The Positive Effect of an Online Appointment Portal on a Breast Cancer Screening Program

Angela Chiereghin[1] Lorenzo Pizzi[1] Lorena Squillace[1] Carmen Bazzani[1] Lorenzo Roti[2] Francesca Mezzetti[1,3]

[1] Governance of Screening Programs Unit, Staff Department, Local Health Authority of Bologna, Bologna, Italy
[2] Health Management, Local Health Authority of Bologna, Bologna, Italy
[3] Pianura Est District, Local Health Authority of Bologna, Bologna, Italy

Address for correspondence Angela Chiereghin, PhD, Governance of Screening Programs Unit, Staff Department, Local Health Authority of Bologna, Via Montebello, 6, 40121 Bologna, Italy (e-mail: angela.chiereghin@ausl.bologna.it).

Appl Clin Inform 2023;14:609–619.

Abstract

Background The adoption of web-based appointment methods by health care systems is increasing.

Objectives This study primarily aimed to evaluate in the setting of an organized breast cancer screening program the actual usage of an online appointment portal by the target population, i.e., how the online tool was used (type and timing of the actions performed) and by whom (users' characteristics); the effect of coronavirus disease 2019 (COVID-19) on its usage was also investigated. The effect of adopting this tool on the attendance to breast cancer screening was contextually investigated.

Methods Electronic data records of 75,903 women (45–74 years old, residing in the territory of Bologna Local Health Authority) were retrospectively reviewed.

Results In total, 12.4% of women logged into the online portal at least once. Most of them (79.9%) rescheduled, 15.7% viewed, and 4.4% cancelled their own appointment. In addition, 40.6% of all rescheduling actions were performed by the online portal; the remaining was performed by the toll-free number/dedicated email address. The highest peak (13.8%) of web accesses was registered at 10 a.m. Monday to Friday, when the toll-free number service is available. Percentages of portal usage were higher: (1) among the younger women, of Italian nationality, and for the first time invited to mammographic screening ($p < 0.0001$), and (2) in the pandemic period versus the prepandemic period (12.5 vs. 8.6%, respectively; $p < 0.001$). Finally, when compared to not using, the online portal usage led to an overall reduction in the no-show rate of almost 20% ($p < 0.0001$).

Conclusion The action mainly performed by using the online appointment portal was the appointment rescheduling. The usage of this tool had a positive effect on the no-show rate and it can be speculated that has led to a reduction of the request load to be handled by the center's screening staff. Finally, this study confirmed that the COVID-19 pandemic boosted the use of digital technologies.

Keywords

- organized breast cancer screening
- online appointment portal
- appointment scheduling
- no-show rate
- COVID−19 pandemic

received
February 9, 2023
accepted after revision
May 5, 2023

DOI https://doi.org/10.1055/s-0043-1769910.
ISSN 1869-0327.

Background and Significance

Rationale for Adopting an Online Appointment Portal

According to the last Global Cancer Observatory (GLOBOCAN) data, breast cancer ranks first and fifth worldwide in terms of incidence and mortality, respectively. About 2.2 million of new cases, accounting for the 11.7% of all cancer cases, and more than 600,000 of new deaths were estimated in 2020.[1] However, due to the availability of organized screening programs, mostly in developed countries, decreases in mortality rates were observed in the last decades.[1–3] It is known that any screening program is successful and efficient when high attendance rates are obtained and sustained. Among the several reasons for nonattendance, practical barriers such as lack of time and difficulties with the booking process were reported.[4,5]

Setting of Usage

From September 10, 2019, the Local Health Authority (LHA) of Bologna (the chief town of the Emilia-Romagna Region, Northern Italy) offers to all women invited to participate in the organized breast cancer screening program an online appointment portal that allows to fully autonomously reschedule or cancel the primary screening test appointment.

Providers' Perspective

All actions performed by means of the online portal are confirmed to users by an automatic message on their electronic health record and no verification or confirmation by the screening center staff is required. In fact, alongside the established benefits for the patient portals (i.e., allowing users to book appointments, view their health information, refill medications, look up test results, and access to secure messaging with health care teams), it is also important to consider the providers' perspective.[6] In particular, Conroy and colleagues in a recent systematic review focused on electronic medical record-based electronic messaging between patients with breast cancer and cancer providers' report that the messaging service requires providers to work outside both clinical working hours and days.[6] In addition, it has been suggested that task switching due to interruptions, such as an incoming message, was a major cause of inefficiency and error and a source of added cognitive burden.[7] In this regard, Steitz et al highlighted the need for understanding work patterns associated with asynchronous messaging to systematically identify opportunities to improve the care team's workload reducing unnecessary work and alleviating unnecessary interruptions.[7]

Literature Gaps

The usage of online patient portals for accessing to the electronic health records and radiology results has been previously investigated.[8,9] However, the usage of these information technology (IT) instruments for accessing to preventive care, such as for scheduling screening mammogram, has yet to be established.[10] In fact, at the time of writing, as far as we know, limited studies focused exclusively on breast self-scheduled imaging.[10,11] Even fewer studies[11] compared the usage of the IT instruments in the coronavirus disease 2019 (COVID-19) pre- and postpandemic period, considering that a digital surge during and postpandemic was observed.[12] Not least, literature data are still inconsistent as to whether facilitated appointment schedule is a factor with a direction of effect on attendance rate in breast cancer screening.[13]

Objectives

This study primarily aimed to evaluate the actual usage of the new IT instrument by the target population, i.e., how the online appointment portal was used (type and timing of the actions performed) and by whom (users' characteristics); the effect of COVID-19 pandemic on its usage was also investigated. Moreover, the effect of adopting the online appointment portal on the attendance to breast cancer screening was contextually analyzed.

