



HOW TO REACH 70% RESPONSE RATE IN THE NATIONAL BREAST CANCER SCREENING PROGRAM IN CROATIA?

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SUMMARY – A mammography response rate exceeding 70% is one of the parameters for monitoring the success of a national breast cancer screening program (BCS). The aim was to explore the potential for improving the response rate in the BCS in Croatia, based on the accuracy of the invitation database and availability of mammography services. In this cross-sectional study, data from the fifth and sixth implementation cycles were collected through a questionnaire from the BCS county coordinators (N=21). The quality of the invitation database and the number of available mammography appointments were analyzed using Microsoft Office Excel. Seventeen percent of women were not available at the address listed in the database and could not be invited for mammography, with variations observed across counties ranging from 31% (Lika-Senj County) to 7% (Krapina-Zagorje County). Only eight counties had a sufficient number of mammography appointments for initial and repeat invitations. With a higher estimate of unavailable women by counties at the end of the fifth cycle, the response rate at the end of the cycle was lower ($p=-0.51$, $p=0.018$). In conclusion, participation in the BCS could be increased with a more accurate invitation database, thereby freeing up additional mammography appointments for both initial and repeat invitations.

Key words: *Breast cancer; Cancer screening program; Improvement*

Introduction

Breast cancer is the most common cancer among women worldwide¹. Invasive breast cancer affects one in eight women². In the World Health Organization (WHO) European Region, the age-standardized

incidence rate (standard world population) in 2020 was 69.7/100,000, and the age-standardized mortality rate (standard world population) was 14.8/100,000. In Croatia, the age-standardized incidence rate was 69.3/100,000 and the mortality rate 14.6/100,000³.

Croatia has a breast cancer mortality rate below the European Union (EU) average, and this rate has been decreasing for four consecutive years, despite breast cancer being one of the most common cancers in terms of incidence and mortality⁴⁻⁸.

Early detection of breast cancer through mammography screening has been employed for over 40 years⁹.

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The International Agency for Research on Cancer (IARC) Working Group confirmed the significance of mammography screening in reducing breast cancer mortality in 2015^{10,11}. According to recent recommendations from the European Society of Breast Imaging, mammography should be offered to all women aged 50 to 69 every two years¹². In 2016, 95% of women aged 50 to 69 were covered by population screening for breast cancer in the EU¹³. The National Breast Cancer Screening Program (BCS) in Croatia was initiated in 2006, following the recommendation of the Croatian Society for Medical Oncology and in alignment with the proposal of the Council of the EU and WHO¹⁴⁻¹⁷.

The BCS involves inviting women aged 50 to 69 to undergo mammography through personal letters. Each invitation round in Croatia encompasses approximately 680,000 women every two years¹⁵. The Ministry of Health of the Republic of Croatia (MHRC) has designated the Commission for Organization, Professional Monitoring, and Quality Control of the BCS, along with national and local BCS coordinators in the Croatian Institute of Public Health (CIPH) and in 21 county institutes of public health¹⁵. BCS expert coordinators, who are medical doctors with specialization in public health or epidemiology, have been appointed to organize, implement, coordinate, monitor, and evaluate the BCS¹⁵.

The objectives of the BCS are as follows: to reduce breast cancer mortality by 25% within the first five years of implementation, to detect a higher proportion of localized breast cancer cases, and to improve the quality of life for women undergoing treatment for breast cancer as emphasized in recent research^{15,18}. To achieve

all the objectives of the BCS, it is essential to achieve a response rate exceeding 70%, as the response rate to mammography invitation serves as one of the key parameters for assessing the success of the BCS^{14,19}.

Croatia has participated in two European initiatives aimed at improving the implementation of screening programs, i.e., Twinning project Improving the Quality of the Implementation of National Program of Early Cancer Detection and Joint European Action CanCon (European Guide to Quality Improvement in Comprehensive Cancer Control). According to the conclusions drawn from these initiatives, the key factors in enhancing the implementation of BCS were the establishment of national screening management working groups and provision of appropriate legal, financial and organizational structures for screening programs with quality control^{20,21}. The Croatian Guidelines for Quality Assurance in Breast Cancer Screening and Diagnosis (Guidelines), which are aligned with the European Guideline, emphasize that the success of the BCS hinges on the quality of its organization, implementation and evaluation^{19,20}. Organizational aspects, serving as the foundation of a successful BCS, significantly impact the assessment of outcomes and interpretation of results. It is imperative to ensure availability of quality demographic data and services for the diagnosis and treatment of breast cancer¹⁹.

