

An overview of factors influencing cancer screening uptake in primary healthcare institutions

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Summary Screening significantly decreases the severity and incidence of conditions, as well as mortality, and therefore can improve the health of the population. Screening in Poland falls below the acceptable level of 45% of organised screening uptake and the recommended level of 65%. Multidimensional factors have been implicated as barriers and facilitators of screening uptake in the primary care setting. This paper summarises the existing evidence on factors influencing screening uptake in a Pap smear for cervical cancer (CC), mammography screening for breast cancer and faecal occult blood test (FOBT) for colorectal cancer (CRC). We performed a literature search in the MEDLINE (PubMed) and EMBASE databases and included articles of any study design published between 2010 and 2020. We also demonstrate the original concept of ‘Ugly Value’, which describes factors that may reduce screening uptake. Primary care practitioners play a vital role in increasing screening rates in the populations and can improve these rates through a variety of systematically implemented strategies and interventions. We determine four areas to improve cancer screening uptake in primary healthcare institutions: data gathering and data use (IT systems, meaningful use of Electronic Health Records to generate reminders, prompting healthcare professionals to refer patients for screening), cost effectiveness (avoiding overuse of screening in low-risk populations), innovative efficient management (use of effective interventions and thoughtful allocation of resources, e.g. engaging nurses into patient navigation instead of assigning them to answer patient concerns about screening by telephone), organisational system (team based, integrated care and patient navigation are ways to improve screening rates).

Key words: early detection of cancer, preventive medicine, primary health care, quality improvement.

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Summary

Cancer is the second leading cause of premature deaths in the world and was responsible for 9.6 million deaths in 2018 [1]. Estimations say that between 3% and 35% of these deaths could be avoided by screening [2]. In Poland, the number of deaths due to cancer in 2018 was 113,388 [3].

The objective of screening is to identify individuals at higher risk for health issues or conditions in an apparently healthy population. Screening may improve the health of the population by reducing mortality and the severity of the conditions through early detection and reduction of the overall incidence of conditions by identifying and treating its precursors [4]. Screening tests are treated as secondary prevention for cancer, as they do not prevent the condition but only indicate the presence of an early stage of cancer, which increases the choice of possible effective treatments [5]. Apart from evident benefits, screening can also cause problems, especially those connected with overuse of resources. Therefore, the 2003 Council of the European Union recommends that Member Countries implement only those screening tests that have proven effect to save lives. Currently, only three screening tests meet this criterion: Pap smear for cervical cancer (CC), mammography screening for breast cancer and faecal occult blood test (FOBT) for colorectal cancer (CRC) [6].

Screening significantly decreases the mortality of colorectal, breast and cervical cancer. Organised screening for cervical

cancer has resulted in a 41–92% reduction of cancer mortality in Europe [7]. Similarly, reduction of CRC mortality varied between 8 and 16% for FOBT and from 21% to 30% for flexible sigmoidoscopy [8]. The reduction in breast cancer mortality varies across European countries and ranges between 12% and 58% throughout the region [9].

Primary health care is an important part of cancer screening, and evidence shows that greater involvement by primary care providers is linked to higher screening rates. General Practitioners (GPs) play an important role in encouraging screening uptake. Screening rates could be improved by implementing systematic strategies and interventions in GP offices, such as audit and feedback systems, office prompt systems and GP endorsement of invitation letters [10].

Based on a literature search and our original concept, the aim of the study was to define, analyse and categorise factors that can positively influence cancer screening uptake in primary healthcare institutions.

Cancer screening in Poland

The National Health Fund is currently organising screenings for cervical and breast cancer. Cervical cancer screening in Poland includes a Pap smear and is recommended for women aged 25–59 every three years for average-risk patients. Mam-



mography is recommended for women aged 50–69 every two years for average-risk patients [11]. The participation rate for these screenings is estimated to be 18.2% and 63.1%, respectively [12]. Colorectal cancer screening with a colonoscopy for patients aged 55–64 is funded by the Ministry of Health [13]. The uptake of colonoscopy in the programme has remained at a level of 17% since the beginning of the programme [14]. Both cervical cancer screenings and colorectal screenings fall below the acceptable level of 45% of organised screening uptake and the recommended level of 65% [15].

Material and methods

This paper is based on a review of literature on factors influencing screening uptake in primary health care. The MEDLINE (PubMed) and EMBASE databases and the reference list of key papers were searched to retrieve research literature. We used the terms: screening rate, screening uptake, screening factors, primary health care, cancer screening. Full strategy search for MEDLINE database can be found in Appendix 1. Searches were limited to the period 2010–2020 and in English language. Duplicates were eliminated.

