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The characteristics of the reading radiologist and the probability of a recall

Quebec Breast Cancer Screening Program - 2007-2017

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DES POPULATIONS

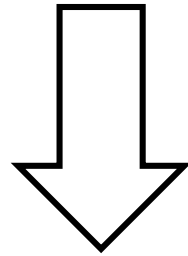
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Québec 

Recall rate (abnormal call rate)

- % of mammograms leading to further assessment
 - ~ 95% are false-positive
- False positive calls
 - Impaired women psychological well-being
 - Reduces screening compliance
 - Generates costs

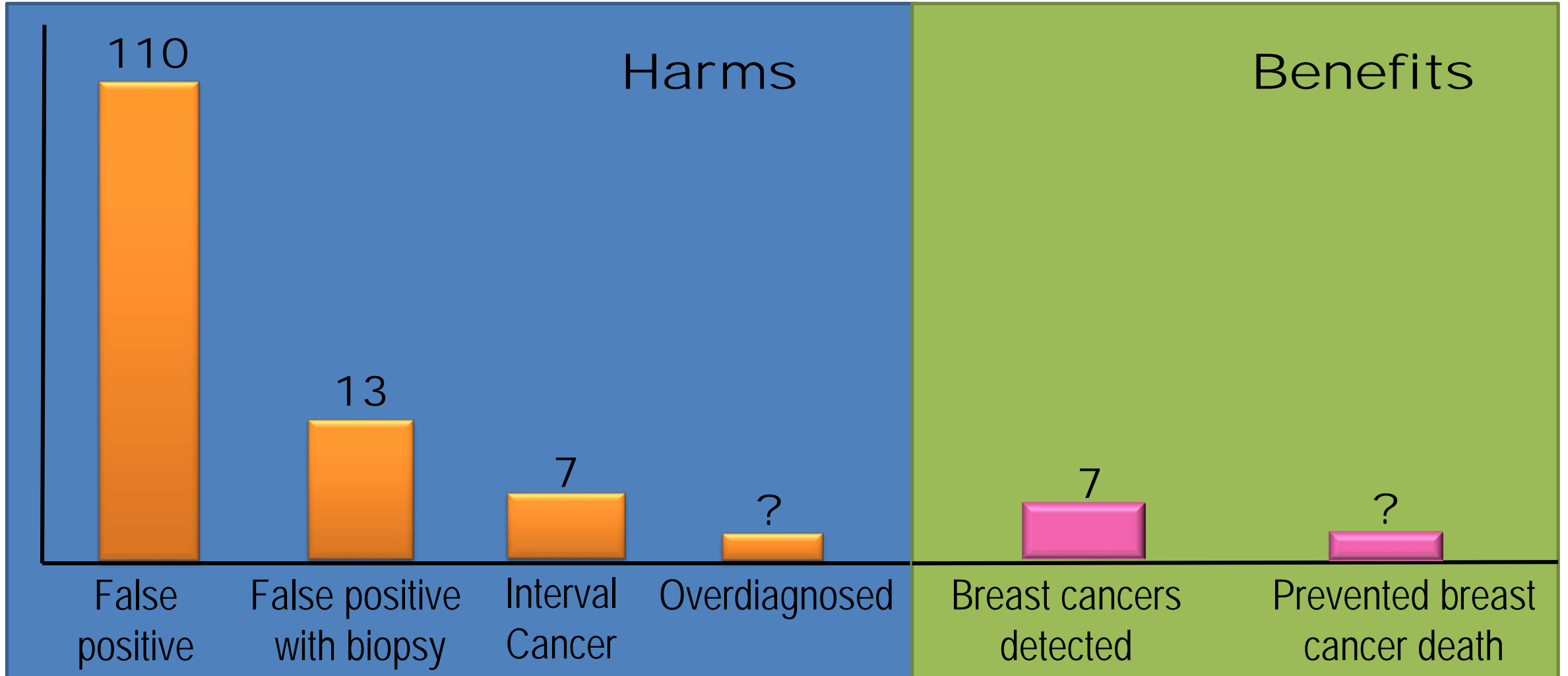
False-positive, an important shortcoming