The quality of demographic data implies that the BCS invitation database should be as accurate as possible. Women participating in the BCS should have correct address to ensure they receive invitation letters for mammography. Any change in a woman's

Key 1. Croatian county abbreviations

Abbr.	No.	County	Abbr.	No.	County	Abbr.	No.	County
BBC	1	Bjelovar-Bilogora	LSC	9	Lika-Senj	VC	17	Varaždin
BPC	2	Brod-Posavina	MC	10	Međimurje	VPC	18	Virovitica-Podravina
DNC	3	Dubrovnik-Neretva	OBC	11	Osijek-Baranja	VSC	19	Vukovar-Srijem
GZ	4	Grad Zagreb	PSC	12	Požega-Slavonija	ZC	20	Zadar
IC	5	Istria	PGC	13	Primorje-Gorski kotar	ZAGC	21	Zagreb
KC	6	Karlovac	SMC	14	Sisak-Moslavina			
KKC	7	Koprivnica-Križevci	SDC	15	Split-Dalmacija			
KZC	8	Krapina-Zagorje	ŠKC	16	Šibenik-Knin			

residence should be automatically registered, and the accuracy of the invitation database should be checked regularly. A lack of quality data in the BCS, combined with an insufficient number of mammography appointments, further reduces the response rate. This is because invitation letters are sent to incorrect addresses and women who did not receive invitations take up appointments^{15,19}.

A sufficient number of mammography appointments were considered another important prerequisite for achieving a good response rate, allowing for the possibility of issuing repeat invitation to women who did not respond to the initial invitation¹⁵. The results of a study conducted in the United Kingdom involving 26,054 women indicated that 22% of them responded to repeat invitations²³. According to studies conducted in Ireland with 819,182 women, repeat calls could increase responses by an additional 29.9%²⁴. A reduction in the number of available mammography appointments from 55 *per day* to 25 *per day* in Požega-Slavonija County led to a decrease in the response rate from 76.3% to 63.6% compared to the previous invitation round. There were no other changes during this period that had a significant impact on the response rate²⁵.

The National Cancer Control Plan highlights the importance of equipment quality, adherence to the Guidelines, and underscores the need to increase the response rate to mammography²⁶.

The coronavirus disease 2019 (COVID-19) pandemic has hindered efforts to enhance the implementation of the BCS. At one point during the pandemic, BCS implementation was halted, and the fear of COVID-19 infection significantly contributed to a decline in the response rate^{27,28}. In addition to the anticipated drop in the response rate to the BCS, researchers also observed a reduced number of women being diagnosed with breast cancer. A study conducted during the pandemic in 2020 in California revealed a 64% decrease in newly diagnosed breast cancer patients, and women were more likely to present with symptomatic disease (78% *vs.* 37%) compared to data from 2019²⁹.

The Community Preventive Services Task Force (CPSTF), based on the results of a systematic review that included 33 studies on breast cancer screening, suggests strong evidence of effectiveness in increasing the response rate by using multi-component

interventions that address needs at the individual, provider, community and system level³⁰.

Physician's recommendation for mammography, sufficient capacity in mammography units, and mailed or telephone reminders have been demonstrated as successful tools for encouraging women to undergo mammograms³⁰⁻³³.

A deficiency in demographic data within the BCS has been identified as one of the reasons for non-response to mammography invitation. Among non-responders (35.3%) to mammography invitations, a significant portion (52.3%) was not available at their home address due to incorrect demographic data in the BCS³⁴.

In the second European screening report on the status of implementation and organization of cancer screening in the EU member states from 2018, it was suggested that the BCS in Croatia could be enhanced if the BCS policies were documented as legal or official recommendations. Consequently, a working group responsible for policy implementation and screening registry was established¹³.

To date, in completed BCS invitation rounds in Croatia, the target response rate of 70% was not achieved. The response rate in the completed invitation rounds (six) in Croatia ranged from 54% to 63%. The highest response rate was achieved in the first round (63%), whereas the lowest was observed in the second and sixth rounds (54%)³⁵.

The aim of this study was to investigate the capacity for improving the BCS in Croatia, with a focus on increasing the response rate based on the accuracy of the BCS invitation database and availability of mammography examinations.

Methods

A cross-sectional study was conducted among BCS county coordinators (N=21) by a questionnaire entitled BCS Improvement on County Level. The questionnaire was distributed to county coordinators in February 2019 *via* their official e-mail addresses, which are commonly used for correspondence between national and county coordinators.

Data were collected from the fifth and the beginning of the sixth invitation round of the BCS,

spanning from November 2016 to February 2019. The questionnaire was specifically created for this study by the BCS county coordinator, with approval from the Commission for Organization, Professional Monitoring and Quality Control of the BCS at the MHRC. The BCS coordinators were queried about locations of mammography units, daily number of available mammography appointments, data regarding any interruptions in the operation of mammography units lasting longer than a week, reasons for such interruptions, and information about additional mammography slots in other counties or mobile mammography units. Data collection continued until the end of March 2019.

The collected data were entered into two previously prepared Microsoft Office Excel databases. The quality of demographic data in the BCS invitation database and number of available appointments in mammography units across counties were analyzed using Microsoft Office Excel. All data were presented at the county level. Spearman's correlation coefficient was calculated for variables describing difference in the number of women in the invitation database in relation to the Croatian Bureau of Statistics (CBS) population estimates, available appointments for mammography examinations in counties, and response rate at the end of the fifth round of the BCS.

