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The professional quality criteria of Italian breast screening radiologists: results from a national survey comparing the programmes started in 2000-2012 *versus* the ones started in 1990-1999

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Abstract

Introduction. In Italy, due to increasing healthcare budget and staff shortages, the recently created regional mammography screening programmes were established under worse radiology practice quality criteria than the previously created programmes.

Methods. Using available data from a national questionnaire survey conducted at the end of 2013 and involving 222 responder radiologists, we compared the main professional quality standards of radiologists working in the screening programmes established during the period 2000-2012 with those working in the screening programmes created from 1990 to 1999.

Results. The former reported more years of clinical experience in breast imaging and a greater clinical mammogram reading volume than the latter. Conversely, they dedicated less working time to breast imaging, were less likely to participate in the diagnostic assessment of screen-detected lesions, to work in large-staffed screening centres, and to have a screening and a total mammogram reading volume (SMRV and TMRV) ≥ 5000 per year.

Conclusions. The level of most professional quality criteria of Italian mammography screening radiologists has decreased over time. As SMRV and TMRV are important predictors of diagnostic accuracy, we can expect a lower interpretation performance of radiologists working in the recently created screening programmes.

Key words

- breast cancer
- experience
- radiologist
- screening
- survey

INTRODUCTION

In many European countries, organised mammography screening activities are having to deal with the retirement of a large number of experienced and dedicated breast radiologists and an adverse trend of healthcare budget and staff shortages, including screening radiologists [1]. This is leading to an increased use of non-dedicated (part-time) personnel [2].

Mammography screening activities in Italy suffer from an additional time-dependent problem. Since the

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implementation of health services is decentralised at the healthcare district level, it has taken 25 years for the large-scale introduction of screening [3]. It is conceivable that the most recent local screening programmes were established under poorer funding and staffing conditions than the previously created programmes. Unfortunately, these conditions are not targeted by the national monitoring system [4].

Between 2013 and 2014, the Italian Group for Mammography Screening (GISMa), the scientific society that promotes communication and dissemination of knowledge across the mammography screening community in the country, carried out a questionnaire survey of professional quality criteria of radiologists. In a previous article, we reported on the prevalence of radiologists with a screening mammogram reading volume (hereafter referred to as SMRV) and a total (screening and clinical) mammogram reading volume (TMRV) ≥ 5000 per year [5], two important predictors of diagnostic accuracy [6]. The probability of SMRV being ≥ 5000 was lower in the recently implemented screening programmes. Hypothesising that this would be associated with other unfavourable correlates, we compared recent and earlier programmes for a wider range of characteristics. This is the subject of the present article.

METHODS

Setting and study design

Complete information on geographic coverage, target population, performance indicators, and impact indicators of local mammography screening programmes in Italy can be found elsewhere [3, 4]. Each healthcare district screening programme is delivered by one or more mammography facilities (screening centres), each with or without an assessment clinic. There are no formal training or experience requirements for radiologists staffing the screening centres.

The purposes and methods of the survey – including objectives, setting, rationale, questionnaire development and circulation, items of information, sources of supplemental data, assessment of response rate, and statistical considerations – can be found in our previous article [5]. Only essential information is provided here. In brief, a concise questionnaire was developed and validated on an unselected group of radiologists. In June 2013, it was sent as a Microsoft Excel file to all radiologists enrolled in the GISMa. Regional screening authorities were asked to circulate the file. Reminders were sent in October 2013. The deadline for responding was 31 December 2013.

The questionnaire included *radiologist experience-related* variables (primary end points) and *facility-level* variables (secondary end points). Of the former, the following were used for the present study: number of years of experience reading mammograms (both screening and clinical mammograms); percentage of working time dedicated to breast imaging and breast care; regular participation in diagnostic assessment sessions for women with abnormal screening mammography results; SMRV; clinical MRV (CMRV); and TMRV.