To the best of our knowledge, no studies on these topics have yet been performed in the setting of an organized Italian breast cancer screening program.

Methods

Brief Description of the Investigated IT Instrument

The link to the portal (*screening.ausl.bologna.it/portalscreen/*) is provided on the website of the LHA and the woman can access 24 hours a day and 7 days a week using the invitation code reported in the invitation letter for attending the breast screening program and the the own fiscal code. By rescheduling the appointment, the woman can choose the preferred location, date, and time by consulting the appointments still available in the agenda displayed on the screen. It is also possible to reschedule an appointment after it has been cancelled and due. Along with the automatic communication reporting the appointment details on the electronic health record, the woman can autonomously request to receive a reminder about own appointment via mail as well as print it directly by the IT tool. The online appointment portal instructions are reported both in the invitation letter and the LHA website. In the setting of the screening center of the LHA of Bologna, the online appointment portal is an additional possibility to the verbal or written communications with schedulers over the telephone (with the dedicated toll-free number in the specific front office time slot) or by online correspondence with the dedicated email address, respectively; both services are available from Monday to Friday.

From May 20, 2020, the online portal to schedule/cancel appointments has also been made available for all women invited to participate in the organized cervical screening program.

Eligible Women and Study Design

The study planned to retrospectively review electronic data records of women aged 45 to 74 years residing in the territory of the Bologna LHA who were invited to participate at the I level screening test (mammography) for breast cancer

in the period October 1, 2019 to September 30, 2020; fixed appointments were given to women.

Women's demographic information such as age and nationality (Italian/Other) as well as the district of residence were gathered. Ranges of age groups were initially defined on the basis of the interval mammogram recommended in Italy (i.e., yearly and biennial for women aged 45–49 years and >50 years, respectively); later women aged >50 years were further subdivided in order to have similar sample size in the groups. Furthermore, based on the screening attendance history in the Bologna LHA organized breast cancer screening program, women were grouped in attenders, never attenders/intermittent attenders, and invited to mammographic screening for the first time (hereinafter "New entries"). Particularly, for the purpose of this study, we defined an attender as a woman who attended at least one round including the last, a never attender a woman who failed to attend ever, and an intermittent attender a woman who attended at least one round excluding the last. Women whose invitation letter resulted not delivered or who had moved out of LHA of Bologna or were deceased were excluded from the study population.

The actual usage of the online appointment portal as well as the effect of its usage in terms of attendance rates to screening were analyzed in both total and stratified by the abovementioned characteristics (i.e., age, nationality, district of residence, and screening attendance history) of the study population. The deadline for evaluating the attendance rates of the study population at the screening was October 31, 2020. The magnitude and the distribution by hour and day of the week of accesses to the online system were analyzed. Specifically, the online accesses recorded from Monday to Friday (business days), on Saturdays, and Sundays along with holidays were evaluated. The timing of an appointment being cancelled or rescheduled by means of the online portal in relation to the date of the scheduled appointment was also investigated and compared with the timing of cancellation/rescheduling by toll-free number or dedicated email address. Finally, the effect of COVID-19 on the usage of the online appointment portal was analyzed; in particular, the period October 2019 to February 2020 was compared with the period March to September 2020 identified as "prepandemic" and "pandemic" periods, respectively.

Statistical Analysis

Univariate and bivariate analyses were carried out. The chi-squared test was used for testing relationship between all categorical variables, with 95% confidence interval (CI). Cross-tabulations and tests were conducted considering age (in age groups), nationality (Italian or foreign nationals), district of residence, attendance screening history, and day of the week of online portal use. These variables were also compared between COVID-19 prepandemic period and pandemic period. Multivariable logistic regression models were performed and the results were expressed as odds ratio (OR) with 95% CI and p-values. Tests were considered significant for p-values ≤ 0.05. Statistical analysis was performed using Stata (Version 16.1).

Results

During the study period, a total of 75,903 women (mean age: 56.2 ± 9.0 years) were invited with a personal letter offering a changeable fixed date, time, and location appointment to the mammographic screening and 68% of these (51,610/75,903) underwent mammography. The attendance to the screening program was different among the six districts of residence ($p < 0.0001$) ranging from 65 to 70.9% in Bologna and Pianura Ovest districts, respectively. Among the 75,903 women, 9,418 (12.4%) logged into the online appointment portal at least once and the total number of web accesses was equal to 38,575 (median number per woman: 3; range: 1–62). Among these 9,418 women, 79.9% ($n = 7,522$) and 4.4% ($n = 413$) used the online tool for rescheduling and cancelling an appointment, respectively; these women accounted for a total of web accesses of 10,074 (median number per woman: 1; range: 1–12). The remaining 15.7% (1,483/9,418) women logged into the online portal and did not select any appointment's change/cancel action accounting for a total of web accesses equal to 73.9% (28,501/38,575). This work focuses the attention on the 7,935 women who logged into the online portal and selected an action aiming to reschedule or cancel an appointment (►Fig. 1). By analyzing the usage of the online appointment system according to the demographic characteristics (i.e., age and nationality), district of residence, and screening attendance history, a statistically higher usage of the online tool was observed among women less than 50 years of age, of Italian nationality, residents in the chief town of the Emilia-Romagna region (i.e., Bologna), and first time invited to mammographic screening (►Table 1); multivariate regression analysis results confirmed those of the univariate analysis (►Table 2).

Overall, a higher attendance rate to screening among women who used the online appointment portal than women who did not was observed (i.e., 85.5% vs. 66.0%, respectively; $p < 0.0001$), resulting in a difference of no-show rate between the two groups of 19.5%. Particularly, the attendance rate resulted higher among women who used the online appointment portal regardless of age group, nationality, district of residence, and screening attendance history (►Table 3). The multivariate regression analysis performed to investigate the variables that could be associated with the overall attendance rate pointed out that attendance rate to screening was significantly higher if women used the online appointment portal, if they were young, Italian, attenders, and if they lived in the Bologna district (►Table 4).