Data on the accuracy of the BCS invitation database were obtained by comparing data from BCS, which include information from the Ministry of the Interior, personal identification number (PIN), Croatian Health Insurance Fund (CHIF) and publication of the Population Estimates of the CBS in mid-2017 as the second source of data^{35,36}. Population estimates incorporated data on natural population movements (birth and death statistics), while the Ministry of the Interior used data on internal and external migration. For the purpose of analysis and paper preparation, data available from BCS at the end of the fifth and the beginning of the sixth invitation round on February 14 and 18, 2019, were also utilized. Total reporting data were employed at the national level, as well as for all counties, including data on the number of women in the BCS (N=710,225), number of invited women, number of women who responded to the invitation, response rates, and reasons for not responding to mammography invitation. Response rate was calculated according to the formula¹⁵:

Response rate, share 2 = (examined + mammography done within a year's time)/(invited – died – have cancer – temporarily unavailable – incorrect address – under processing).

Total number of available appointments was determined for all mammography units and counties using data on the number of working days during the fifth round. The estimate of the required number of appointments for both the first and repeat invitation was calculated based on the data from the BCS in the first half of the fifth invitation round throughout the year 2017 when initial invitations were sent. According to the response rate of 52%, the necessary number of appointments for the initial and repeat invitation letters should be 1.5 times the number of women in the BCS invitation database³.

In case of requiring additional clarification, country coordinators were contacted by phone.

Ethics

Data collection was carried out with approval of the Commission for Organization, Professional Monitoring and Quality Control of the National Breast Cancer Screening BCS at the MHRC, as well as the national coordinator and all county coordinators.

Results

Regarding accuracy of the BCS invitation database, the most significant difference in the number of women in the invitation database compared to estimates of the number of women in the same age group according to CBS data at the beginning of the fifth invitation round of the BCS was observed in Lika-Senj County (31%), Sisak-Moslavina County (28%), Šibenik-Knin County (27%) and Vukovar-Srijem County (24%). Conversely, the lowest discrepancies were found in Krapina-Zagorje County (7%), Varaždin County (9%), Zagreb County (9%) and Koprivnica-Križevci County (9%), with an overall national average of 17%.

By the end of the fifth round, efforts of the coordinators and entry of information regarding women with unknown addresses had reduced these differences, resulting in a more accurate BCS invitation database. The most accurate data were observed in Istria County, where the lowest differences were recorded (1.9%). On

the other hand, the highest differences in the accuracy of the invitation database were in Zadar County (18.5%), with an average difference of 10.5% for Croatia as a whole (Table 1).

In Croatia, there were 967,971 mammography appointments available for 710,225 women in the invitation database. This translates to 34.4% more appointments than the number of women in the database. However, this quantity was still insufficient to send a second invitation letter to all women. Analysis of the number of available mammography appointments at the county level revealed significant disparities. Only eight counties had a sufficient number of appointments for both the first and repeat invitation, exceeding 150% of the required appointments. These counties included Primorje-Gorski Kotar, Koprivnica-Križevci, Krapina-Zagorje, Međimurje, Istria, Zagreb and Lika-Senj counties, along with the City of Zagreb (Table 2).

Difference in women's responses to mammography at the end of the fifth invitation round between the counties with the lowest and highest response rates was

34.8% (Međimurje 77.3% *vs.* Šibenik-Knin 42.4%). To analyze the prerequisites for successful implementation of the BCS, counties were examined based on the difference in the number of women in the invitation database at the beginning and end of the fifth invitation round and the CBS population estimates. The results revealed the portion of women unavailable for invitation, availability of appointments, and their correlation with the response rate at the end of the invitation round. A significant correlation was found between the response rate and estimate of the share of women unavailable for invitation at the end of the invitation round by counties with a higher estimate of unavailable women resulting in a lower response rate at the end of the round ($\rho=-0.51$, $p=0.018$). Additionally, there was a correlation between the response rate at the end of the fifth invitation round and estimate of the portion of women unavailable for invitation by counties at the beginning of the round ($\rho=-0.43$, $p=0.052$). However, there was no significant correlation between the response rate at the end of the fifth

Table 1. Estimation of the invitation base accuracy at the end of the 5th round of BCS, measured as a deviation in comparison to data of the invitation base and CBS population estimate

Deviation in invitation database data compared to CBS data at the end of the 5 th round of BCS implementation	Deviation by counties	
	County	%
<5%	IC, PSC, VSC, BBC	1.9-4.5
5%-10%	KZC, VC, ZAGC, KKC, BPC, MC, GZ, SDC, PGC, DNC	5.6-10
>10%	LSC, OBC, KC, VPC, SMC, ŠKC, ZC	10.9-18.5

County abbreviations: see Key 1; BCS = Breast Cancer Screening Program; CBS = Croatian Bureau of Statistics

Table 2. Availability of appointments in mammography units at the county level during 5th round of BCS implementation

Availability of appointments in the 5 th round of BCS implementation	Availability of appointments by counties	
	County	%
Insufficient appointments for first invitation (<100%)	SMC, BBC, OBC, ZADC, VSC, BPC	76.6-96.6
Sufficient appointments for first invitation (100%-150%)	DNC, VC, SDC, PSC, ŠKC, KC, VPC	110.5-145.3
Sufficient appointments for first and repeat invitation (>150%)	PGC, KKC, KZC, MC, IC, ZAGC, GZ, LSC	150-206.3

County abbreviations: see Key 1; BCS = Breast Cancer Screening Program

invitation round of the BCS and availability of appointments in mammography units by counties ($p=0.069$, $p=0.767$).