1000 women screened

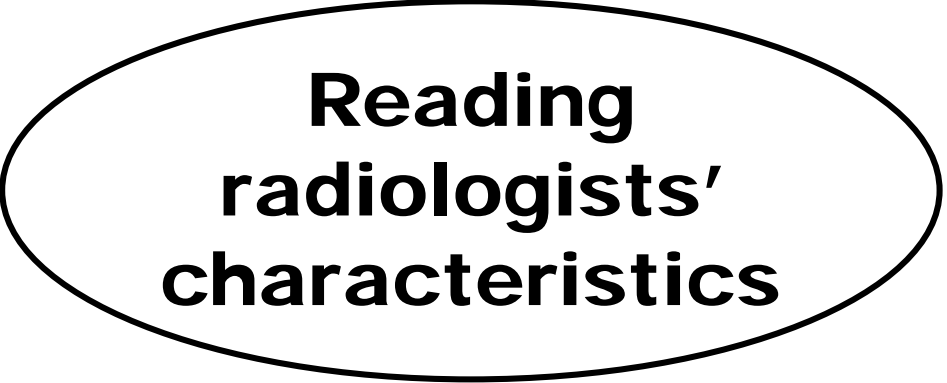


117 recalled

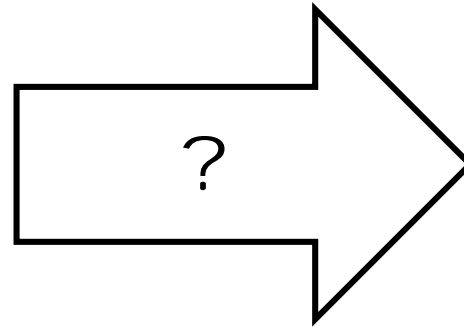
False-positive, and important shortcoming



Our aim



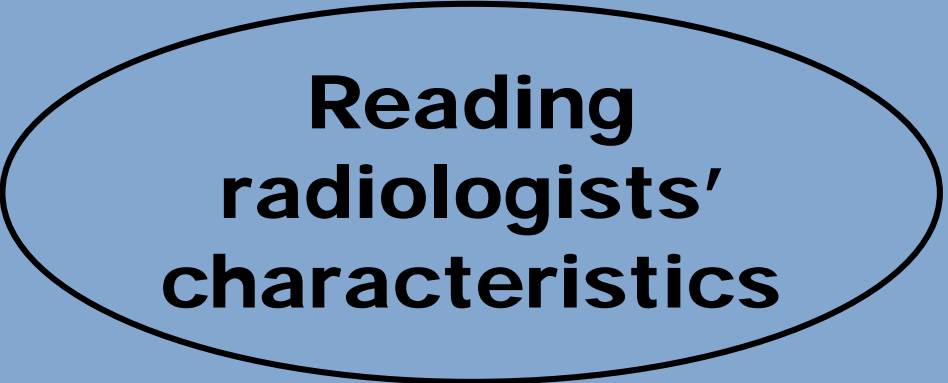
Reading
radiologists'
characteristics



Recall

Our aim

In all digital mammograms



Reading
radiologists'
characteristics



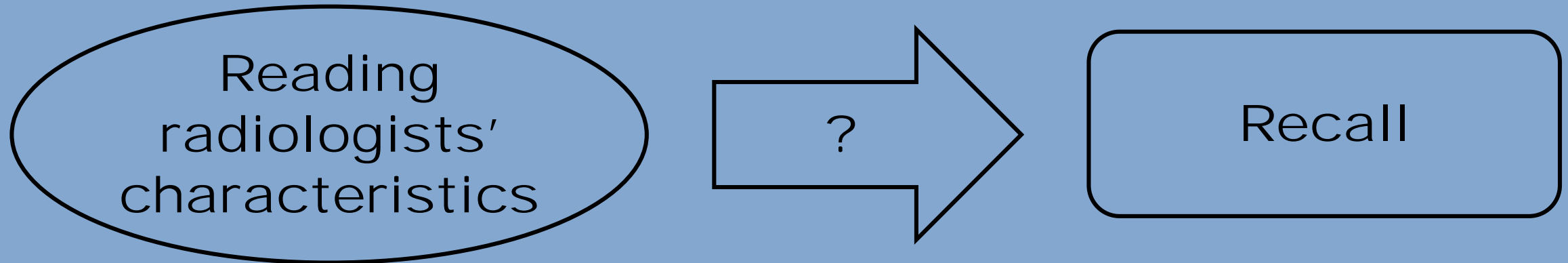
?