The usage of the online tool in terms of number of accesses and time of use varied significantly according to the days of the week considered ($p < 0.0001$; ►Fig. 2). Specifically, from Monday to Friday the highest number of online accesses was recorded during the morning from 7 a.m. to 2 p.m., with a peak of 13.8% of accesses at 10 a.m.. An overlapping trend in terms of time of use was observed when Saturdays were analyzed; however, a lower peak of online accesses was registered (i.e., 11.9% at 10 a.m.). The lowest peak of online accesses (10.0%) was recorded on Sundays and holidays and it was during the afternoon, approximately at 6 p.m. (►Fig. 2).

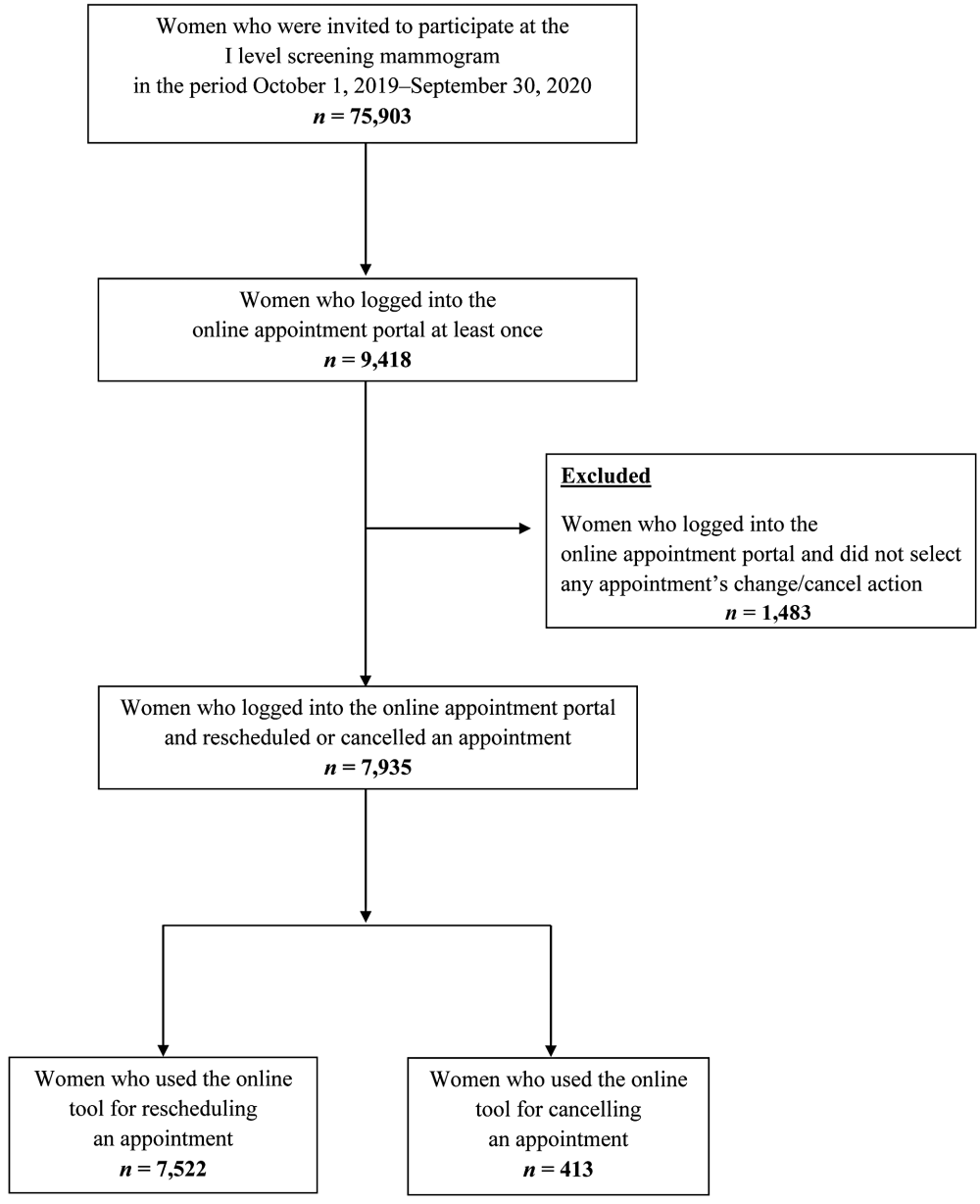

Fig. 1 Flowchart of the eligible women.

With regard to the appointment's rescheduling and cancelling actions, women in the "Attenders" group accounted for the 76.9% of all the actions performed by using the three available tools (data not shown). Overall, lower percentages of rescheduling and cancelling actions by the online portal than the toll-free number/dedicated email address were observed, i.e., 40.6 versus 59.4% and 14.1 versus 85.9%, respectively (►**Table 5**). However, in the "New entries" group, a higher percentage of rescheduling actions by the online tool than the toll-free number/dedicated email address was observed (60.3 vs. 39.7%; ►**Table 5A**).