To help identify more inaccessible women at the beginning of the sixth invitation round, the status of

'temporarily unavailable' was assigned to all women without a chosen family doctor. This approach achieved an accuracy rate of the invitation database of 97.7% compared to data from the CBS population estimate (BCS $N=584,204$ and CBS $N=597,746$).

Table 3. Deviation in the number of women between invitation bases in the 5th and 6th rounds of the Program compared to CBS data, appointment availability, and potential impact of a more accurate invitation base on response rates, along with detailed presentation of results by counties

County	Invitation base 5 th round				Available appointments				Response rate/change with different preconditions		
	Invitation base	CBS estimate ¹	Deviation according to CBS, beginning of the round (%) [*]	Deviation according to CBS, end of the round (%) ^{**}	Invitation base of the 6 th round ²	Available appointments	5 th round (>150%)	6 th round (>150%)	Response rate 5 th round (>70%) ^{*/**}	Calculated response rate with accurate invitation base (%)	Calculated possible increase in response rate (%)
BBC ³	19,356	16,486	14.8	4.5	16,056	14,954	77.3	90.7	70.9	75.1	4.1
BPC	25,148	20,386	18.9	8.4	19,334	24,284	96.6	119.1	64.1	72.7	8.6
DNC	19,967	17,126	14.2	10.0	17,045	22,072	110.5	128.9	46.3	53.4	7.0
GZ	131,696	112,880	14.3	9.4	107,905	241,310	183.2	213.8	57.2	65.0	7.9
IC	35,777	32,288	9.8	1.9	31,020	61,462	171.8	190.4	57.9	59.1	1.3
KC	23,074	17,669	23.4	12.1	17,865	33,166	143.7	187.7	51.0	60.9	9.9
KKC	17,644	15,996	9.3	7.7	15,699	27,075	153.5	169.3	60.5	66.2	5.7
KZC	19,458	18,048	7.2	5.6	17,303	30,120	154.8	166.9	64.8	69.3	4.4
LSC	9,073	6,270	30.9	10.9	6,139	18,722	206.3	298.6	44.3	53.3	9.0
MC	16,992	15,218	10.4	8.8	14,877	26,520	156.1	174.3	77.3	86.0	8.7
OBC	50,096	42,605	15.0	11.8	42,694	40,928	81.7	96.1	58.0	68.4	10.3
PSC	12,701	9,790	22.9	2.4	98,10	16,550	130.3	169.1	68.1	70.4	2.3
PGC	52,932	45,752	13.6	9.9	43,532	79,397	150.0	173.5	52.8	60.0	7.3
SMC	31,981	22,923	28.3	15.2	23,321	24,498	76.6	106.9	46.1	58.3	12.3
SDC	73,151	63,169	13.6	9.8	62,543	88,082	120.4	139.4	52.9	60.0	7.1
ŠKC	20,184	14,744	27.0	16.0	14,650	27,850	138.0	188.9	42.4	54.8	12.3
VC	26,165	23,818	9.0	7.1	23,622	29,190	111.6	122.6	63.6	69.2	5.5
VPC	14,741	11,527	21.8	13.0	11,688	21,415	145.3	185.8	60.5	72.9	12.3
VSC	30,497	23,117	24.2	3.8	23,845	27,360	89.7	118.4	56.3	59.9	3.6
ZC	30,322	23,111	23.8	18.5	21,861	26,008	85.8	112.5	63.2	86.2	23.0
ZAGC	49,300	44,823	9.1	7.5	43,395	87,008	176.5	194.1	56.4	61.6	5.3
Croatia	710,225	597,746	17.0	10.5	584,204	967,971	136.3	161.9	57.1	65.9	8.8

County abbreviations: see Key 1; BCS = Breast Cancer Screening Program; CBS = Croatian Bureau of Statistics; ^{*} $p=-0.43$, $p=0.052$; ^{**} $p=-0.51$, $p=0.018$; ¹CBS population estimate, mid-2017; ²granting status of 'temporarily unavailable' to women who do not have a doctor of their choice had reduced the number of women in the invitation base; ³BBC had enough appointments to make multiple use of available appointments with great commitment of the staff working on BCS.

Consequently, all counties had a difference of less than 20%, with 13 counties having a difference of less than 10% compared to CBS estimates.

With a more accurate invitation database, more mammography appointments were automatically made available, which could positively impact the response rate. In the fifth invitation round of the BCS, there were substantial differences among counties in terms of appointment availability. For instance, in Bjelovar-Bilogora County, only 77.3% of the required appointments

were available, while in Lika-Senj County, there were 206.3% of the required appointments. By the fifth invitation round, eight counties had a sufficient number of appointments for both the first and repeat invitations to mammography, and in the sixth round, 12 counties had a sufficient number of appointments (Table 3). In the fifth invitation round, two counties achieved a response rate higher than 70%, and it is estimated that in the sixth invitation round, six counties could achieve a response rate higher than 70% (Fig. 1).