We included the full-text articles of any study design in which primary care provider-level factors influenced cervical, breast or colorectal cancer screening uptake. We excluded articles when the full-text was not available, screening services other than cervical, breast or colorectal cancer were analysed, study analysed individual-level factors, as well as secondary or tertiary care provider-level factors.

For each included study, we extracted information about: author, date of publication or availability online, publication type, region, screening type and analysed factor or intervention. The findings are presented in Table 1. The results of this review are presented as a narrative due to the heterogeneity of the included studies. A quality review was not performed as part of this review, as its aim was to identify all available evidence regardless of the quality.

Results

The initial search yielded 1,252 potential articles. After removing duplicates (386) and articles with no identifiable full text (38), we reviewed the titles and abstracts and identified 29 studies to be included in this review.

Table 1. Summary of studies included in the review

Author	Date of publication	Publication type	Region	Cancer type	Analysed factor or intervention
Abadi et al. [43]	2018	Randomised trial	Iran	Cervical cancer	Motivational interview
Baxter et al. [16]	2017	Cross-sectional survey	Canada	CRC	Electronic Medical Record (EMR), reminders, generation of lists, audit and feedback reports, designated staff responsible for screening
Beaber et al. [17]	2016	Cohort study	United States	Breast cancer	Number of primary care visits within a year
Brenner et al. [18]	2017	Review	N/A	CRC	Kind of test offered, patient navigation, decision aids, reminders
Buist et al. [19]	2017	Cohort study	United States	Breast cancer	Reminders
Carney et al. [20]	2015	Computational modelling	N/A	Breast cancer, cervical cancer	Knowledge acquisition, retention and sharing within the setting of the facility
Chuang et al. [21]	2019	Cross-sectional study	United States	CRC, cervical cancer	Organisational factors
Clouston et al. [22]	2014	Randomised controlled trial	Canada	CRC	Website with information about the screening, telephone
Deding et al. [23]	2019	Cohort study	Denmark	CRC	Reminders
Emery et al. [10]	2014	Review	N/A	CRC, breast cancer	Audit and feedback systems, office system prompts, physician education and training, financial incentives, invitation letters or reminders
Everett et al. [24]	2011	Systematic review	N/A	Cervical cancer	Invitation letters
Gimeno Gracia et al. [25]	2014	Review	N/A	CRC	Participant reminders, small media (e.g. leaflets, newsletters, video), one-to-one education, group education, reduction of structural barriers or reducing out-of-pocket costs, incentives
Giordano et al. [26]	2012	Randomised trial	Italy	Breast cancer	Invitation letters
Goldzweig et al. [27]	2004	Cross-sectional study	United States	Breast cancer, cervical cancer	Primary-specialist coordination, GP staffing, formal PCP-patient assignment, primary care-based quality improvement programme
Ingrand et al. [28]	2016	Randomised controlled trial	France	CRC	Tailored counselling vs standard information
Kitchener et al. [29]	2016	Randomised trial	United Kingdom	Breast cancer	Nurse navigator scheduling appointments with patients
Krok-Schoen et al. [30]	2016	Systematic review	N/A	Breast cancer, cervical cancer	Patient navigation

Table 1. Summary of studies included in the review

Author	Date of publication	Publication type	Region	Cancer type	Analysed factor or intervention
Lin et al. [31]	2017	Cross-sectional study	United States	CRC	Provider-patient communication
MacLaughlin et al. [32]	2014	Cohort study	United States	Cervical cancer	Historical compliance, reminders
Molina et al. [33]	2018	Randomised controlled trial	United States	Breast cancer	Patient navigation
Offman et al. [34]	2013	Randomised trial	United Kingdom	Breast cancer	Screening appointments
Percac-Lima et al. [35]	2014	Cross-sectional study	United States	CRC	Patient navigation
Peterson et al. [36]	2016	Systematic review	N/A	CRC, breast cancer, cervical cancer	Provider-patient communication
Raine et al. [37]	2016	Randomised controlled trial	United Kingdom	CRC	Physician endorsement
Robinson-White et al. [38]	2010	Systematic review	N/A	Breast cancer	Patient navigation
Sabatino et al. [39]	2012	Meta-analysis	N/A	Breast cancer, cervical cancer, CRC cancer	Educational interventions, reminders, reducing out-of-pocket costs, reducing structural barriers, provider assessment and feedback
Stone et al. [40]	2002	Meta-analysis	N/A	CRC, cervical cancer	Separate clinics for prevention, planned care visit for prevention, designation of nonphysician staff to prevention activities, patient financial incentives, reminders, patient education, feedback
Underhill et al. [41]	2012	Observational study	United States	CRC	Provider-patient communication
Yano et al. [42]	2007	Cross-sectional study	United States	CRC	Practice organisation

Factors increasing cancer screening uptake

The endorsement and recommendation of Primary Care Providers (PCPs) are consequently referred to as key determinants in participating in screening. This association has been confirmed in CRC screening, where patients were more likely to participate in the screening following a physician's recommendation (OR = 1.07 and OR = 1.54 in two studies) [22, 37]. A small Iranian study observed the positive effect of motivational interviews in increasing Pap smear testing in middle-aged women [43].

