Management of a prostate cancer screening research program in the City of Antwerp

by

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Abstract

Objective: To investigate the value of the management of a prostate cancer-screening research program in the City of Antwerp through the evaluation of non-participation.

Methods: The cancer screening study targeted men aged 55 to 74 years living in two districts (Deurne and Borgerhout) of Antwerp City. The districts are subdivided in 37 sectors with a total of 11,382 subjects to be contacted. Retrospective analysis of non-participation per sector was studied regarding sector specific variables and the reasons of non-participation. It was hypothesized that sector specific characteristics may influence the rate of non-participation. Moreover it was searched if some of these variables could be correlated with individual reasons of non-participation. Sector specific variables were: the average distance to the research center; the invitation period; the age-composition; the social class; the population density; the general practitioner (GP) density; and the district area (Borgerhout or Deurne). The individual reasons asked

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among the at home visited non-participants were: "No Interest" in the program; "Consult a GP"; "Being Absent" during the invitation period; and "Other Reasons".

Correlation statistics, non-parametric tests, and regression analysis are used to determine variables that may explain the variation in the rate of non-participation per sector.

Results: *Average non-participation rate per sector was 70% (range 61% to 79%). Non-participation was highly correlated with "Invitation Period" and "Age-Specific" groups. Individual responses were highly correlated with these variables and inter-correlated between "Being Absent", "Consult a GP" and having "No Interest" and "Other Reasons". Multiple regression analysis suggests that the rate of non-participation per sector increased significantly with "Being Absent", and a dominant presence in a sector of 55-59 years old subjects. The fitted model explained around 60% of the variation.*

Conclusion: *Rates of participation to the prostate cancer research screening of men aged 55 to 74 years old could be improved if the project management should act on the following issues: better collaboration with GP's; an invitation period avoiding holidays; flexible opening hours of the research center to capture the working individuals; the development of age-specific information strategies.*

Keywords

Introduction

In cancer screening programs the medical community is actively searching presumed at risk persons for cancer. This is in contrast to clinical practice and case finding situations where persons with complaints or symptoms are actively seeking medical advice (1). Success of cancer screening programs that could be expressed as the rate of participation or non-participation and the number detected of early and treatment sensitive cancer cases depends of different factors (2). They include the validity of the screening test used, the acceptability of the screening method proposed and the adequacy of the management of the screening program

set up. With management is defined the ways the screening program are proposed to the target audience taking into account local constraints such as logistic facilities and the collaboration with third parties to be involved (local authorities, health care workers, reimbursement authorities).

Estimates of the validity of the screening test can easily be measured through feasibility studies, where the sensitivity can accurately be calculated, but the specificity and the predictive values could be challenged in the absence of any gold standard. The acceptability of the screening method can be reported through the rate of participation overall and per specific sub-groups (3).

The evaluation of the adequacy of the management is more difficult to investigate. The different groups involved in the screening program (participants, non-participants, support groups and the screening team) should be interviewed in depth. The evaluation should be a continuous process not delimited by time, geographical area or a subgroup. The outcome should encompass following aspects:

1. The level understanding of the screening project by the target group;
2. The involvement of the intermediates or third party groups;
3. The delivery of the best services by the screening team for the target audience.

Adequate management of the screening program may impact the participation and thus the success of the screening campaign as importantly as the test validity and acceptability of the screening method proposed. For instance practical issues such as moment during the day when the screening is offered, period of the year, place and distance where the screening takes place and the invitation method – through general practitioner (GP), specialist or the community – are elements that may influence its success or failure (4).