Fig. 1. Estimation of the possible increase in response rates by counties as a contribution to a more accurate BCS invitation base in Croatia and by counties.

County numbers: see Key 1; BCS = Breast Cancer Screening Program

Discussion

The results of the study highlighted the inconsistencies in the prerequisites for successful implementation of the BCS at the county level. Comparing the CBS data, it was found that an average of 17% of women in the BCS invitation database in Croatia were not residing in the specific county, making it impossible to invite them for an examination at the address specified in the BCS. This observed difference ranged from 31% in Lika-Senj County to as low as 7% in Krapina-Zagorje County. Additionally, there were only 34.4% more available mammography appointments than the number of women in the database, which was insufficient for sending a second invitation letter. Only eight counties had a sufficient number of mammography appointments exceeding 150%. The results also demonstrated a negative correlation between the estimate of unavailable women at the end of the invitation round by counties and the response rate at the end of the round ($p=-0.51$, $p=0.018$). Furthermore, a correlation was observed between the response rate and estimate of women unavailable for invitation at the beginning of the round ($p=-0.43$, $p=0.052$). The findings suggest that a more accurate invitation database and an adequate number of appointments for mammography could positively impact the response rate in the BCS. It is estimated that in the sixth invitation round, six counties could achieve a response rate higher than 70%, compared to only two in the fifth round, resulting in a total increase of 8.8% in the response rate.

At the beginning of the fifth invitation round, the accuracy of the BCS invitation database matched 83% of women in the target group compared to CBS data. The results of the study conducted in Požega-Slavonija County, which involved home visits to 1,208 women who did not respond to mammography invitations, revealed that contact with 17% of women was not possible, primarily due to incorrect addresses ($n=99$)³⁷. In our study, while working on improving the accuracy of the invitation database during the fifth invitation round, the exact address was not available in the BCS database for 6.5% of women, and by the end of the round, an additional 10.5% of data in the invitation database did not match the CBS data. When observed at the county level, counties with a history of more

migrations in the past exhibited larger discrepancies from the estimates of the number of women in the target group for BCS compared to CBS data. By the end of the fifth invitation round, the number of counties that, according to CBS data had more than a 15% difference in the number of women in the target group, was reduced from ten to three, i.e., Sisak-Moslavina County (15.2%), Šibenik-Knin County (16%) and Zadar County (18.5%). The results of our study revealed a significant correlation between discrepancies in data within the invitation database and the response rate. In counties where a higher proportion of women were estimated to be unavailable for invitation, the response rate was lower. Correcting prerequisites for the implementation of the BCS and improving the accuracy of the invitation database could lead to a more precise calculation of the response rate in Croatia, potentially increasing it by an average of 8.8%. This increase would vary from 1.3% in Istria to 23% in Zadar County. According to these estimates, with the indicated response rate increase, the overall response rate could reach approximately 65%. The available resources of county coordinators, particularly human resources, may partly explain the observed differences³⁸.

At the outset of the sixth invitation round of the BCS, the BCS database exhibited significantly improved accuracy, with 97% of the data matching the CBS data. This improvement was primarily attributed to the inclusion of the 'temporarily unavailable' status for women without a chosen doctor. Our study found no correlation between the availability of a sufficient number of appointments and the response rate in the BCS. However, there was significant variability in the number of available appointments among counties. A more accurate invitation database can contribute to a greater number of available mammography appointments, which can have a positive impact on the response rate. In the sixth invitation round of the BCS, notable differences among counties were observed. For instance, Lika-Senj County had three times more available mammography appointments compared to the number of women invited than Bjelovar-Bilogora County. In the fifth invitation round, eight counties encompassing 49.6% of women included in the BCS had enough appointments for repeat invitations. In the sixth invitation round, 12 counties comprising 59.9% of women met this criterion. With a more accurate

invitation database, more women had the opportunity to receive repeat invitations for mammography examinations, leading to the expected positive impact on the response rate²⁴⁻²⁵. The implementation and use of a population register in Croatia could prove beneficial for the BCS. In most European countries, population registers have been established based on a census and require the use of a PIN for each individual. These prerequisites are already implemented in Croatia. A population register allows for continuous monitoring of population movements by tracking changes in place of residence, which could also be valuable for researchers in various scientific fields³⁹.

County coordinators, who, despite having a more accurate invitation database, do not have a sufficient number of appointments for both the first and repeat invitations, could utilize the data from this study as an argument to advocate for an increase in the number of available appointments. It is essential to consider the issue of inadequate human resources, both in mammography units and in public health institutes, while also taking into account the unique circumstances of each county.

The analyzed preconditions for improving the implementation of the BCS in our study represent the initial step toward achieving a response rate exceeding 70%. To further increase the response rate, it is imperative to analyze the characteristics of specific groups of unresponsive women and identify the barriers preventing these women from responding to both the initial and repeat invitations, while implementing suitable interventions in accordance with available resources³⁷.