The analysis regarding the timing of an appointment being rescheduled or cancelled in relation to the date of the scheduled appointment showed that the time elapsing between the scheduled appointment and the specific action is lower when the online portal was used instead of the toll-free number/dedicated email address (median value: 8 vs. 10 days, respectively; $p < 0.0001$; ►**Table 6**). The longest timing, i.e., ≥8 days from the date of the scheduled appointment, was observed in the "Attenders" group regardless of the method used. Indeed, at this time point, a higher percentage of "Attenders" rescheduled/cancelled appointment by toll-free number/dedicated email when compared to "New entries" (60.2 vs. 52.3%, respectively; $p < 0.001$) and to "Never/intermittent" attenders (60.2 vs. 56.4%, respectively; $p < 0.001$). Overlapping results were obtained comparing the percentage of "Attenders" who rescheduled/cancelled the appointment at this time-point by using the online portal when compared to "New entries" (i.e., 55.0 vs. 37.3%, respectively; $p < 0.001$) and to "Never/intermittent" attenders (55.0 vs. 43.4%, respectively; $p < 0.001$; ►**Table 6B**). A higher percentage of rescheduling or cancelling actions after the

Table 1 Usage of the online appointment portal according to demographic characteristics, district of residence, and screening attendance history

Variable	Usage of online appointment portal		*p*
	No	Yes	
	No. of women	No. of women	
Age group, y (No.)			
< 50 (27,088)	22,950 (84.7%)	4,138 (15.3%)	$\chi^2 = 1.5e+03$ (2df), $p < 0.00001$
50–59 (23,262)	20,739 (89.2%)	2,523 (10.8%)	
> 59 (25,553)	24,279 (95%)	1,274 (5.0%)	
Nationality (No.)			
Other[a] (7,487)	7,142 (95.4%)	345 (4.6%)	$\chi^2 = 303.26$ (1df), $p < 0.00001$
Italian (68,416)	60,826 (88.9%)	7,590 (11.1%)	
District of residence (No.)			
Pianura Ovest (7,421)	6,694 (90.2%)	727 (9.8%)	$\chi^2 = 115.16$ (5df), $p < 0.00001$
Bologna (31,715)	28,049 (88.4%)	3,666 (11.6%)	
Pianura Est (14,966)	13,574 (90.7%)	1,392 (9.3%)	
Reno Lavino e Samoggia (10,011)	8,919 (89.1%)	1,092 (10.9%)	
San Lazzaro di Savena (6,660)	5,990 (89.9%)	670 (10.1%)	
Appennino Bolognese (5,130)	4,742 (92.4%)	388 (7.6%)	
Screening attendance history (No.)			
Attenders (51,088)	45,574 (89.2%)	5,514 (10.8%)	$\chi^2 = 681.04$ (2df), $p < 0.00001$
New entries (8,146)	6,769 (83.1%)	1,377 (16.9%)	
Never/intermittent attenders (16,669)	15,625 (93.7%)	1,044 (6.3%)	

[a]More than 50% of "Other" is represented by users from Romania, Ukraine, Moldova, and Morocco.

Table 2 Results of multivariate regression analysis of online appointment portal usage according to demographics characteristics, district of residence, and screening attendance history

Variable	OR	SE	95% CI	*p*
Log likelihood = −24,148.8, $\chi^2 = 2{,}549.55$ (10df), $p < 0.00001$, no. of obs. = 75,903				
Age group (y)				
< 50	1.00[a]			
50–59	0.72	0.02	0.68–0.76	<0.001
> 59	0.30	0.01	0.28–0.33	<0.001
Nationality				
Italian	1.00[a]			
Other	0.33	0.02	0.30–0.37	<0.001
District of residence				
Città di Bologna	1.00[a]			
Pianura Ovest	0.78	0.03	0.72–0.85	<0.001
Pianura Est	0.73	0.02	0.69–0.78	<0.001
Reno, Lavino, Samoggia	0.89	0.03	0.83–0.96	0.002
Savena Idice	0.79	0.04	0.72–0.86	<0.001
Appennino Bolognese	0.62	0.04	0.56–0.69	<0.001
Screening attendance history				
Attenders	1.00[a]			
New entries	1.24	0.04	1.16–1.33	<0.001
Never/Intermittent attenders	0.59	0.02	0.55–0.64	<0.001

Abbreviations: CI, confidence interval; OR, odds ratio; SE, standard error.
[a]Reference category.

Table 3 Attendance to screening program stratified by demographic characteristics, district of residence, and screening attendance history according to the usage of the online appointment portal

Variable	Attendance to screening program according to usage of online appointment portal		*p*
	No usage No. of women	Yes usage No. of women	
Age group, y (No.)			
< 50 (27,088)	63.3% (14,532/22,950)	85.3% (3,531/4,138)	$\chi^2 = 1.4e+03$ (2df), $p < 0.00001$
50–59 (23,262)	68.1% (14,116/20,739)	87.6% (2,209/2,523)	
> 59 (25,553)	66.6% (16,174/24,279)	82.3% (1,048/1,274)	
Nationality (No.)			
Other[a] (7,487)	49.3% (3,523/7,142)	83.5% (288/345)	$\chi^2 = 112.79$ (1df), $p < 0.00001$
Italian (68,416)	67.9% (41,299/60,826)	85.6% (6,500/7,590)	
District of residence (No.)			
Pianura Ovest (7,421)	69.3% (4,642/6,694)	85.0 % (618/727)	$\chi^2 = 198.54$ (5df), $p < 0.00001$
Bologna (31,715)	62.3% (17,472/28,049)	86.1% (3,156/3,666)	
Pianura Est (14,966)	67.7% (9,187/13,574)	84.6% (1,177/1,392)	
Reno Lavino e Samoggia (10,011)	66.3% (5,914/8,919)	86.8% (948/1,092)	
San Lazzaro di Savena (6,660)	71.4% (4,278/5,990)	86.3% (578/670)	
Appennino Bolognese (5,130)	70.2% (3,329/4,742)	80.2% (311/388)	
Screening attendance history (No.)			
Attenders (51,088)	86.5% (39,417/45,574)	88.4% (4,872/5,514)	$\chi^2 = 1.3e+03$ (2df), $p < 0.00001$
New entries (8,146)	42.5% (2,874/6,769)	81.8% (1,126/1,377)	
Never/intermittent attenders (16,669)	16.2% (2,531/15,625)	75.7% (790/1,044)	

[a]More than 50% of "Other" is represented by users from Romania, Ukraine, Moldova, and Morocco.

appointment was due by using the online appointment portal than the toll-free number/dedicated email address (14.2 and 3.8%; $p < 0.0001$) was performed (►Table 6). During the study period, the overall attendance rate among the women who rescheduled/cancelled an appointment at this specific time point was equal to 83.45%.

