

The effect on attendance of the requirement to confirm a pre-scheduled appointment in a population-based mammography screening programme

Mathijs Goossens^{1,2,*} and Thuy Ngan Tran^{2,3}

¹Vrije Universiteit Brussel, Brussels, Belgium

²Centrum voor Kankeropsporing (Centre for Cancer Detection), Brugge, Belgium

³Universiteit Antwerpen, Wilrijk, Belgium

*Corresponding author. Vrije Universiteit Brussel, Laarbeeklaan 103, 1090 Brussels, Belgium.

E-mail: mathieu.goossens@bevolkingsonderzoek.be.

Abstract

The European Commission Initiative on Breast Cancer recommends pre-scheduled appointments to enhance attendance in population-based mammography screening programmes (PMSP). Pre-scheduled appointments often lead to no-shows, resulting in inefficient use of time and staff in screening units. Requiring women to confirm their appointments can reduce no-shows but might negatively impact attendance. We conducted a non-interventional study to assess the impact of requiring confirmation on attendance rates. The study involved 291 127 women aged 50–69 invited to PMSP between 1 June 2022 and 31 May 2023. Propensity scores were used to match women who were required to confirm their pre-scheduled appointments (exposure) 1:1 with those who were not required to confirm (comparator). This was done separately in four strata based on screening history: first-time invitees, regular attendees, irregular attendees, and non-attendees. Logistic regression with generalized estimating equations was used to analyse the effect of the exposure on attendance within 60 days, separately for each stratum. If first-time invitees were obliged to confirm their pre-scheduled appointment, their attendance was 19% lower [odds ratio (OR) 0.81, 95% confidence interval (CI) 0.76–0.86]. The impact on regular attendees (OR 0.95, 95% CI 0.92–0.99), irregular attendees (OR 0.94, 95% CI 0.89–0.99), and non-attendees (OR 0.96, 95% CI 0.90–1.01) was minimal or non-significant. Requiring confirmation poses a barrier for first-time invitees but has little effect on those with previous screening history. Limiting confirmation requirements to women with prior invitations could optimize resource use in screening units without a notable decrease in attendance rates.

Introduction

Breast cancer is a leading cause of disease burden, the International Agency for Research on Cancer (IARC) estimates that worldwide 2 296 840 women were diagnosed with breast cancer in 2022, which represents 25.0% of all incident cancers among women (excl. non-melanoma skin cancers) [1]. One of the strategies to lower this burden is to establish population-based mammography screening programmes (PMSP). The European Commission Initiative on Breast Cancer (ECIBC) guidelines recommend using a pre-scheduled appointment when inviting women to a PMSP. The pre-scheduled appointment (also referred to as a fixed appointment or a timed appointment) helps minimize barriers to attendance, and this is supported by randomized studies that show it is an effective tool to improve attendance in a PMSP [2–4].

One of the issues with a system of pre-scheduled appointments is that a proportion of the scheduled appointments will end in a no-show, resulting in inefficient use of time and staff resources in the screening units. This can be partly mitigated by overbooking appointments that have a high probability of being a no-show based on a woman's PMSP history [3]. Another theoretical solution is to provide a pre-scheduled appointment but request that the woman confirm that appointment.

The Flemish PMSP has always used pre-scheduled appointments for all invitations. Since 01 June 2020, screening units have been allowed to *request confirmation* of the pre-scheduled appointment. This was initially implemented to facilitate social distancing in the screening units during the coronavirus disease 2019 (COVID-19) pandemic. There are three options:

- the invitation includes a pre-scheduled appointment and makes no mention of a need to confirm,
- the invitation includes a pre-scheduled appointment and explains that confirmation would be appreciated, and
- the invitation includes a pre-scheduled appointment and explains that confirmation by telephone or email is obligatory.

The screening units were free to choose any of those three options, which were then used for all the invitations sent to the women invited to that screening unit. The screening units were allowed to reconsider their choice as often as they liked. To work with option C (mandatory confirmation), screening units were required to ensure that any woman showing up for her appointment without prior confirmation would nonetheless be either screened immediately or offered a new appointment the same week (which would no longer require confirmation). We set up a non-interventional study to evaluate whether attendance was affected by required confirmation, compared to a pre-scheduled appointment without any need to confirm (respectively options c and a above).