We tried as a first attempt to investigate retrospectively part of the good or bad management of a cancer-screening research activity in a community in order to understand the huge variation observed in participation or non-participation rate per geographical entity screened. We looked at items present at the level of each area that may explain the variation and how we may tackle them accordingly. The project studied is the cancer-screening program of a randomized trial on prostate cancer screening in Antwerp (Belgium) that currently takes part of the European Randomized Screening Program on Prostate Cancer (ERSP) (5) In that study men aged 55 to 74 years old are offered 3 screening tests when they are selected

through randomization after accepting participation. The 3 screening tests included the digital rectal examination (DRE), the prostate specific antigen (PSA) measured in blood serum and the trans-rectal ultrasound (TRUS). The first screening round performed in the area surrounding the research unit obtained a participation rate above 40%. Later results showed a wide variation in a declining participation rate. This latter finding was the incentive to investigate in depth what may cause these changes. It was hypothesized that looking at factors that may determine non-participation per specific area, it will indicate if the management of the program was adequate and if not, how the management could be improved. Also an analysis per area screened may identify factors that could be more easily changed as compared to individual, participant specific criteria that should be more time intensive and therefore more costly to alter. Moreover the analysis was retrospectively planned and it was therefore difficult to re-collect individual data.

Population and Methods

Population

Antwerp is a city divided in 9 districts of around 30.000 to 70.000 inhabitants each. For this study 2 from the 5 districts screened (Deurne and Borgerhout) were selected based on the completeness of the data collected, the same method of screening and randomization applied and having differences noted in the explanatory factors considered between them (see further). The two districts are subdivided into 37 specific area's called sectors – 25 for Deurne (1400 ha and 68.000 inhabitants) and 12 for Borgerhout (400 ha and 40.000 inhabitants). A sector is a geographical entity of houses and/or apartment buildings grouped together in a cluster delimited by street boundaries. This geographical design was used by the City administration for sending to the target population the invitation letter of participation to the screening program. Each sector has around 300 men aged 55 to 74 years old to be invited. Over a period of 2 years a total of 11,382 potential participants living in the 2 districts received the invitation letter (6). Once the letter was sent, the recipient had 2 weeks time to respond either by a pre-stamped return mail, by fax or by a phone call. With a positive response the person was randomized to receive either the 3 tests at the research unit, either he may visit his GP for a consult at no extra cost. With no response a home-visit by the social worker of the research team took place for investigating the intention of participation or the reasons of non-participation. During his home visit the social worker

used a standard questionnaire collecting anonymous data per interviewed person and summarizing the results per sector. If after two home visits the non-responder was still absent, it was searched for the reasons of not being at home by interviewing the relatives and/or the neighborhood. The research unit where the screening was set up was fixed and located in the center of the City that is easily accessible by public transport. Visits to the unit were organized during the whole year including the holiday periods. It was assumed that holiday periods might not impact the target group for participation to the screening program. The center was open 3 working day afternoons per week from 2 until 6 p.m. The screening was free of charge for the participant who received the 3 screening tests mentioned above. Transportation costs to and from the research unit was also paid by the research project.

Methods

The analysis was retrospectively planned and key information was complete and specific at each sector level from the point of view of the non-responder, non-participant level. We first investigated if the variation in the rate of non-participation per sector could be explained by some sec-

TABLE 1
Variables included in the analysis

Variable name	Variable Type	
	Numeric	Categorical
Sector specific variables:		
Social Class		X
Invitation period		X
Distance to research unit (m)	X	
Population density (km2)	X	
GP density (km2)	X	
Age composition (%):		
55 to 59 years	X	
60 to 64 years	X	
65 to 69 years	X	
70 to 74 years	X	
Reason of non-participation (%):		
"No Interest"	X	
"Consult a GP"	X	
"Absent"	X	
"Other Reasons"	X	
District area		X
Non-Participation rate per sector (%)	X	

tor specific variables. In a next stage we searched if the sensitive, sector specific variables could be correlated with the different reasons the non-participant reported, also grouped per sector.

The following list of variables were considered as sector specific information and were used for the analysis with their specification (numeric or categorical) presented in Table 1. A description of each variable is given below.