Finally, with regard to the effect of COVID-19 pandemic on the usage of the online appointment portal, an overall higher usage of this tool was observed in the pandemic than in the prepandemic period (12.5 vs. 8.6%, respectively; $p < 0.001$). In particular, the comparison of the usage of the online appointment system in these two specific periods according to the demographic characteristics, district of residence, and screening attendance history is reported in ►Table 7. The greatest difference in usage was observed among the younger women and the "New entries" group, with delta values comparing COVID-19 pandemic versus prepandemic period of +63.73% and +93.60%, respectively.

Discussion

The adoption of web-based appointment methods by health care systems is increasing.[14] An online appointment portal was recently introduced in the LHA of Bologna in the setting of an organized breast cancer screening program. The purposes of this study were to evaluate the actual usage of this new IT instrument by the target population and its effect on the screening attendance.

As previously reported,[15,16] the number of users of the online portal was higher among the younger women ($p < 0.0001$), probably due to a higher confidence with technology or presence of time constraints.[17] The use of this instrument was also influenced by the nationality, the district of residence, and the screening attendance history ($p < 0.0001$). Limited Italian proficiency may have been a barrier to the usage of the online tool by women of non-Italian nationality, as the interface of the IT instrument was available only in Italian. The district of residence in which the lowest use of the online tool was observed was the district in which the average income/taxpayer and the level of education were the lowest. Conversely, the district with the highest use of the online portal showed the highest values for these two socioeconomic indicators. About that, the 2022 summary document on the health of the population living in the LHA of Bologna territory, referring to the triennium 2018 to 2021, has been consulted.[18] Finally, by grouping the invited population on the basis of their screening attendance history allowed us to compare the usage of the online portal among women who attend regularly for screening versus women at their first experience with the organized breast screening program and those who are nonattenders or intermittent attenders. To

Table 4 Results of multivariate regression analysis of attendance to screening program according to demographic characteristics, district of residence, screening attendance history, and usage of the online appointment portal

Variable	OR	SE	95% CI	*p*
Log likelihood = −33167.95, χ^2 = 28832.74 (11df), p < 0.00001, no. of obs. = 75,903				
Usage of online appointment portal				
No usage	1.00[a]			
Yes usage	3.66	0.14	3.39–3.95	<0.001
Age group				
< 50	1.00[a]			
50–59	0.93	0.02	0.88–0.98	0.007
> 59	0.90	0.02	0.85–0.94	<0.001
Nationality				
Italian	1.00[a]			
Other	0.69	0.02	0.64–0.73	<0.001
District of residence				
Città di Bologna	1.00[a]			
Pianura Ovest	1.18	0.04	1.10–1.26	<0.001
Pianura Est	1.20	0.03	1.14–1.27	<0.001
Reno, Lavino, Samoggia	1.17	0.04	1.10–1.24	<0.001
Savena Idice	1.30	0.05	1.21–1.40	<0.001
Appennino Bolognese	1.26	0.05	1.16–1.37	<0.001
Screening attendance history				
Attenders	1.00[a]			
New entries	0.13	0.004	0.12–0.14	<0.001
Never/intermittent attenders	0.04	0.001	0.036–0.040	<0.001

Abbreviations: CI, confidence interval; OR, odds ratio; SE, standard error.
[a]Reference category.

engage the latter two categories of women is one of the missions of the population-based health program.

During the study period, the action mainly performed by using the informatics tool was the appointment rescheduling; however, in the approximately 15% of cases, no active actions of appointment rescheduling or cancelling were performed. In this regard, it can be speculated that the login into the online portal was performed to check or retrieve the appointment details resulting in a reduction of this kind of requests to the screening center's staff. In fact, in absence of this tool, women would most likely have used the toll-free number or the dedicated email address. Similarly, although a lower overall number of rescheduling and cancelling actions by the online portal than the toll-free number/dedicated email was registered, it should be noted that the use of the online portal accounted for 40.6% of all rescheduling actions, which otherwise should have been performed by the screening center's staff. In addition, the highest number of online accesses was recorded inside of normal business days and hours for appointments scheduling/cancelling. All of this may have resulted into a reduction of the request load to handle by the screening personnel. Such supposed improvement on staff's work is in line with literature data. In fact, Zhao and colleagues performing a systematic review of studies relating to the effects of web-based appointment scheduling systems, in different clinical settings, found that the most cited positive change due to the adoption of such instruments was reducing staff's labor.[14] However, as pointed out by the authors themselves, the studies were highly heterogeneous in research design.[14] Moreover, the assessment methods were not reported in almost all the studies considering the staff labor as a metric for the evaluation of the web-based scheduling systems.

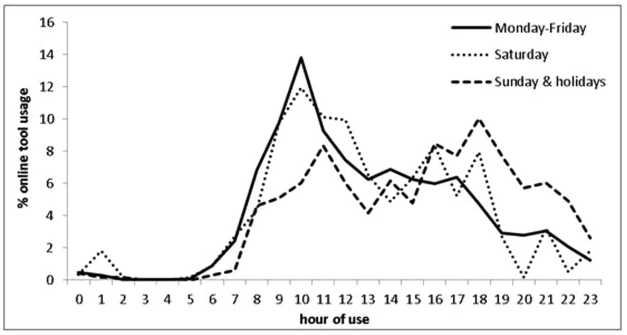

Fig. 2 Percentage distribution of daily accesses to the online appointment portal by time and day of the week.