There were possible limitations to this study, stemming from the chosen time frame and data retrieval from the database, as the data in the BCS invitation database are updated every 24 hours. Consequently, efforts were made to select critical dates (the end of the previous invitation round and beginning of the next invitation round). In reality, when the prior invitation round concludes, mammography examinations from that round remain open for some time, allowing for the inclusion of findings into the BCS. Consequently, the final response rates in the fifth invitation round in Croatia increased from 57% in mid-February 2019 to 59% in mid-March 2021³⁵. Moreover, due to the COVID-19 pandemic, the response rate in the BCS was lower than expected despite improved implementation

conditions. This was accompanied by reduction in the number of available appointments in mammography units and decreased participation in examinations due to fear of COVID-19 infection. The resolution of the pandemic threat, the implementation of vaccination programs, and the establishment of a safe environment in healthcare facilities contribute to normalization of the implementation of the BCS and will also lead to improved response rates^{27,28}.

Conclusion

The results of the study revealed significant variability in the preconditions for implementing BCS at the county level. The accuracy of the invitation database correlates with better response to mammography invitations and results in greater availability of appointments at mammography units. Regarding diagnostic services at mammography units at the county level, there were three times as many available appointments in the county with the highest availability compared to the one with the lowest availability. It was estimated that improvement of the analyzed preconditions for the implementation of the BCS, which was achieved at the beginning of the sixth invitation round of the BCS, could have a positive impact on the response rate. In most counties, the response rate could be more accurately calculated based on a more precise invitation database. Sending repeat invitations to women who did not respond to the initial invitation could have a positive impact on the response rate. As the BCS is an important national program, additional efforts are required to ensure that all counties have favorable preconditions for implementation, thereby providing the target group of women with an equal opportunity for early breast cancer detection regardless of their county of residence. To enhance the implementation of the BCS, in addition to human and material resources, it is necessary to recognize BCS as a priority in the fight against cancer so that existing resources can be redirected.

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References

- Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, *et al.* Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin.* 2021 May;71(3):209-49. doi: 10.3322/caac.21660.
- Siegel RL, Miller KD, Fuchs HE, Jemal A. Cancer statistics, 2021. *CA Cancer J Clin.* 2021;71(1):7-33. doi.org/10.3322/caac.21654.
- Ferlay J, Ervik M, Lam F, Colombet M, Mery L, Piñeros M, *et al.* Global cancer observatory: cancer today. [homepage on the Internet] Lyon, France: International Agency for Research on Cancer; 2020 [cited 2022 Jul 30]. gco.iarc.fr/today
- Croatian Institute of Public Health. Škerija M, editor. Cancer incidence in Croatia 2015, Bilten 40 [Internet]. Zagreb: Croatian Institute of Public Health; 2018 [cited 2021 April 9]. (In Croatian). Available from: https://www.hzjz.hr/wp-content/wp-content/uploads/2018/03/Bilten_2015_rak_final.
- Croatian Institute of Public Health. Škerija M, editor. Cancer incidence in Croatia 2016, Bilten 41 [Internet]. Zagreb: Croatian Institute of Public Health; 2019 [cited 2021 April 9]. (in Croatian). Available from: https://www.hzjz.hr/wp-content/wp-content/uploads/2017/01/Bilten-2016_zavrсна.
- Croatian Institute of Public Health. Škerija M, editor. Cancer incidence in Croatia 2017, Bilten 42 [Internet]. Zagreb: Croatian Institute of Public Health; 2020 [cited 2021 Jun 9]. (in Croatian). Available from: <https://www.hzjz.hr/wp-content/wp-content/uploads/2017/01/Bilten-2017-final>.
- Croatian Institute of Public Health. Škerija M, editor. Cancer incidence in Croatia 2018, Bilten 43 [Internet]. Zagreb: Croatian Institute of Public Health; 2021 [cited 2021 April 9]. (in Croatian). Available from: https://www.hzjz.hr/wp-content/uploads/2020/12/Bilten_2018_final.
- Brkljačić B, Šupe Parun A. Croatian success in early breast cancer detection: favorable news in Breast Cancer Awareness Month. *Croat Med J.* 2020;61(5):389-90. doi: 10.3325/cmj.2020.61.389.
- Shapiro S, Coleman EA, Broeders M, Codd M, de Koning H, Fracheboud J, *et al.* Breast cancer screening programmes in 22 countries: current policies, administration and guidelines. *Int J Epidemiol.* 1998;27:735-42. doi: 10.1093/ije/27.5.735.
- Jemal A, Center M, De Santis C, Ward E. Global patterns of cancer incidence and mortality rates and trends. *Cancer Epidemiol Biomarkers Prev.* 2010;19(8):1893-907. doi: 10.1158/1055-9965.EPI-10-0437. Epub 2010 Jul 20.
- Lauby-Secretan B, Scoccianti C, Loomis D, Benbrahim-Tallaa L, Bouvard V, Bianchini F, *et al.* Breast-cancer screening – viewpoint of the IARC Working Group. *N Engl J Med.* 2015;372:2353-8. doi: 10.1056/NEJMs1504363. Epub 2015 Jun 3.
- Sardanelli F, Aase HS, Álvarez M, Azavedo E, Baarslag HJ, Balleyguier C, *et al.* Position paper on screening for breast cancer by the European Society of Breast Imaging (EUSOBI) and 30 national breast radiology bodies from Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Israel, Lithuania, Moldova, The Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Spain, Sweden, Switzerland and Turkey. *Eur Radiol.* 2017;27(7):2737-43. doi: 10.1007/s00330-016-4612-z. Epub 2016 Nov 2.
- Basu P, Ponti A, Anttila A, Ronco G, Senore C, Vale DB, *et al.* Status of implementation and organization of cancer screening in the European Union member states – summary results from the second European screening report. *Int J Cancer.* 2018;142(1):44-56. doi: 10.1002/ijc.31043. Epub 2017 Oct 10.
- Šamija M, Strnad M, Ebling Z, Kovačić L, Znaor A. Proposal of the National Programme of Prevention and Early Detection of Cancer in Croatia. Zagreb: Croatian Oncological Society, Ministry of Health of the Republic of Croatia, Croatian Institute of Public Health, Croatian Institute of Health Insurance; 2006.
- Ministry of Health of the Republic of Croatia. National Breast Cancer Screening Programme [Internet]. Zagreb: Ministry of Health of the Republic of Croatia; 2006 [cited 2021 May 29]. Available from: <UserDocsImages/dokumenti/Programi,%20projekti%20i%20strategije/Nacionalni%20program%20ranog%20otkrivanja%20raka%20dojke>.
- Council of the European Union. Council Recommendation of 2 December 2003 on Cancer Screening (2003/878/EC). *Off J Eur Union.* 2003;L327:34-8. (Dec 2, 2003).
- World Health Organization. Document WHA58/22. Agenda item 13.12 Cancer prevention and control [Internet]. Geneva: World Health Organization; 2005 [cited 2021 May 25]. Available from: https://apps.who.int/gb/ebwha/pdf_files/WHA58/WHA58_22-en.pdf.

