INTERVAL CARCINOMAS IN THE MAMMOGRAPHY SCREENING PROGRAM "DONNA" (ST. GALLEN & GRAUBÜNDEN): A RETROSPECTIVE EVALUATION FOR QUALITY CONTROL AND IMPROVEMENT

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BACKGROUND & RESEARCH QUESTIONS

Background:

- Breast cancer is the most frequently diagnosed cancer in women worldwide with more than 2 million new cases in 2020 (Łukasiewicz, et al., 2021)
- Screening programs aim to detect cancer at an early stage to minimize adverse health outcomes and, most particularly, to reduce breast cancer mortality (Bulliard et al. 2021)
- Tracking interval carcinomas is a key parameter of breast screening quality assurance and important both for quality improvement and education (Fitzpatrick, et al., 2022)

Research questions:

1. **How effective is the "donna" program in screen-detecting carcinomas, and thus limiting interval carcinomas?**
2. **Is there a difference in survival between interval carcinomas and screen-detected carcinomas?**
3. **What are the factors that contribute to the development of interval carcinomas?**

PATIENTS & METHODS

Patients

- Data from the Cancer Registry of Eastern Switzerland and the "donna" screening program (cantons SG and GR) covering the years 2010 to 2019 were analyzed. Women with screen-detected carcinomas (SDCs) were identified using donna data, while interval carcinomas (ICs) were identified among donna participants who were diagnosed outside the program.
- The merged and anonymized dataset includes 1,152 carcinomas, of which 884 are screening-detected carcinomas and 268 are interval carcinomas
- Further, the dataset includes detailed information: Socio-demographics (e.g. age), screening-program (e.g. screening round/ year), staging and histology (e.g. Ki-67), carcinoma details (e.g. TNM classification), treatment details (e.g. utilized therapies), and vital status/ time and cause of death (e.g. death year).
- Data points were excluded from analysis if the interval carcinoma was a lobular carcinoma in-situ (ICD-O-3: 8520/2; 1 SDC/ 16 ICs excluded).
- Additionally, we reached out to other Swiss mammography screening programs and asked about their interval carcinoma numbers for benchmarking purposes.

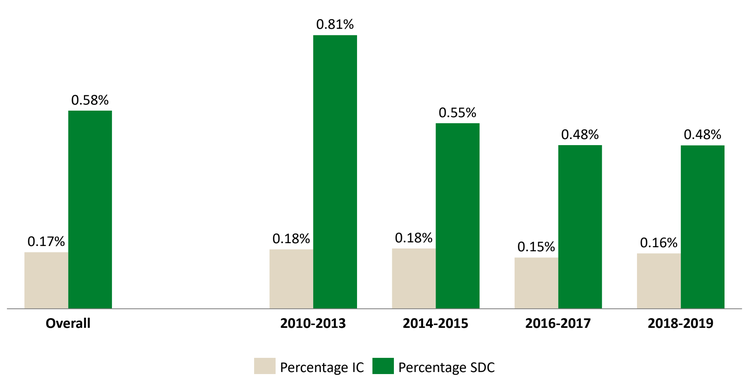
Methods

- Descriptive statistics/ benchmark
- Survival analysis (Kaplan-Meier curve, survival rates)
- Regression analysis (Binary logistic regression)

RESULTS

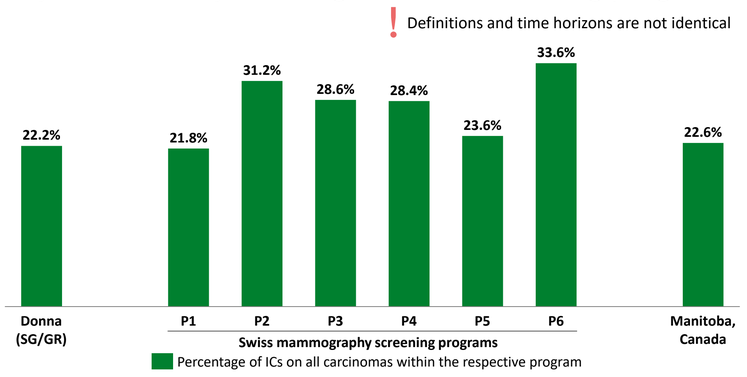
1 Interval carcinoma rates

Percentages of SDCs and ICs per screened women (donna)