Table 5 Appointment's rescheduling (A) and cancelling (B) actions by toll-free number/dedicated email address and by the online appointment portal according to the screening attendance history

(A)			
	Rescheduling appointment No. of actions = 23,516		***p***
Screening attendance history	Toll-free number/dedicated email	Online portal	
Attenders	12,057 (64.1%)	6,741 (35.9%)	$\chi^2 = 865.43$ (2df), $p < 0.00001$
New entries	1,106 (39.7%)	1,682 (60.3%)	
Never/intermittent attenders	812 (42.1%)	1,118 (57.9%)	
Total	13,975 (59.4%)	9,541 (40.6%)	
(B)			
	Cancellation appointment No. of actions = 3,767		*p*
Screening attendance history	Toll-free number/dedicated email	Online portal	
Attenders	1,906 (87.0%)	285 (13.0%)	$\chi^2 = 6.13$ (2df), $p = 0.047$
New entries	511 (83.5%)	101 (16.5%)	
Never/Intermittent attenders	817 (84.8%)	147 (15.2%)	
Total	3,234 (85.9%)	533 (14.1%)	

Table 6 Timing of appointment's rescheduling or cancelling action by tool-free number/dedicated email address (A) and online appointment portal (B) in relation to the date of the scheduled appointment

(A)						
Action of rescheduling or cancelling appointment by toll-free number/ dedicated email (No. of actions)	**Time elapsing between scheduled appointment and action of rescheduling/cancelling, days**				***p***	**Median value in day (range)**
	0–4	***5–7***	***≥8***	**After appointment expired**		
Attenders (13,963)	3,413 (24.4%)	1,832 (13.1%)	8,402 (60.2%)	316 (2.3%)	$\chi^2 = 995.47$ (6df), $p = 0.047$	10 (0–123)
New entries (1,617)	423 (26.2%)	201 (12.4%)	846 (52.3%)	147 (9.1%)		8 (0–153)
Never/intermittent attenders (1,629)	337 (20.7%)	185 (11.4%)	919 (56.4%)	188 (11.5%)		10 (0–130)
Total (17,209)	4,173 (24.2%)	2,218 (12.9%)	10,167 (59.1%)	651 (3.8%)		10 (0–153)
(B)						
Action of rescheduling or cancelling appointment by online portal (No. of actions)	Time elapsing between scheduled appointment and action of rescheduling/cancelling, (d)				*p*	Median value in day (range)
	0–4	5–7	≥8	After appointment expired		
Attenders (7,026)	1,915 (27.3%)	744 (10.6%)	3,864 (55.0%)	503 (7.2%)	$\chi^2 = 497.14$ (6df), $p < 0.00001$	9 (0–148)
New entries (1,783)	465 (26.1%)	154 (8.6%)	670 (37.3%)	494 (27.7%)		3 (0–113)
Never/intermittent attenders (1,265)	203 (16.0%)	84 (6.6%)	549 (43.4%)	429 (33.9%)		5 (0–129)
Total (10,074)	2,583 (25.6%)	982 (9.7%)	5,083 (50.0%)	1,426 (14.2%)		8 (0–148)

Table 7 Usage of the online appointment portal according to demographic characteristics, district of residence, and screening attendance history in prepandemic and pandemic periods

Variable	Usage of online appointment portal			
	COVID-19 prepandemic period No. of women	COVID-19 pandemic period No. of women	*p*	Δ values COVID-19 pandemic vs. prepandemic periods
Age group, y (no.)				
< 50 (4,138)	1,569 (46.1%)	2,569 (56.7%)	$\chi^2 = 115.86$ (2df), $p < 0.00001$	+63.73%
50–59 (3,351)	1,282 (37.7%)	1,241 (27.3%)		−3.20%
> 59 (1,048)	550 (16.2%)	724 (16.0%)		+31.64%
Nationality (no.)				
Other[a] (345)	131 (3.9%)	214 (4.7%)	$\chi^2 = 3.61$ (1df), $p = 0.057$	+63.36%
Italian (7,590)	3,270 (96.1%)	4,320 (95.3%)		+32.11%
District of residence (no.)				
Pianura Ovest (727)	303 (8.9%)	424 (9,4%)	$\chi^2 = 2.45$ (5df), $p = 0.785$	+39.93%
Bologna (3,666)	1,600 (47.0%)	2,066 (45.6%)		+29.13%
Pianura Est (1,392)	597 (17.6%)	795 (17.5%)		+33.17%
Reno Lavino e Samoggia (1,092)	465 (13.7%)	627 (13.8%)		+34.84%
San Lazzaro di Savena (670)	285 (8.4%)	385 (8.5%)		+35.09%
Appennino Bolognese (388)	151 (4.4%)	237 (5.2%)		+56.95%
Screening attendance history (no.)				
Attenders (5,514)	2,406 (70,7%)	3,108 (68.5%)	$\chi^2 = 72.8$ (5df), $p < 000001$	+29.18%
New entries (1,377)	469 (13.8%)	908 (20.1%)		+93.60%
Never/intermittent attenders (1,044)	526 (15.5%)	518 (11.4%)		−1.52%

[a]More than 50% of "Other" is represented by users from Romania, Ukraine, Moldova, and Morocco.