1. *Social Class* in 3 categories: Working, Middle, or Upper Class. An approximation of the dominant social class per sector was estimated through the main housing structure in each sector (villa, semi-villa, house and/or social building).
2. *Invitation period in 3 categories:* Holiday Period (July, August and December); Pre/Post-holiday periods (June, September and November); All other months (January, February, March, April and May).
3. *Average distance* of each sector to the research unit in meters.
4. *Population density per sector* expressed as the number of target people living per km2 in a sector.
5. *General practitioner density per sector* expressed as the number of GP's per km2 in a sector.
6. *Main age composition of each sector (in%)* subdivided into 4 age categories: 55-59, 60-64, 65-69, and 70-74 years of age.
7. *District areas:* Borgerhout and Deurne.
8. *Main reason of non-participation per sector (in%) subdivided into 4 categories:* No Interest, Consult GP, Absent, and Other Reasons. Not all the non-participants wanted to have an interview or were absent so that the sum of all the different reasons do not match to 100%.

Descriptive results of each sector variable are first reported overall and per district as a mean with standard deviation, median value, minimum and maximum range for numerical variables and as a proportion for categorical variables. For some continuous values log transformation of the data has been applied in order to comply with normal distribution of the values in order to introduce them in linear regression analysis. Significant differences between the two districts for each sector variable in univariate analysis were tested using 2-sample Kolmogorov-Smirnov test. Significant trend differences in non-participation per sector for different invitation periods and for different social classes were tested using the Kruskal-Wallis test. Correlation coefficients were tested using the Pearson and the Spearman method. Stepwise multiple regression analysis of the rate of non-participation per sector as the dependent variable on the following sector specific variables was tested: reason of non-participation;

age composition; distance; population density; GP density; social class and invitation periods. All significant differences were tested at a two-sided p < 0.05 level.

All computations were performed using SPSS version 10.0 for Windows 98.

Results

Figure 1 reports in a tree diagram the results of the target population (n = 11.382) subdivided as the participants (n = 3.432) who were willing to be screened after randomization and the non-participants (n = 7.950) who were not screened. After the invitation letter sent by the local authorities only 31% (n = 3.530) of all the subjects invited responded among whom 2.097 individuals answered they wanted to participate. Seven thousand eight hundred and fifty two (69%) subjects did not respond the invitation letter. We have tried to reach them with a home visit by a social worker. After the home-visits 17% of the non-responders reported that they want to participate to the screening program. It resulted in an overall participation rate after the home-visits of 30% who wanted to be screened.

The analysis on the adequacy of the management of the screening program is limited to the non-participants of the non-responders (n = 6.517) who after the home-visits were still absent or reported not wanted to be involved in the screening project.
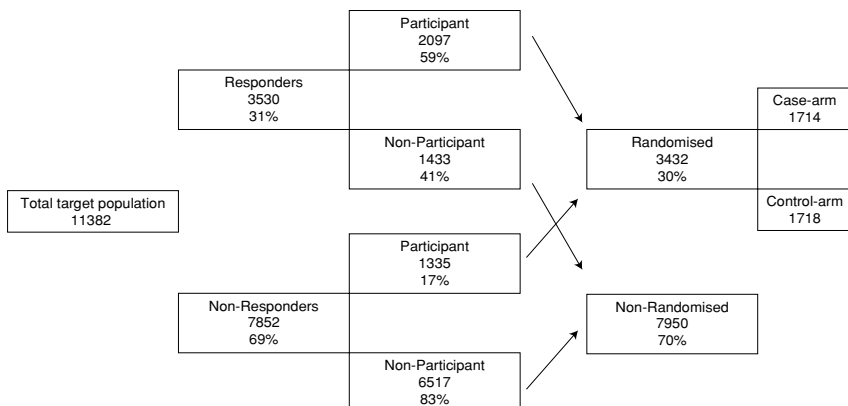

Fig. 1: Overall results of participation and non-participation

Table 2 reports overall the average value for the different sector specific variables considered. Among the main reasons of non-participation individually reported during the home visits "No Interest" was on average the largest (i.e. 21,36%) response and "Other reasons" was the lowest (i.e. 8,77%) response.

Differences in sector variables between the two districts, Borgerhout and Deurne, are presented in Table 3. The two districts differ significantly with regard to the percentage of "No Interest", the percentage of "Consult a GP", distance to the research unit and the population density. The average rate of non-participation between the two districts was not significant (p = 0.17).