The following facility-level variables were used: year of implementation of screening at the healthcare district level; geographic area (north, centre, south); number of interpreting radiologists at the facility (each single facility in multifacility screening programmes); availability of digital mammography; availability of digital tomosynthesis; and availability of vacuum-assisted biopsy. The last two variables were used as proxies of a high technological level.

Data analysis

The year of implementation of screening at the healthcare district level was obtained from the National Centre for Screening Monitoring (Italian: Osservatorio Nazionale Screening, ONS) [4]. The number of screening and clinical mammograms was rounded to the nearest multiple of 100. The percentage of working time devoted to breast radiology and the three reading volumes were calculated as the average of the previous three years. High-volume readers (SMRV and TMRV ≥ 5000) were defined according to accredited guidelines [7, 8]. All other continuous variables were dichotomised by the median value. Large-staffed screening centres were defined as having a number of interpreting radiologists ≥ 5 (median number across the participating centres). Missing data were imputed using the multiple imputation technique. Differences in distributions were evaluated with the Mann-Whitney test. Multivariate analysis was performed using backward stepwise multiple logistic regression models. Variables that were significant at $p < 0.10$ were retained in the models.

RESULTS

Questionnaires were returned by 235 radiologists from 51 district screening programmes. Thirteen were excluded because they were only involved in the reading of clinical mammograms and in the diagnostic assessment of screen-detected lesions. Two hundred and twenty-two radiologists, equivalent to 77% of the 290 who were enrolled in the GISMa, were included in the analysis. Among all the variables in the analysis, the average proportion of responder radiologists with missing information was 3%.

The median year of implementation of local screening programmes was 2000 (range, 1990-2012). As shown in *Table 1*, all the radiologist characteristics studied were significantly influenced by the year of implementation of the local screening programme. The radiologists who reported working in programmes implemented in the 2000s were approximately twofold more likely to have 15 or more years of experience reading mammograms and to read ≥ 1400 clinical mammograms per year. Conversely, they had lower odds for a percentage of working time dedicated to breast imaging and breast care ≥ 75%, for a regular participation in the diagnostic assessment of screen-detected lesions, and for a SMRV and a TMRV ≥ 5000. The median SMRV and TMRV were 4400 *vs* 7000 ($p = 0.000$) and 6000 *vs* 7900, respectively ($p = 0.001$).

As regards facility-level variables (not shown in *Table 1*), the radiologists employed in recently implemented programmes were less likely to work in large-staffed screening centres (odds ratio, 0.62; 95% confidence interval, 0.36-1.05) and in centres where vacuum-assisted

Table 1
Univariate and multivariate effect of the year of implementation of the local screening programme on the professional quality criteria of Italian breast screening radiologists

Professional quality criterion	Year of implementation of the screening programme	
	1990-1999 (n = 97)	2000-2012 (n = 125)
Number of years of experience reading mammograms		
1-14	56.7%	38.4%
15-40	43.3%	61.6%
Odds ratio (95% CI)	1.00 (reference)	2.10 (1.22-3.60)*
Percentage of working time dedicated to breast imaging and breast care		
10-74%	32.0%	63.2%
75-100%	68.0%	36.8%
Odds ratio (95% CI)	1.00 (reference)	0.27 (0.16-0.48)*
Regular participation in diagnostic assessment sessions		
No	9.3%	24.8%
Yes	90.7%	75.2%
Odds ratio (95% CI)	1.00 (reference)	0.47 (0.20-1.10)**
Screening mammogram reading volume per year		
< 5000	24.7%	52.0%
≥ 5000	75.3%	48.0%
Odds ratio (95% CI)	1.00 (reference)	0.47 (0.25-0.90)***
Clinical mammogram reading volume per year		
< 1300	57.7%	44.0%
1400-10,000	42.3%	56.0%
Odds ratio (95% CI)	1.00 (reference)	2.20 (1.23-3.95)***
Total (screening and clinical) mammogram reading volume per year		
< 5000	13.4%	36.8%
≥ 5000	86.6%	63.2%
Odds ratio (95% CI)	1.00 (reference)	0.48 (0.22-1.07)***