Far more SDCs are identified than ICs noted

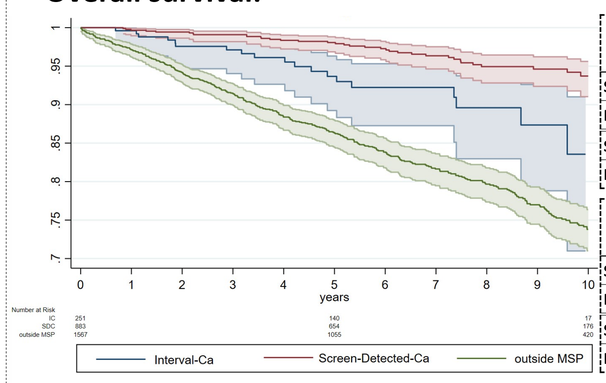
Comparison of IC percentages across screening programs



Donna has a comparatively low IC percentage

2 Kaplan-Meier survival analysis

Overall survival:



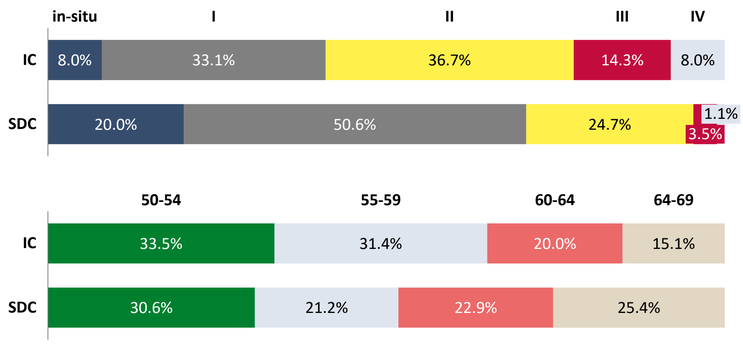
Survival rates[1] | Overall	1y	2y	5y
SDC	99.8%	99.6%	97.8%
IC	99.2%	97.0%	91.5%
SDC_n	518		
IC_n	133		

Survival rates[1] | Stage 1	1y	2y	5y
SDC	100%	100%	98.4%
IC	100%	100%	97.6%
SDC_n	254		
IC_n	42		

1) Based on survival data from first two screening rounds (2010 to 2015)

Survival rates are in general much better for SDCs

Diagnosis stage/ age distribution:



ICs are diagnosed more advanced/ at a younger age

3 Regression analysis

Observations: 876 (Only considering completely existing data points)

Pseudo R2: 0.1029

Depending variable: SDC (0) vs. IC (1)

Variable	Coefficient	Confidence Interval (95%)
Screening-round (baseline: 2010-2013)		
vs. 2014-2015	-0.100	(-0.621 – 0.421)
vs. 2016-2017	-0.263	(-0.839 – 0.313)
vs. 2018-2019	-0.049	(-0.612 – 0.514)
Detection (after nth mammography; baseline 1st mammography in program)		
vs. 2nd mammography in program	0.974***	(0.502 – 1.446)
vs. 3rd mammography in program	0.759**	(0.134 – 1.385)
vs. 4th mammography in program	0.968**	(0.205 – 1.732)
Age (years; baseline: 50-54)		
vs. 55-59	-0.062	(-0.525 – 0.402)
vs. 60-64	-0.573**	(-1.089 – -0.057)
vs. 65-69	-0.969***	(-1.490 – -0.449)
Foreign vs. Swiss birthplace	-0.216	(-0.589 – 0.158)
Breast density (baseline: ACR a)		
vs. ACR b	0.469	(-0.403 – 1.341)
vs. ACR c	1.172**	(0.314 – 2.030)
vs. ACR d	2.034***	(0.896 – 3.173)
Hormone receptors	0.032	(-0.889 – 0.954)
Estrogen receptors	0.000	(-0.009 – 0.009)
Progesterone receptors	-0.004	(-0.008 – 0.001)
Ki-67 proliferation factor	0.020***	(0.008 – 0.031)
HER2 receptors	0.094	(-0.369 – 0.557)
Constant	-2.115***	(-3.340 – -0.890)

*Significance levels: *p<0.1; **p<0.05; *** p<0.01*

Detection time, age, breast density and KI-67 are significant factors for the development of ICs

DISCUSSION & CONCLUSION

1. The share of ICs of the "donna" program is at the lower end, compared with those from other Swiss programs. Thus, the program has achieved a high sensitivity. Measures such as reviewing IC mammograms are currently conducted to further increase the sensitivity of the program.
2. The survival rates and the characteristics of the ICs compared to the SDCs highlight that it is important to decrease the number of ICs within any screening program. Lower survival rates of ICs compared to SDCs can partly be explained by their less favorable stage distribution and prognostic factors.
3. ICs were significantly more often diagnosed in younger women who participated in the screening program for the first time, had a high breast density, and a high Ki-67 factor. To address the factors that influence the occurrence of ICs, further examinations should be considered for woman with these characteristics.

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