Recall

Our aim

Separately in mammograms read by ♀ and ♂ radiologists



Setting

- Quebec breast cancer screening program invites
 - 50 to 69 years old women
 - every 2 years
 - bilateral two-view mammograms
 - accredited facilities
- The program
 - was implemented in 1998
 - reaches 64% of its target population
 - performs 350 000 mammograms yearly

Study set

From 2007 to 2017 → 3 357 663 mammograms

Excluded

Analog films

25.1%

Special clinical context

4.7%

Missing information

0.2%

Study set → 2 505 816 mammograms

Variables

Outcome → leading or not to a reference

Exposure → radiologist gender, experience, volume

Confounder → exam year, exam round

→ facility type, technology, volume

→ Several women characteristics

Statistical analysis

- Multivariate logistic regression modelling
- Generalized estimating equations (GEE) method
- Marginal standardization
- Wald 99% confidence interval and p-value
- GENMOD procedure
- SAS® 9.4 software

Descriptive information on study set

102 screening facilities

417 radiologists (176 ♀, 241 ♂)

991 779 participating women

2 505 816 screening mammograms

274 352 recalls (10.9%)

2 231 464 no recall



Radiologists' characteristics and recalls

	Recall rate (%)	Odds ratio (99% CI)	<i>P</i> value
Gender			
Female	12.5	1.00	<0.0001
Male	9.9	0.77 (0.67-0.87)	
Experience (y)			
0-2	13.0	1.00	<0.0001
3-5	11.6	0.86 (0.77-0.97)	
6-9	11.0	0.83 (0.71-0.96)	
≥10	10.6	0.79 (0.68-0.91)	
Volume (#/y)			
<500	14.1	1.00	<0.0001
500-999	11.9	0.82 (0.75-0.89)	
1000-1499	11.4	0.78 (0.68-0.89)	
1500-1999	10.9	0.74 (0.63-0.87)	
2000-2499	9.8	0.65 (0.54-0.79)	
≥2500	9.7	0.65 (0.54-0.79)	

Experience and recalls

	♀ radiologists		♂ radiologists	
	Rate	Odds	Rate	Odds
0-2 y	14.4	1.00	12.3	1.00
3-5 y	13.2	0.90 (0.73-1.11)	10.3	0.82 (0.70-0.96)
6-9 y	13.9	0.95 (0.76-1.19)	9.1	0.71 (0.55-0.91)
≥10 y	12.9	0.87 (0.70-1.09)	9.2	0.72 (0.57-0.90)
	<i>P</i> value = 0.2308		<i>P</i> value = 0.0002	

P value interaction term : 0.1443

In summary

- **35% less likely when radiologist volume ≥ 2000**
- **21% less likely when radiologist cumulates ≥ 10 y exp.**

♀ versus ♂ radiologists

- 23% less likely with ♂ radiologist
- Results could suggest ♀ and ♂ radiologists have different learning curves

NB: ♀ radiologists detect as many breast cancers as ♂ radiologists

Strengths and limitations

Limitations

- Fellowship
- Year of certification
- Reading modalities

Strengths

- Population-based
- Statistical precision
- Control of confounders

Conclusion

In digital era of breast cancer screening programs in North America

- radiologist volume → opportunity for improvement!
- radiologist experience → need to be better understood!

Coauthors

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