

# Evaluation Of The Population Dose From The UK NHSBSP

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 \*Coventry Breast Screening Programme

Funded by the European Commission under the specific programme (Euratom) for research and training in the nuclear energy field (2002-2006) as part of the 6th Framework Programme

- 78 Breast screening units
- 508 X-ray machines
- 193 Mobile screening units
- Women screened every 3 years
- Women aged 50-70 screened



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## Introduction

- Study the attendance rates in the NHSBSP
- Deduce the patient dose at both the screening and assessment stages
- Estimate the population dose and dose to individuals



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## Objectives

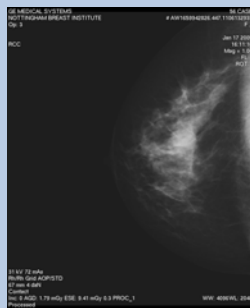
- Follow a group of women over 4 screening rounds
- Determine how many times a woman attends the NHSBSP
- Determine how many times women were assessed



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## Objectives

- Estimate the population dose received by women in the NHSBSP
- Deduce the dose received by a typical woman
- Estimate the maximum dose received over 4 rounds



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## Study Group

- 54,610 women
- Four screening programmes in Yorkshire and Coventry
- Women aged between 50 and 53 at the start of the screening programme (1989 – 1992)
- Each woman's' screening outcomes was assessed

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- Cancer
- Assessed
- Screened
- Did not attend
- No further record on the BSP computer database
- 500 possible pathways

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| Unit | Round 1 | Round 2 | Round 3 | Round 4 | Mean  |
|------|---------|---------|---------|---------|-------|
| A    | 80      | 79      | 82      | 81      | 80.5  |
| B    | 79      | 79      | 79      | 79      | 79    |
| C    | 74      | 73      | 74      | 75      | 74    |
| D    | 75      | 74      | 76      | 75      | 74.75 |
| E    | 81      | 81      | 82      | 83      | 81.75 |
| All  | 75      | 77      | 78      | 78      | 77.5  |

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| Unit | Round 1 | Round 2 | Round 3 | Round 4 |
|------|---------|---------|---------|---------|
| A    | 4.8     | 3.2     | 2.7     | 3.5     |
| B    | 4.2     | 2.0     | 3.4     | 2.8     |
| C    | 8.4     | 4.3     | 4.2     | 3.9     |
| D    | 11.5    | 5.0     | 4.5     | 4.1     |
| E    | 6.0     | 3.3     | 3.3     | 2.8     |
| All  | 7.3     | 3.6     | 3.7     | 3.5     |

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| Unit | Round 1 | Round 2 | Round 3 | Round 4 |
|------|---------|---------|---------|---------|
| A    | 4.0     | 3.2     | 3.6     | 7.0     |
| B    | 3.8     | 3.0     | 5.6     | 6.6     |
| C    | 3.4     | 6.4     | 11.0    | 10.0    |
| D    | 2.1     | 3.0     | 4.9     | 6.9     |
| E    | 4.2     | 3.9     | 6.3     | 6.6     |
| All  | 3.3     | 3.9     | 6.5     | 7.5     |

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| Unit | 0    | 1   | 2    | 3    | 4    |
|------|------|-----|------|------|------|
| A    | 9.7  | 6.5 | 9.0  | 16.3 | 58.5 |
| B    | 10.1 | 6.7 | 10.6 | 23.8 | 48.8 |
| C    | 13.4 | 8.2 | 10.6 | 17.9 | 49.9 |
| D    | 12.2 | 8.2 | 10.9 | 18.3 | 50.4 |
| E    | 9.2  | 5.5 | 8.6  | 14.7 | 62.1 |
| All  | 10.1 | 5.6 | 7.2  | 15.2 | 62.0 |

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| Unit | 0    | 1    | 2    | 3    | 4 |
|------|------|------|------|------|---|
| A    | 89.9 | 9.5  | 0.76 | 0    | 0 |
| B    | 91.4 | 8.0  | 0.55 | 0.05 | 0 |
| C    | 86.5 | 12.3 | 1.1  | 0.1  | 0 |
| D    | 83.3 | 15.2 | 1.45 | 0.05 | 0 |
| E    | 88.5 | 10.8 | 0.65 | 0.05 | 0 |
| All  | 87.7 | 11.3 | 0.91 | 0.06 | 0 |

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## NHS MGD At Various Stages in The NHSBSP



| Stage   | MGD (mGy) |
|---|-----------|
| Screening<br>(Law & Faulkner 2002)                  | 4.5       |
| Assessment*<br>(Law & Faulkner 2004)                | 10.2      |
| Digital Stereo taxis*<br>(Faulkner & Bennison 2005) | 4.5       |

\* Single breast

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## NHS Population Dose Screening Stage



### Four Screening Rounds

- $D_{pop,s} = N \times 3.5 \times 4.5$  mGy
- N is the number of women in the screened population
- On average 3.5 attendances
- MGD 4.5mGy

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## NHS Population Dose Assessment Stage



### Four Screening Rounds

- $D_{pop,ass} = N \times A \times Ass_1 \times 10.2$  mGy
- N is the number of women in the screened population
- A is the attendance rate
- $Ass_1$  is the percentage of women assessed once
- Allow for one breast irradiated
- Repeat for women assessed twice and three times

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## NHS Population Dose Biopsy Stage



### Four Screening Rounds

- $D_{pop,biop} = N \times B \times 4.5$  mGy
- N is the number of women in the screened population
- B is the biopsy rate
- Allow for one breast irradiated
- Repeat for each screening round

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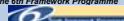


## NHS Population Dose At Various Stages in The NHSBSP (4 Rounds)



| Stage      | Population Dose {MGD(Gy)} | % Contribution |
|------------|---------------------------|----------------|
| Screening  | 5093                      | 96.7           |
| Assessment | 171                       | 3.2            |
| Biopsy     | 2.3                       | 0.04           |

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## NHS Summary



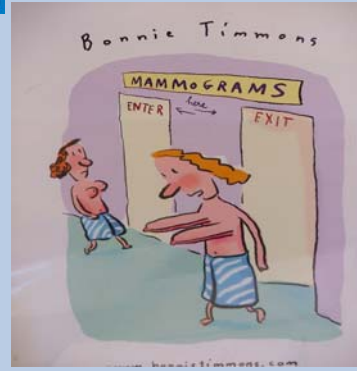
- On average a woman attends 3.5 times
- 87.7% of women are never assessed
- Population MGD to all women from one screening round is estimated as 7658Gy
- Most of the dose arises from the screening stage
- Only 3.3% of the population dose arises from the assessment or biopsy stages

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- Highest dose received by a typical woman is 53.1mGy (Screened 4 times, assessed 3 times)
- A typical woman will receive a dose of 16mGy over four screening rounds
- Population MGD to all women from all mammography is estimated as 8035Gy

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