Methods

General outline of the PMSP in Flanders

The Flemish PMSP and its database have been extensively described previously but we provide a few details below to contextualize this study [5]. Flanders is the most populated region in Belgium and has had a PMSP since June 2001. The PMSP is organized, coordinated,

and monitored by the Centre for Cancer Detection (CvKO) in close collaboration with the Belgian Cancer Registry (BCR). Women aged 50–69 are invited for screening every other calendar year (two-view mammogram of both breasts). The screenings are performed in around 161 certified screening units and are paid directly and entirely by the Belgian healthcare insurance companies to the accredited screening units.

The *target* population includes all women in Flanders aged 50–69, identified through the central population registry. A unique 11-digit personal identification number is used to cross-link each individual of the target population to the BCR. This makes it possible to exclude women who had breast cancer in the last 10 years or a bilateral mastectomy. The resulting *eligible* population should receive a PMSP invitation every 2 years, except if they:

- actively opted out,
- already had a PMSP screening in the previous calendar year,
- already had an opportunistic screening in the last 24 months, and
- were already invited to the PMSP in the previous calendar year.

Each PMSP invitation contains a pre-scheduled appointment, which can be altered by calling a toll-free number. Besides this letter, there is no other formal system to remind women of the upcoming appointment (neither by text-message, email, post, or otherwise). From 01 June 2020 onwards, the invitations still included the pre-scheduled appointment, but there were three possibilities regarding the need to confirm, as explained above.

To help the screening units optimize their time, the *a priori* probability that an invited woman will attend screening is estimated based on individual PMSP history. The Flemish PMSP makes this estimate and categorized into four groups: first-time invitees, history of regular attendance, history of irregular attendance, and history of non-attendance [3].

- First-time invitees: At the time of the current planning, these women have not yet received any previous invitations. These women are scheduled for an appointment in a screening unit near their home.
- History of regular attendance: At the time of the current planning, these women (i) have had at least one previous invitation, and (ii) participated in the last 36 months. These women are scheduled for an appointment in the screening unit where they participated last time.
- History of irregular attendance: At the time of the current planning, these women (i) have had at least one previous invitation, (ii) did not participate in the last 36 months, and (iii) participated at least once in the past. These women are scheduled for an appointment in the screening unit where they participated last time.
- History of non-attendance: At the time of the current planning, these women (i) have had at least one previous invitation and (ii) have never participated in the past. These women are scheduled for an appointment in a screening unit near their home.

The groups have an average probability of being screened on the day of their pre-scheduled appointment of 23%, 54%, 19%, and 6%, respectively, and an average probability of being screened within 60 days of their pre-scheduled appointment of 39%, 81%, 30%, and 9% (estimates from data of 2018). This shows how the probability of screening within 60 days is quite different between the four categories, but also that many of the screenings occur after the day of the initial pre-scheduled appointment. When studying the effect on attendance, it is therefore important to not only look at whether a woman shows up at the pre-scheduled appointment but also whether she gets screened afterward. It was previously shown that >95% of women who will attend within a year of the pre-scheduled appointment, have attended by day-60 [6]. This is why we choose the day-60 attendance as outcome.

Data sources

All screen-related data were extracted from the Flemish PMSP database. Sector-aggregated demographic and socioeconomic variables (see below) were extracted from the database of the Flemish provinces [7, 8]. This database provides variables on demographic and socioeconomic status at the geographical level called the *statistical sector* where a person lives. The *statistical sector* is similar to the 'neighbourhood' in literature. These sector variables were used as a proxy for the demographic and socioeconomic status at the individual level. This has previously been shown to predict screening behaviour at the individual level [7, 9].