18. Žigman T, Lukša I, Mihaljević G, Žarković M, Kirac I, Vrdoljak DV, *et al.* Defining health-related quality of life in localized and advanced stages of breast cancer – the first step towards hereditary cancer genetic counselling. *Acta Clin Croat.* 2020;59:209–15. doi: 10.20471/acc.2020.59.02.02
19. Brkljačić B, Brnić Z, Grgurević-Dujmić E, Jurković S, Kovačević J, Martić K, *et al.* Croatian Guidelines for Quality Assurance in Breast Cancer Screening and Diagnosis. Zagreb: Croatian Institute of Public Health, Ministry of Health of the Republic of Croatia, 2017.
20. Cro Screening [Internet]. Zagreb: Twinning project Improvement of Quality of the National Cancer Screening Programmes Implementation; c2016–2022 [cited 2022 March 25]. Ministry of Health of the Republic of Croatia. Available from: <http://croscreening.hzjz.hr>.
21. CanCon [Internet]. Ljubljana: Cancer Control Joint Action; c2014–2022 [cited 2022 March 20]. National Institute of Public Health of Republic of Slovenia. Available from: <http://cancercontrol.eu/archived>.
22. Perry N, Broeders M, de Wolf C, Törnberg S, Holland R, von Karsa L, *et al.*; European Commission. European Guidelines for Quality Assurance in Breast Cancer Screening and Diagnosis [Internet]. 4th ed. Luxembourg: Luxembourg Office for Official Publications of the European Communities; 2006 [cited 2021 May 10]. Available from: <http://euref.org/downloads?download=24:european-guidelines-for-quality-assurance-in-breast-cancer-screening-and-diagnosis>.
23. Allgood PC, Maroni R, Hudson S. Effect of second timed appointments for non-attenders of breast cancer screening in England: a randomised controlled trial. *Lancet Oncol.* 2017 Jul;18(7):972–80. doi: 10.1016/S1470-2045(17)30340-6.
24. Fleming P, Mooney T, Fitzpatrick P. Impact of second reminder invitation on uptake of screening and cancer detection in Breast Check. *Ir Med J.* 2012 Jan;105(1):7–9. PMID: 22397204
25. Kovačević J, Musil V, Jureša V. The role of public health institutes in improving the implementation of National Programmes of Early Cancer Detection. *Food Health Dis.* 2017 (Special Issue 3):41–7.
26. Committee for National Cancer Control Plan development. National Cancer Control Plan [Internet]. Zagreb: Ministry of Health of the Republic of Croatia; 2019 [cited 2021 May 18]. Available from: <http://nppr.hr/plan>.
27. Kovačević J, Musil V, Sović S, Kosić Bibić N, Zombori D, Jureša V. COVID-19 control measures and the response rate in the organized breast cancer screening in Croatia [abstract]. *Eur J Public Health.* 2021 Oct;31(Suppl 3):470.
28. Kovačević J, Sović S, Musil V, Kosić Bibić N, Zombori D, Jureša V. COVID-19 pandemic effect in the organized breast cancer screening program in Croatia [abstract]. *Eur J Public Health.* 2021 Oct;31(Suppl 3):364.
29. Chang S, Savitz A, Vuong B, Tang A, Mentakiset, Miller MA, *et al.* Characterization of breast cancer management during the COVID 19 pandemic in a large integrated healthcare delivery system: stage at diagnosis and timing/modality of first treatment. San Antonio Breast Cancer Symposium: Proceedings of San Antonio Breast Cancer Symposium; 2020 Dec 8–11; San Antonio, Texas, USA. San Antonio: SABCS, 2020; SS2–06.
30. Community Preventive Services Task Force. Cancer Screening: Multicomponent Interventions – Breast Cancer [Internet]. Centers for Disease Control and Prevention, U.S. Department of Health & Human Services; 2016 [cited 2021 May 12]. Available from: <http://thecommunityguide.org/indings/cancer-screening-multicomponent-interventions-breast-cancer>.
31. Wong FL. The Manual of Intervention Strategies to Increase Mammography Rates [Internet]. Atlanta: Center for Disease Control and Prevention; 1997 [cited 2021 Jun 16]. Available from: <http://cdc.gov/cancer/nbccedp/pdf/prumannual>.
32. Duffy SW, Myles JP, Maroni R, Mohammad A. Rapid review of evaluation of interventions to improve participation in cancer screening services. *J Med Screen.* 2017 Sep;24(3):127–45. doi: 10.1177/0969141316664757.
33. Blanchard K, Colbert JA, Puri D, Weissman J, Moy B, Kopans DB, *et al.* Mammographic screening: patterns of use and estimated impact on breast carcinoma survival. *Cancer.* 2004;101(3):495–507. doi: 10.1002/cncr.20392.
34. Jureša V, Kovačević J, Musil V, Majer M. Implementation of national cancer early detection programs in rural areas. In: Mazzi B, editor. Proceedings of the 13th Congress of Croatian Society of Family Physicians; 2013 Oct 3–5; Rovinj, Croatia. Rovinj: Croatian Society of Family Physicians of Croatian Medical Association, 2013; p. 67–75.
35. Ericsson Nikola Tesla, Croatian Health Insurance Institute; NPP system. Version 1.0.7093.17475 [software]. 2014 Nov 30 [cited 2021 Feb 14]. Available from: <http://cezih.hr/NPP/Home>.
36. Central Bureau of Statistics. Population estimates of the Republic of Croatia in 2017 [Internet]. Zagreb: Central Bureau of Statistics; 2018 [cited 2021 Jun 22]. Available from: <http://dzs.hr/>.
37. Kovačević J, Jureša V, Musil V, Zombori D. Public health intervention to increase the coverage of women with