Percentages are by column. Odds ratios were obtained from six backward stepwise multiple logistic regression models. In each of these, the year of implementation of the local screening programme was treated as an independent variable and the characteristic listed in the column at left as the dependent variable. Independent variables that were significant at $p < 0.10$ were retained in the models.
CI: confidence interval.
*Adjusted for geographic area.
**Adjusted for geographic area, percentage of working time dedicated to breast imaging and breast care, and total (screening and clinical) mammogram reading volume per year.
***Adjusted for geographic area and percentage of working time dedicated to breast imaging and breast care.

biopsy was available (odds ratio, 0.47; 95% confidence interval, 0.27-0.82). The year of implementation of the programme did not predict the odds for the availability of digital mammography and digital tomosynthesis. These four models were adjusted for the geographic area.

DISCUSSION

The survey, which has no precedents in Italy, provided a snapshot of the increasing staff constraints affecting mammography screening centres. The year of implementation of the local screening programme was inversely associated with most study variables.

The decrease in SMRV, TMRV and in the odds for a regular participation in diagnostic assessment is particularly worthy of attention because these parameters are central to both the European guidelines for quality assurance in breast cancer screening [7] and the more recent European Society of Breast Cancer Specialists (Eusoma) position paper on specialist breast centres' certification [8]. In our previous article, we showed that SMRV and TMRV were strongly dependent on the percentage of working time dedicated to breast imaging and breast care. In the present study, this percentage showed the strongest (inverse) association with a recent year of implementation of the programme. The trend towards increasing employment of non-dedicated radiologists who divide their time between the clinical setting and the screening setting was confirmed.

Our findings that the number of years of experience and the CMRV were greater among radiologists who reported working in recent programmes are falsely reassuring. The former suggests that the staff who retire are not replaced or only partially replaced by newly trained personnel, while the latter is a consequence of the fact that the presence of non-dedicated radiologists in screening centres is increasing.

At least in part, the observation that the CMRV is greater in recent programmes is also explained by the advent of breast centres, or breast units, in which diagnostic breast imaging and mammography screening are increasingly integrated [8]. Disappointingly, our results suggest that an increasing CMRV may adversely affect SMRV and TMRV. The Eusoma position paper states that each radiologist working in a specialist breast centre must read at least 1000 mammography cases per year, which increase to 5000, including both screening and clinical mammograms, if he (or she) participates in a screening programme [8].

Another important finding of our study is that the radiologists employed in the most recent programmes were less likely to work in large-staffed screening centres. Many of the most recent programmes have been

set up in southern Italy where health services are less developed. However, since all of our estimates were adjusted for the geographic area, we believe that the observed trend is due to staff shortages, as has been observed in the United Kingdom and elsewhere [1, 2]. The independent inverse association with the availability of vacuum-assisted biopsy at the facility suggests that recent programmes have a higher degree of decentralisation and are based in less-equipped reading centres.

The possibility of a recall bias must be borne in mind when interpreting these results. In order to minimise it, we dichotomised all continuous variables. Another limitation of the study is the approximation in the estimate of the questionnaire response rate, which is due to the fact that screening radiologists in Italy are not registered with official bodies. The proportion of survey respondents out of the total number of radiologists enrolled in the GISMa, 77%, should be considered with caution.

CONCLUSIONS

The survey confirmed the expected relationship between a later date of implementation of the local screening programme and a lower level of most radiologist professional quality criteria, most notably of SMRV and TMRV. As these are important predictors of diagnostic accuracy, we can expect a lower interpretation performance of radiologists working in the recently created screening programmes.

Authors' contributions

All authors, with the exception of DG and LV, were members of the Coordinating Committee of the GISMa in the years in which the survey was carried out. DM conceived the survey, developed the questionnaire and collected the data. LG amended the questionnaire. CF, DG, and LV contributed to the data collection. LB contributed to the development of the questionnaire, analysed the data and drafted the manuscript. All authors contributed to the interpretation of results, revised the manuscript and agreed to its submission.

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Conflict of interest statement

None of the authors has any kind of conflict of interest to declare.

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