Study cohort

We constructed a cohort of women ($n = 314\,712$) who were in the eligible population, were sent a PMSP invitation in the period 01 June 2022–31 May 2023, and received either the option a or c invitation (see Introduction). We excluded the following groups: those who died within 60 days after invitation ($n = 340$; 0.1%); those with no known screening history ($n = 398$; 0.1%); and those without available sector data on demographic and socio-economic variables ($n = 22\,847$; 7.3%). The reason for the absence of sector data is mainly that some sectors are small and therefore conceal data based on the principle of small numbers. This resulted in 291 127 eligible invitations to be part of the study.

Study design and definition of exposure and comparator

Women who received an invitation in which they were required to confirm their pre-scheduled appointment (exposure) were matched in 1:1 pairs with women who received an invitation with a pre-scheduled appointment without any mention of the need to confirm (comparator).

We hypothesized that if there is an effect of requiring confirmation, it will vary depending on PMSP screening history: e.g. women who are first-time invitees vs. women who participated regularly in the past. Therefore, we stratified the cohort by the four categories that predict the *a priori* probability that an invited woman will attend screening (see section *General outline of the PMSP in Flanders*). Matching and analyses were conducted separately for each of those four categories.

Matching variables

Women were matched on the below covariates using a propensity score with a caliper width of 0.2. These covariates were selected because they are associated with the likelihood of attending screening or the potential impact of requiring confirmation and were available in either the screening database or the provincial database. Other factors such as health literacy, cultural attitudes towards screening, healthcare-seeking behaviour, individual health status, or prior experiences with the healthcare system may also be associated with the likelihood of attending screening but were not in any database available to us (and therefore considered here as unmeasured confounding) [7, 10–12].

- Individual variables from the screening database.
 - Screening participation rates vary by age. Age was included as four groups: each of 5 years.
 - Outpatient appointments have higher rates of no-show in the beginning of the week. Weekday of the pre-scheduled appointment was included as five groups: one for each workday (week-end appointment are not given).
 - A previous false positive screening outcome is associated to a lower attendance rate. Screening outcome of previous screening was included as three groups: one for true negative; one for false positive; one for no prior attendance.

- Variables aggregated on the sector level from the database of the provinces.

Higher overall PMSP screening rates are more likely to occur in municipalities where a larger percentage of individuals have partners. Lower screening rates are more likely to occur in municipalities with higher percentages of foreign residents, larger average household sizes, and higher average personal annual income (higher income is also associated with a higher rate of screening outside the PMSP). The following variables were therefore included:

- The percentage of unmarried single residents that have at least one child.
- The percentage of cohabiting married residents that have at least one child.
- The percentage of cohabiting unmarried residents that have at least one child.
- The percentage of residents without Belgian nationality.
- The average number of persons in a household.
- The number of residents per km².
- Average personal annual income.

Outcome

The outcome of interest was the screening status at 60 days after the pre-scheduled appointment mentioned in the invitation. This was called 'd60 attendance status', which had values of 0 or 1. Individuals were followed from the day of their pre-scheduled appointment (index date) until the outcome, or 60 days after the start of follow-up, whichever occurred first. Death was not included as an outcome because these individuals were excluded from the study cohort.

Statistical analysis

A descriptive analysis was conducted where the exposure and comparator groups were described: sector-based variables with medians and interquartile ranges, individual-based variables with absolute numbers and percentages. Logistic regression with generalized estimating equations (GEEs) was used to calculate odds ratios (ORs) and corresponding 95% confidence interval (CI). Logistic regression with GEE was used because of the anticipated correlation in the probabilities of women participating in screening within the same mammographic unit (i.e. data are clustered by invited mammographic units). Only the main exposure was included in the model, no confounders were added because of the prior matching.

Results

Descriptive analysis of exposure and comparator groups

After propensity score matching, our analysis included 18 202 first-time invitees (9101 matched pairs), 81 358 women with regular attendance history (40 679 matched pairs), 21 482 women with irregular attendance history (10 741 matched pairs), and 49 196 women with a history of non-attendance (24 598 matched pairs). Table 1 presents the characteristics of the exposure and comparator groups, stratified by these four categories of screening history.