The average rate of non-participation per specific invitation period and per social class is reported in Table 4. The average rate was highest (74,5%) when the invitation letters were sent during holiday periods (Kruskal-Wallis c^2 = 10.242, df = 2, p = 0.006). Social class differences had no statistically significant influence on the rate of non-participation per sector (Kruskal-Wallis c^2 = 1.331, df = 2, p = 0.514).

The correlation study revealed that "Consult a GP" was negatively associated with "No Interest" or "other reasons". In other words, "Consult a GP" significantly decreases the rate of "No Interest" and the rate of

TABLE 2

Mean values overall for main reasons and sector specific information

Main reason of non-participation/sector	Mean	Std-Dev	Median	Min.	Max.
% No Interest	21,36	4,0993	21,38	13,73	28,62
% Consult a GP	16,02	4,2385	15,75	8,87	27,07
% Absent	11,21	3,7190	11,53	5,86	19,63
% Other Reasons	8,77	3,1133	8,90	2,74	15,85
Rate of non-participation/sector	69,96	4,2963	69,91	60,80	79,23
Sector specific information:					
Population Density (km²)*	1057,07	0,0372	1131,31	177,89	2943,47
GP Density (km²)*	8,39	0,0667	7,39	1,31	75,65
Distance (m)*	3246	175,5	3290	1350	5920
Age-groups/sector					
% 55 – 59 years	25,60	3,8929	24,54	20,23	35,21
% 60 – 64 years	25,96	2,7515	25,97	21,05	33,54
% 65 – 69 years	25,09	2,6439	24,91	19,35	31,33
% 70 – 74 years	23,35	3,2546	23,53	16,99	32,89

* Logarithmic transformation was used.

TABLE 3
Descriptive information for Borgerhout (n = 12) and Deurne (n = 25)

Main reasons of non-participation	District	Mean	Std-Dev	Median	Min.	Max.	K-S test*
% No Interest	Borgerhout	24,56	3,43	25,23	18,28	28,62	1.585
	Deurne	19,83	3,50	20,25	13,73	26,95	P = 0.013
% Consult a GP	Borgerhout	12,64	2,75	11,96	8,87	18,39	1.813
	Deurne	17,64	3,88	17,31	11,81	27,07	P = 0.003
% Being Absent	Borgerhout	9,46	3,08	8,18	5,86	14,08	1.101
	Deurne	12,05	3,76	11,69	6,23	19,63	p = 0.177
% Other Reasons	Borgerhout	10,53	3,01	9,68	7,12	15,85	1.073
	Deurne	7,93	2,84	8,61	2,74	12,30	p = 0.2
Rate of non-participation	Borgerhout	68,25	3,24	67,76	62,28	72,35	1.107
	Deurne	70,77	4,55	70,8	60,8	79,23	P = 0.17
Sector Specific Information							
Distance (m)	Borgerhout	2102	0,09713	2267	1350	2830	2.496
	Deurne	3683	0,09749	3720	2580	5920	p = 0.0001
GP's Density (km²)	Borgerhout	12,30	0,41173	11,58	2,37	75,65	1.092
	Deurne	6,98	0,38562	6,18	1,31	68,23	P = 0.184
Pop. Density (km²)	Borgerhout	1381	0,17884	1631	592	2125	1.803
	Deurne	930	0,22821	1009	178	2943	P = 0.003
Age-groups/district % 55 – 59 years	Borgerhout	25,46	4,80	23,37	20,76	35,21	0.636
	Deurne	25,66	3,49	26,22	20,23	34,94	p = 0.813
% 60 – 64 years	Borgerhout	25,20	2,07	25,65	22,01	28,66	0.902
	Deurne	26,33	2,99	26,16	21,05	33,54	P = 0.39
% 65 – 69 years	Borgerhout	25,43	2,21	25,22	21,50	28,93	0.788
	Deurne	24,92	2,86	24,91	19,35	31,33	p = 0.564
% 70 – 74 years	Borgerhout	23,91	3,49	24,82	18,28	28,00	1.338
	Deurne	23,08	3,18	22,68	16,99	32,89	P = 0.056

* Kolmogorov-Smirnov test, p < 0.05 two-sided.