By analyzing the attendance to screening, for each variable considered, consistently higher percentage values of attendance were observed among the women who did use the portal than the women who did not use the portal. Overall, when compared to not using, the usage of the online portal led to a reduction in no-show rate of almost 20%. Similar results were reported by other authors when compared, in other settings, no-show rates of appointments made by web-based scheduling services with those made by means of traditional methods.[19–22] As previously supposed,[14] this finding can be attributed to the fact that a personal management of the own appointment makes people more responsible for the appointment itself. Moreover, although a higher percentage of rescheduling/cancelling actions after the appointment expired was performed by using the online portal than the toll-free number/dedicated email ($p < 0.0001$), the overall attendance screening observed during the study period among these women was very high, i.e., > 80%. North et al at Mayo Clinic, on the other hand, found that self-scheduled screening mammogram was associated with a slight increase in no-shows compared to staff-scheduling, i.e., 5.7 vs. 4.6%, respectively (with a small but significant OR of 1.12 in a model adjusted for age, race, and ethnicity [95% CI: 1.02–1.23; $p = 0.02$]).[11] Of note, both these no-show percentages were markedly lower than those we found comparing screening attendance between online portal users and not users.

Finally, the higher usage of the online portal in the pandemic than in the prepandemic period is in line with the literature data reporting that the COVID-19–pandemic boosted the use of digital technologies, including the web-based applications for health services.[12,23]

The large sample size of the eligible women investigated and the opportunity to evaluate the IT instrument in two different scenarios such as the COVID-19 prepandemic and pandemic periods were the strengths of this study. Of note, with the goal to limit waste of clinical resources, we recently carried out analyses assessing the number of actions performed by using the online tool per women after which the attendance rate significantly decreases (i.e., the target population we invited in the biennium 2020 to 2021 was taken into account). In fact, it is known that no-show leads to an under-utilization of medical resources, an increase of health care costs, a reduction of provider's clinic efficiency and

productivity, and a decrease in access to health care.[24] Moreover, no-show has a negative impact also on the subjects who keep their appointments leading to an unsatisfaction for high waiting times and a perception of overall decrease in service quality.[25] Our evaluations pointed out that after three rescheduling/cancelling actions the screening attendance rate decreased up to 8.8% among the "New entries" when compared with one action. Therefore, a predefined appointment rule has been enforced in the online portal, i.e., an IT block impedes to perform more than three actions per women, regardless of the screening attendance history, and an automatic message indicating the possibility to make the appointment by means of the toll-free number service is generated.

Despite our screening service is mainly directed toward the Italian population, as can be seen from the composition of eligible women (i.e., about 10% was of non-Italian), not having analyzed variables such as race/ethnicity as well as their specific socioeconomic status in relation to the online appointment portal usage is one of the limitations of the study. In fact, literature data report lower rates of technology adoption both among racial/ethnic minority groups and individuals from lower socioeconomic status background.[10,26] As previously suggested, health informatics interventions are tending to unintentionally worsen underlying health inequalities by benefiting more advantaged people.[27] Therefore, strategies facilitating the reduction of health disparities should be planned. In our setting, the interface of the IT instrument will soon also be provided in English to increase the possibility of its use by all women invited to participate in screening. Promotional and informative campaigns will be also carried out. Finally, surveys on the perceived quality of the IT instrument investigating its usability (i.e., overall reactions to the tool, screen design and layout, terminology, learning, ease of use)[28] will be performed aiming to understand the needs of women for guiding further improvement actions.

The present study provides new insights into the usage of an online appointment portal in the setting of a breast cancer screening program, which may be useful for clinicians and policymakers involved in the design and implementation of this oncology program. Indeed, our findings highlight the importance to consider both the characteristics of the target population to tailor outreach and education efforts to the use of the tool and introduce a predefined appointment rule to limiting waste of clinical resources. Furthermore, study results can be of note for researchers evaluating different strategies for improving attendance screening rates.

Conclusion

This study points out that the adoption of an online appointment portal can be a useful tool in the setting of breast cancer organized screening program since its use can have a positive effect on the no-show rate. Furthermore, the study findings suggest a positive effect also on the center's screening staff work. Future efforts should be performed to increase the usage of this tool.

Clinical Relevance Statement

Giving the possibility to women to be actively engaged in scheduling of their own appointment can lead to a higher percentage of women receiving screening mammograms, limiting the negative effects of the no-show rate on the clinical effectiveness of the organized breast screening, the productivity of cancer providers, and the access to health care.

Multiple-Choice Questions

1. By using the online appointment portal, the woman has the possibility to:
   a. Reschedule 24 hours a day and 7 days a week the appointment choosing location, date, and the time
   b. Reschedule from Monday to Friday the appointment choosing location, date, and time
   c. Reschedule 24 hours a day and 7 days a week the appointment, choosing date and time
   d. Only to check or retrieve the appointment details

   Correct Answer: The correct answer is option a. The IT tool was designed to offer women full flexibility in scheduling the most suitable appointment, without day or time restrictions.

2. Among women who used the online appointment portal, the attendance rate to the organized breast cancer screening program:
   a. Was influenced by nationality
   b. Was influenced by nationality and screening attendance history
   c. Was influenced by nationality and district of residence
   d. Was not influenced by any of the above variables

   Correct Answer: The correct answer is option d. This finding can be attributed to the fact that a personal management of the own appointment makes people more responsible for the appointment itself.

3. What was the effect of COVID-19 on the usage of the online appointment portal?
   a. An overall lower usage in pandemic than in prepandemic period was observed
   b. No difference of usage comparing pandemic and prepandemic period was observed
   c. An overall higher usage in pandemic than in prepandemic period was observed
   d. The IT instrument was not working during the pandemic period

   Correct Answer: The correct answer is option c. COVID-19 pandemic boosted the use of digital technologies, including the web-based applications for health services.

Protection of Human and Animal Subjects

The study was approved by the Ethical Committee of the LHA of Bologna on January 21, 2021 (Prot. No. 47-2021-

OSS-AUSLBO). Considering the retrospective nature of the study, which was based on women electronic data records reviewing, collection of informed consent was not required.