In each category, the characteristics of the exposure and comparator groups were comparable. Most first-time invitees (90%) were in the youngest age group (50–54 years), while 95% of women with irregular attendance were above 55 years. Women with regular attendance and non-attendance were more evenly distributed across age groups. Pre-scheduled appointments were relatively evenly distributed among the weekdays, with a slight preference for Tuesday.

Regarding previous screening outcomes, almost all women with regular or irregular attendance had a true negative outcome in their previous screening, with a minority having a false positive outcome (around 2.3% for regular attendees and 7.0% for irregular attendees).

Demographic and socioeconomic characteristics varied slightly across the screening history categories. Women with regular attendance had a lower sector percentage of residents without Belgian nationality (6.6% vs. 7.7–9% in other categories), lived in less densely populated areas (2000 vs. 2200–2600 residents/km²), and had a higher average personal annual income (€21 400/year vs. €21 000/year). Other sector variables were similar across screening history categories: sector percentages of unmarried single residents with at least one child ranged between 3.5% and 3.8%, cohabiting married residents with at least one child between 17.5% and 17.9%, cohabiting unmarried residents with at least one child between 6.9% and 7.1%, and the average number of persons per household was around 2.4.

Correlation between confirmation requirement and attendance

The results in Table 2 show that there was a clear and significant difference in the chance of attendance among first-time invitees. If first-time invitees were obliged to confirm their pre-scheduled appointment, their attendance was 19% lower (OR 0.81, 95% CI 0.76–0.86).

In the three other groups (history of regular attendance, history of irregular attendance, and history of non-attendance), much smaller or non-significant differences were found. Those three groups all consisted of women that had already received an invitation before the confirmation system was implemented.

Discussion

This study evaluated the impact on attendance rates of requiring confirmation of pre-scheduled appointments in the Flemish PMSP. Our findings indicate that a requirement to confirm a pre-scheduled appointment significantly decreases attendance rates among first-time invitees, whereas the impact on women with previous screening history is negligible.

The additional step of confirming the appointment may act as a barrier for women who are new to the screening process. This finding is consistent with previous studies that highlighted that additional steps in a procedure can lower the use of preventive health services and affect a woman's future adherence to screening recommendations, particularly among those who are not yet familiar with the process [13, 14].

The attendance rates of women with a history of regular or irregular attendance, as well as those with a history of non-attendance, were hardly affected by the requirement to confirm. Prior experience with the PMSP seems to mitigate the perceived additional burden of having to confirm a pre-scheduled appointment. This could be because these women are already familiar with the screening process and have thereby already established their own screening routine. The negligible impact of confirmation requirements on women with prior screening experience supports the notion that once individuals are accustomed to a health service, minor procedural changes are less likely to influence their behaviour [14, 15].

While we focused on the effect of requiring confirmation for pre-scheduled appointments, it is important to acknowledge that a pre-scheduled appointment is not the only strategy to enhance participation in breast cancer screening programmes. Other effective interventions include SMS reminders, tailored invitation letters, phone call reminders, and general practitioner endorsement. Integrating multiple strategies can help optimize participation rates [16, 17].

Strengths and limitations

One of the strengths of our study is the large, population-based cohort, which enhances the generalizability of our findings. The use of propensity score matching and stratification by screening history categories allowed for a robust comparison between groups.

Table 1. Descriptive analysis of exposure and comparator groups, Belgium 2022–23^a