- mammography examination within the National Programme for Early Detection of Breast Cancer. *Acta Med Croatica*. 2018;72(2):115-23.
38. Kovačević J, Džono Boban A. Public health activity recording – survey results. In: 1st Croatian Congress of Preventive Medicine of the Public Health Institute; 2017 May 25-27; Opatija, Croatia. Zagreb: Croatian Epidemiological Society, Croatian Society of School and University Medicine, Croatian Society of Public Health and Croatian Society of Health Ecology of the Croatian Medical Association, 2017.
39. Poulain M, Herm A. Central population registers as a source of demographic statistics in Europe. *Population*. 2013;68(2):215-47. doi: 10.3917/popu.1302.0215

Sažetak

KAKO POSTIĆI STOPU ODAZIVA OD 70% U NACIONALNOM PROGRAMU RANOG OTKRIVANJA RAKA DOJKE U HRVATSKOJ?

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Odaziv na mamografiju viši od 70% jedan je od parametara za praćenje uspješnosti provedbe nacionalnog programa probira na rak dojke. Cilj ovog rada bio je istražiti mogućnosti unapređenja odaziva u Nacionalnom programu ranog otkrivanja raka dojke (NPP) u Hrvatskoj ovisno o točnosti pozivne baze i dostupnosti usluge mamografije. U ovoj presječnoj studiji prikupljeni su podaci upitnikom od županijskih koordinatora NPP (N=21). Prikupljeni su podaci iz petog i šestog ciklusa provedbe. Kvaliteta pozivne baze i broj dostupnih mamografskih termina analizirani su programom Microsoft Office Excel. Oko 17% žena nije bilo dostupno na adresi navedenoj u bazi podataka i nije ih bilo moguće pozvati na mamografiju, promatrano prema županijama, najviše (31%) iz Ličko-senjske županije do najmanje iz Krapinsko-zagorske županije (7%). Dovoljan broj termina za mamografiju za prvo i ponovljeno pozivanje imalo je samo osam županija. Uz višu procjenu nedostupnih žena po županijama na kraju petog ciklusa, na kraju ciklusa bio je niži odaziv ($p=0,51$, $p=0,018$). Odaziv u sklopu NPP mogao bi biti viši uz točniju pozivnu bazu što bi oslobodilo dodatne termine za mamografiju i omogućilo upućivanje ponovljenih poziva ženama koje se nisu odazvale na prvi poziv.

Ključne riječi: *Rak dojke; Program probira na rak; Unapređenje*