and exposure) surveillance is precious for promoting research studies, for planning risk prevention measures, for supporting insurance system effectiveness.

Michael Marmot
“No data, no problem. No problem, no action.”
Epidemiological surveillance of occupational cancer in women. Remarks

Studies of occupational cancer among women have identified increased risk associated with employment in several job context (agriculture, health care, manufacturing).

Occupational exposure to carcinogens and cancer risk in women remain a real concern in the actual working society.

Occupational cancers among women are largely preventable and deserve attention for our kids’ future.
«Nihil volitum, quin cognitum»
Summa theologica scholastica

Thanks for attention

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