Variables	First-time invitees		History of regular attendance		History of irregular attendance		History of non-attendance	
	No requirement to confirm (n = 9101)	Obligatory to confirm (n = 9101)	No requirement to confirm (n = 40 679)	Obligatory to confirm (n = 40 679)	No requirement to confirm (n = 10 741)	Obligatory to confirm (n = 10 741)	No requirement to confirm (n = 24 598)	Obligatory to confirm (n = 24 598)
Age								
50–54	8169 (89.76)	8302 (91.22)	7253 (17.83)	6953 (17.09)	545 (5.07)	534 (4.97)	7325 (29.78)	7291 (29.64)
55–59	417 (4.58)	359 (3.94)	10 853 (26.68)	10 906 (26.81)	2708 (25.21)	2696 (25.10)	7064 (28.72)	7144 (29.04)
60–64	294 (3.23)	254 (2.79)	11 419 (28.07)	11 624 (28.57)	3471 (32.32)	3611 (33.62)	5780 (23.39)	5754 (23.39)
65–69	221 (2.43)	186 (2.04)	11 154 (27.42)	11 196 (27.52)	4017 (37.40)	3900 (36.31)	4429 (18.01)	4409 (17.92)
Weekday of pre-scheduled appointment								
Monday	1683 (18.49)	1743 (19.15)	7626 (18.75)	7644 (18.79)	2048 (19.07)	2027 (18.87)	4456 (18.12)	4377 (17.79)
Tuesday	2376 (26.11)	2380 (26.15)	9946 (24.45)	10 157 (24.97)	2672 (24.88)	2695 (25.09)	6445 (26.20)	6483 (26.36)
Wednesday	1534 (16.86)	1559 (17.13)	7164 (17.61)	7016 (17.25)	1844 (17.17)	1866 (17.37)	4298 (17.47)	4376 (17.79)
Thursday	1830 (20.11)	1789 (19.66)	9206 (22.63)	9243 (22.72)	2366 (22.03)	2352 (21.90)	4729 (19.23)	4702 (19.12)
Friday	1678 (18.44)	1630 (17.91)	6737 (16.56)	6619 (16.27)	1811 (16.86)	1801 (16.77)	4670 (18.99)	4660 (18.94)
Screening outcome of previous screening								
True negative	–	–	39 641 (97.45)	39 808 (97.86)	9948 (92.62)	10 026 (93.34)	–	–
False positive	–	–	1038 (2.55)	871 (2.14)	793 (7.38)	715 (6.66)	–	–
No prior attendance	9101 (100.00)	9101 (100.00)	–	–	–	–	24 598 (100.00)	24 598 (100.00)
Unmarried single residents with ≥ 1 child	3.64 (2.96–4.35)	3.66 (3.02–4.33)	3.53 (2.84–4.19)	3.53 (2.86–4.22)	3.65 (2.94–4.32)	3.70 (2.96–4.37)	3.72 (3.03–4.44)	3.79 (3.10–4.41)
Cohabiting married residents with ≥ 1 child	17.90 (15.29–20.25)	17.90 (15.45–20.20)	17.80 (15.11–20.10)	17.77 (15.34–20.12)	17.54 (14.84–19.95)	17.54 (15.07–20.09)	17.69 (15.10–20.17)	17.85 (15.25–20.18)
Cohabiting unmarried residents with ≥ 1 child	6.94 (5.76–8.17)	6.98 (5.72–8.22)	7.10 (5.87–8.35)	7.07 (5.83–8.37)	6.91 (5.70–8.17)	6.86 (5.69–8.06)	6.86 (5.70–8.16)	6.86 (5.66–8.00)
Residents without Belgian nationality	8.00 (4.40–14.40)	8.30 (4.20–17.10)	6.60 (3.90–11.60)	6.60 (3.60–13.00)	7.70 (4.40–13.80)	8.10 (4.20–15.90)	8.60 (4.80–15.70)	9.00 (4.50–18.30)
Number of persons in a household	2.38 (2.21–2.52)	2.38 (2.20–2.53)	2.36 (2.19–2.49)	2.36 (2.20–2.50)	2.35 (2.17–2.49)	2.36 (2.18–2.50)	2.37 (2.19–2.51)	2.38 (2.19–2.53)
Number of residents per km ²	2.21 (1.26–4.09)	2.32 (1.33–4.86)	1.98 (1.15–3.43)	2.06 (1.19–3.64)	2.17 (1.26–4.14)	2.33 (1.29–4.79)	2.32 (1.30–4.72)	2.60 (1.38–5.57)
Average personal annual income in euro	21.03 (18.88–23.22)	21.08 (18.79–23.08)	21.40 (19.64–23.52)	21.46 (19.55–23.39)	21.06 (19.11–23.14)	21.03 (18.81–23.14)	21.04 (18.67–23.41)	20.98 (18.45–23.12)

a: For statistical purposes, number of residents per km² and average personal annual income were divided by 1000 before inclusion into analyses.