Funding
None.

Conflict of interest
None declared.

Acknowledgements
The authors would like to thank the IT engineer, Dr. Gianfranco Valastro, for his assistant in developing the online appointment portal and all the members of the center screening's staff of the Local Health Authority of Bologna for their work.

References

1 Sung H, Ferlay J, Siegel RL, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin 2021;71(03): 209–249
2 Nelson HD, Tyne K, Naik A, Bougatsos C, Chan BK, Humphrey LU.S. Preventive Services Task Force. Screening for breast cancer: an update for the U.S. Preventive Services Task Force. Ann Intern Med 2009;151(10):727–737, W237-42
3 Harris R, Yeatts J, Kinsinger L. Breast cancer screening for women ages 50 to 69 years a systematic review of observational evidence. Prev Med 2011;53(03):108–114
4 Catarino RR, Vassilakos PP, Royannez-Drevard II, et al. Barriers to cervical cancer screening in Geneva (DEPIST Study). J Low Genit Tract Dis 2016;20(02):135–138
5 Young B, Bedford L, Kendrick D, Vedhara K, Robertson JFR, das Nair R. Factors influencing the decision to attend screening for cancer in the UK: a meta-ethnography of qualitative research. J Public Health (Oxf) 2018;40(02):315–339
6 Conroy M, Powell M, Suelzer E, et al. Electronic medical record-based electronic messaging among patients with breast cancer: a systematic review. Appl Clin Inform 2023;14(01):134–143
7 Steitz BD, Unertl KM, Levy MA. An analysis of electronic health record work to manage asynchronous clinical messages among breast cancer care teams. Appl Clin Inform 2021;12(04):877–887
8 Miles RC, Hippe DS, Elmore JG, Wang CL, Payne TH, Lee CI. Patient access to online radiology reports: frequency and sociodemographic characteristics associated with use. Acad Radiol 2016;23 (09):1162–1169
9 Beal LL, Kolman JM, Jones SL, Khleif A, Menser T. Quantifying patient portal use: systematic review of utilization metrics. J Med Internet Res 2021;23(02):e23493
10 Balthazar P, Narayan AK, Reid N, Miles RC, Flores E. effect of sociodemographic factors on utilization of an online patient portal to self-schedule screening mammography: a cross-sectional study. J Am Coll Radiol 2022;19(07):866–873
11 North F, Nelson EM, Buss RJ, Majerus RJ, Thompson MC, Crum BA. The effect of automated mammogram orders paired with electronic invitations to self-schedule on mammogram scheduling outcomes: observational cohort comparison. JMIR Med Inform 2021;9(12):e27072
12 De' R, Pandey N, Pal A. Impact of digital surge during Covid-19 pandemic: a viewpoint on research and practice. Int J Inf Manage 2020;55:102171
13 Mandrik O, Tolma E, Zielonke N, et al. Systematic reviews as a "lens of evidence": determinants of participation in breast cancer screening. J Med Screen 2021;28(02):70–79
14 Zhao P, Yoo I, Lavoie J, Lavoie BJ, Simoes E. Web-based medical appointment systems: a systematic review. J Med Internet Res 2017;19(04):e134
15 Ryan M, Waller J, Marlow LAV. Could changing invitation and booking processes help women translate their cervical screening intentions into action? A population-based survey of women's preferences in Great Britain. BMJ Open 2019;9(07):e028134
16 Ryan M, Marlow L, Forster A, Ruwende J, Waller J. Offering an app to book cervical screening appointments: a service evaluation. J Med Screen 2020;27(02):85–89
17 Yanovsky RL, Das S. Patient-initiated online appointment scheduling: pilot program at an urban academic dermatology practice. J Am Acad Dermatol 2020;83(05):1479–1481
18 Perlangeli V, Musti MA, Ferretti F, et al. Profilo di salute. Azienda USL di Bologna. Accessed April 5, 2023 at: https://www.ausl.bologna.it/servt/dipt/dsp/trasp/informazioni-ambientali/stato-della-salute-e-della-sicurezza-umana/profilo-di-salute-2022a.pdf/view
19 Parmar V, Large A, Madden C, Das V. The online outpatient booking system 'Choose and Book' improves attendance rates at an audiology clinic: a comparative audit. Inform Prim Care 2009; 17(03):183–186
20 Siddiqui Z, Rashid R. Cancellations and patient access to physicians: ZocDoc and the evolution of e-medicine. Dermatol Online J 2013;19(04):14
21 Lowes R. Let patients book their own appointments? Med Econ 2006;83(11):27–28
22 Friedman JP. Internet patient scheduling in real-life practice. J Med Pract Manage 2004;20(01):13–15
23 Antonio MG, Petrovskaya O, Lau F. The state of evidence in patient portals: umbrella review. J Med Internet Res 2020;22(11):e23851
24 Huang J, Zuniga P. Effective cancellation policy to reduce the negative impact of patient no-show. J Oper Res Soc 2014; 65:610–615
25 Dantas LF, Fleck JL, Cyrino Oliveira FL, Hamacher S. No-shows in appointment scheduling - a systematic literature review. Health Policy 2018;122(04):412–421
26 Chang E, Blondon K, Lyles CR, Jordan L, Ralston JD. Racial/ethnic variation in devices used to access patient portals. Am J Manag Care 2018;24(01):e1–e8
27 Veinot TC, Mitchell H, Ancker JS. Good intentions are not enough: how informatics interventions can worsen inequality. J Am Med Inform Assoc 2018;25(08):1080–1088
28 Ahmadi M, Shahrokhi SN, Khavaninzadeh M, Alipour J. Development of a mobile-based self-care application for patients with breast cancer-related lymphedema in Iran. Appl Clin Inform 2022; 13(05):935–948