"Other reasons" (correlation coefficients: – 0,553, and – 0.534 respectively ($p < 0,001$)). The same pattern was present as well in Deurne as in Borgerhout. The population density and the GP density are positively correlated (correlation coefficient: 0.431, $p < 0,001$). Since population density in Borgerhout was higher than in Deurne, the GP density was also higher in the former.

The correlation between each variable considered is given in Table 5. The results suggest that the age-group "55-59 years" old were associated

TABLE 4
Average rate of non-participation by invitation period and social class

Invitation Periods	Mean	N	Std. Deviation	95% Confidence Limits	
				Lower Lim.	Upper Lim.
Other Periods	67,9925	14	4,3346	65,7	70,3
Pre/Post Holiday Period	69,7005	16	3,0962	68,2	71,2
Holiday Period	74,4793	7	3,6102	71,8	77,2

$\chi 2 = 10.242$, df = 2, p = 0.006.

Invitation Periods	Mean	N	Std. Deviation	95% Confidence Limits	
				Lower Lim.	Upper Lim.
Working Class	71,5453	8	3,5138	69,1	74,0
Middle Class	69,5925	23	4,7285	67,7	71,5
Upper Class	69,2447	6	3,4607	66,5	72,0

$\chi 2 = 1.331$, df = 2, p = 0.514.

TABLE 6
Results of stepwise regression analysis of non-participation

Fitted Model	Est. Coeff. (β)	Std. Error	t-test	Sig.	95% CI for (β)		Adj. R²
					Lower	Upper	
Constant	53,675	3,198	16.785	< 0.001	47,169	60,181	59,2%
% "Being Absent"*	0,808	0,126	6.417	< 0.001	0,552	1,065	
% 55-59 years	0,276	0,120	2.303	0.028	0,032	0,519	

with different variables such as other age-groups, population and GP density and non-participation rate. The oldest age-group was also correlated with a high non-participation rate, but were less likely to be absent.

Finally, Table 6 reports the results of stepwise multiple regression analysis with the rate of non-participation as dependent variable on 7 explanatory variables. The fitted model suggests that the non-participation is strongly associated with "Being Absent" followed by the percentage of being "55-59 years" old (Adjusted R^2 = 59,2%). The addition of the age variable improved the model by 5%. The other variables showed no significant impact on the dependent variable and were removed from the model.

TABLE 5

Correlation coefficients between the different variables included in the regression model

		% No Interest	% Consult GP	% Absent	% Other reason	% 55-59y	% 60-64y	% 65-69 y	% 70-74 y	Log pop Dens	Log GP Dens	Log Distance	% Total Non-participants
% No Interest	Corr	1											
	P	'											
% Consult GP	Corr	−0.553	1										
	P	*0.000*											
% Absent	Corr	0.004	0.231	1									
	P	0.983	0.170										
% Other Reason	Corr	0.010	−0.534	−0.236	1								
	P	0.954	*0.001*	0.159	'								
% 55-59y	Corr	0.260	−0.004	0.167	−0.013	1							
	P	0.120	0.983	0.323	0.938	'							
% 60-64y	Corr	−0.047	0.111	0.051	−0.211	−0.032	1						
	P	0.781	0.512	0.766	0.209	0.852	'						
% 65-69 y	Corr	−0.109	−0.102	0.109	0.259	−0.582	−0.444	1					
	P	0.520	0.547	0.522	0.122	*0.000*	*0.006*	'					
% 70-74 y	Corr	−0.182	−0.007	−0.331	−0.016	−0.696	−0.447	0.259	1				
	P	0.280	0.969	*0.045*	0.927	*0.000*	*0.006*	0.121	'				
Log Pop Dens	Corr	0.138	−0.145	0.090	0.045	−0.320	−0.064	0.308	0.186	1			
	P	0.417	0.392	0.595	0.791	*0.054*	0.708	0.064	0.270	'			
Log GP Dens	Corr	−0.013	−0.084	−0.054	0.075	−0.422	−0.204	0.430	0.328	0.619	1		
	P	0.938	0.623	0.750	0.660	*0.009*	0.226	*0.008*	*0.048*	*0.000*			
Log Distance	Corr	−0.658	0.399	0.251	−0.039	0.021	0.128	0.064	−0.185	−0.316	−0.249	1	
	P	*0.000*	*0.014*	0.134	0.819	0.904	0.449	0.707	0.273	*0.057*	0.138	'	
% Total Nonpart	Pearson												
	Corr	0.174	0.228	0.717	−0.038	0.356	0.016	0.014	−0.451	−0.188	−0.197	0.114	1
	P	0.304	0.175	*0.000*	0.825	*0.030*	0.924	0.934	*0.005*	0.266	0.244	0.503	'