Table 2. The correlation between the requirement for appointment confirmation and attendance in a population-based mammography screening programmes, Belgium 2022–23^a

Screening history type	Study arm	Number of invitations	Number of attenders (%)	OR (95% CI)	P-value
First-time invitees	No requirement to confirm	9101	3966 (43.58)	Ref	<0.001
	Obligatory to confirm	9101	3483 (32.27)	0.81 (0.76–0.86)	
History of regular attendance	No requirement to confirm	40 679	34 430 (84.64%)	0.95 (0.92–0.99)	0.009
	Obligatory to confirm	40 679	34 165 (83.99%)		
History of irregular attendance	No requirement to confirm	10 741	3877 (36.10%)	0.94 (0.89–0.99)	0.048
	Obligatory to confirm	10 741	3738 (34.80%)		
History of non-attendance	No requirement to confirm	24 598	2790 (11.34%)	0.96 (0.90–1.01)	0.120
	Obligatory to confirm	24 598	2683 (10.91%)		

a: Logistic regression with generalized estimating equations (GEEs) was used to analyse the effect of the confirmation requirement on attendance within 60 days, separately for each screening history stratum (first-time invitees, history of regular attendance, history of irregular attendance, and history of non-attendance). Only the main exposure variable (confirmation requirement) was included in the model; no additional confounders were added due to prior propensity score matching. Clustering was accounted for at the level of invited mammographic units.

However, there are limitations to consider. Firstly, when a woman reschedules her appointment, this also automatically serves as a confirmation. We found that in each of the strata more women in Group C rescheduled compared to Group A. This means that for a subset of women in Group C, the confirmation requirement became irrelevant because their rescheduling call already fulfilled that function. As a result, the measured effect of requiring confirmation is likely an underestimate of the true effect, meaning the actual impact of requiring confirmation may be stronger than our estimates suggest. Secondly, our study relied on administrative data, which may not capture all relevant variables influencing attendance. Thirdly, the exclusion of women without available sector data on demographic and socio-economic variables, although necessary for data integrity, may have introduced selection bias. Ideally, a randomized controlled trial would be set up which verified the results.

Conclusion

To maximize attendance, specifically among first-time invitees, it will be beneficial to maintain a system of pre-scheduled appointments without requiring confirmation. For women that have already received previous invitations, the requirement for confirmation appears to have minimal impact. This means targeting confirmation requirements only to women who have already received a prior invitation could optimize resource use in the screening units without compromising attendance rates among first-time invitees.

Author contributions

All authors contributed to the study conception and design, data collection and analysis, and writing of the manuscript. All authors read and approved the final manuscript.

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Data availability

The data underlying this article will be shared upon reasonable request to the corresponding author.

Ethics approval

The Sectoral Committee of Social Security and Health (the national privacy commission) approved the use of a unique patient identifier

to crosslink the screening database and the BCR database for quality assurance. A separate ethical approval for this observational study was not requested because this research was carried out as part of the evaluation of the PMSP, which is monitored by the working group of quality assurance of the PMSP.

Key points

- Pre-scheduled appointments increase uptake in a population-based mammography screening programmes, but often lead to no-shows. Mammographic units therefore favour working only with confirmed appointments.
- If first-time invitees were obliged to confirm their pre-scheduled appointment, their attendance was 19% lower [odds ratio (OR) 0.81, 95% confidence interval (CI) 0.76–0.86].
- The impact on regular attendees (OR 0.95, 95% CI 0.92–0.99), irregular attendees (OR 0.94, 95% CI 0.89–0.99), and non-attendees (OR 0.96, 95% CI 0.90–1.01) was minimal or non-significant.
- Limiting confirmation requirements to women with prior invitations could optimize resource use in screening units without a notable decrease in attendance rates.

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