Discussion

The low participation rates to the prostate cancer-screening program observed in the two districts (Deurne and Borgerhout) did not fit with the first study results when rates above 40% were attained (6). Overall about 70% of the target population did not participate to the program. For more than 35% of the non-participants who did not respond, it was mainly due to either "No Interest", either "Consult a GP". Further analysis suggests that "No Interest" and/or "Other Reasons" could be altered if GP's were more involved in the project: the rate of persons with "No Interest" was significantly higher in Borgerhout than in Deurne despite a significantly higher GP density in the former district. A more intense collaboration with GP's is therefore recommended as they may reinforce the participation and decrease the lack of interest by the target group when better involved into the screening program.

"Being Absent" was the most important factor explaining the variation of non-participation of the non-responders per sector. One cause for this was the selected invitation period as mentioned above. It was discovered that many elderly people have a secondary residence making them absent at their home address during long periods of the year. It may have heavily affected the outcome since the response period to the invitation letter was limited to maximum 2 weeks. To tackle this issue it was suggested to abandon the criteria of limiting the response-period as there is no rational for applying them. Related to the problem of accessibility of the research program another critic frequently reported was the time during the day the research unit was open for offering the screening. The selected time schedule should also be in accordance with what specific target groups like workers and the younger age groups wanted: open after working hours and/or also on Saturday mornings.

It was expected to find that distance might have an influence on the rate of non-participation. A longer distance to the research center to cover may negatively impact the rate of participation. We did not observe such an association possibly because the transport cost was fully reimbursed. Also, it was expected that the social classes should create differences in participation, but the observed differences were not significant.

Finally the information about the project is critical that should be improved as one fifth to more than one fourth of the people per sector reported having "No Interest" in the program. As suggested above information for the target group may happen through a better collaboration with the GP's, but potentially also through the media and other techniques such

as discussion evenings in local cafés and social clubs (7). More laborious and time-consuming is the individual consult of a home-visit performed by a social worker. This initiative created a positive effect in the decision taken by the non-responder in 6 to 17% per sector. This type of success indicates again the individual need for a consult that could be emphasized by the GP. Moreover the type and the way the information is disclosed should be age-specific as the screening program covers a wide age-range of men sensitive about health specific information in very different ways.

It should be stressed that the participation may have obtained better results if global prevention strategies amongst the elderly were already operational in the field (8-9). So far no systematic health prevention activity is currently developed for men aged above 65 years old who are maybe most in need. Preventive health care that encompasses screening of age-related-conditions such as cardiovascular diseases and specific cancer types should be considered. The idea has recently been discussed in the Flemish County with the introduction of the prevention health chart developed by the GP's (10). The chart to be used by all persons aged 50 years and above stimulates the behavior for having annual medical check-ups performed by GP's. The latter health strategy may certainly facilitate the introduction and the promotion of population based research-screening studies such as prostate cancer screening programs. These programs should however be submitted to extensive evaluation by ethical and scientific advisory boards for approval and subvention before they can take place (11).

In conclusion, to improve participation to cancer screening programs following actions are at least recommended at the level of the organization of the project:

1. Increased collaboration with the GP's. They are critical in informing precisely and in motivating the target population to be reached.
2. Increased flexibility of research unit where the screening is offered: time constraints should be adjusted to the type of the individual to be reached.
3. Better information strategies through the media that is sustained during the whole period of the screening research.

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