As it turns out, this association is especially strong when the recommendation involves enthusiasm and encouragement on the provider's side [36]. Despite this finding, the effect of physician's communication skills on screening uptake has been controversial. In studies where the link was confirmed, the effect was moderate. There has also been a difference in study methodology, making it hard to compare the outcomes. A study in US Community Health Centres found no correlation between the high-rating of patient-provider communication and all types of CRC screenings [31]. An earlier US study concluded that this association can result in a 16% overall increase in screening uptake, and the correlation is stronger for colonoscopy than for FOBT. The factors associated with engagement in screening were: understanding the patient's perspective, addressing patient's needs and involving the patient in the decision-making process [41]. Tailored, nurse-led counselling for high-risk patients resulted in a 2.37 times higher rate of CRC screening than standard information [28]. Another study found that factors associated with increased breast cancer screening uptake were a primary visit in the year of 40th birthday and an increasing number of primary care visits within a year [17].

Organisational systems have also been linked to screening rates. Generally, providers with team-based care and value-

based care displayed higher screening rates. Teamwork and collaboration significantly increased the use of cervical cancer and CRC screening [40]. Rewards for quality were linked with higher rates of screening for breast cancer (OR = 1.04) and cervical cancer (OR = 1.06) [27]. Mathematical analysis has also shown that although highly organised quality improvement interventions can have positive results in the short term, greater network cohesion and efficient forms of collaboration are more sustainable and help with diffusion of good practices in the organization [20]. Higher levels of primary care-subspecialist coordination were associated with higher mammogram screening (OR = 6.24) but were negatively correlated with cervical cancer screening [27].

Team-based care and value-based care were also associated with lower provider burnout, therefore increasing the quality of care and recommendations provided by physicians to patients. The higher provider-to-patient ratio is associated with higher cancer screening uptake [21]. Large panel sizes may increase provider burnout and decrease the quality of provided preventive care [42, 44].

Audit and feedback systems designed to help physicians identify gaps in their knowledge and motivate them to change their practice can also be helpful in increasing cancer screening uptake [10, 39].

Although not always successful, the use of reminders and recall systems are the most effective in increasing screening uptake [25]. In a large Dutch study, electronically distributed reminders after 6 weeks increased overall participation in colorectal cancer screening, especially in younger age groups [23]. Reminder letters were more successful in previously compliant women for cervical cancer screening than in initially overdue women [32]. Moreover, sending mammogram specific reminders was more effective than sending reminders about all pre-

ventive care services at once [19]. When used meaningfully, Electronic Health Record systems can facilitate the processes of patient identification and automatise reminder generation, and these have been associated with increased screening rates [21].

Invitation letters are another way of increasing screening uptake [24]. Invitation letters with a fixed date of appointment correlated with higher attendance rates [26]. Moreover, attendance to breast screening appointment was highest (OR = 1,158) when an invitation letter had scheduled an appointment during office hours with an option to reschedule [34]. Providing women with more information on mammography did not improve attendance rate, regardless of the intervention type [26]. Likewise, pre-invitation letters and online booking service for mammography did not increase screening uptake [29]. Intervention consisting of a website with information about CRC and a telephone line with a nurse was not connected with higher FOBT use [22]. In a UK study, an increased uptake was observed with the utility of nurse navigator who scheduled appointments with patients [29].

Patient navigation is another provider strategy that can longitudinally improve screening. Patient navigation has been defined as tracking individual patients over a period of time until reaching a specific endpoint and which focuses on reducing individual barriers and delays in accessing care by the patient [45]. Systematic reviews suggest that patient navigation positively impacts screening rates for CRC, breast cancer and cervical cancer [30, 35, 38, 46]. In a preliminary study, patient navigation has also improved the chance of subsequent mammography screenings 2 years after the initial screening [33].

Research has also shown that individual PCP strategies are suboptimal in increasing the screening. Multiple strategies, such as use of Electronic Medical Records (EMRs), prompts for PCPs to remind patients due for screening, systematic process to generate lists for patients due for screening, designated staff members responsible for managing cancer screening and used of government issued practice-specific audit and feedback reports can increase screenings [16]. Another important finding was that adding one or more effective intervention components to an already existing intervention component can enhance the effectiveness [40].

Factor/intervention	Summary of results
Physician recommendation	Patients more likely to participate in screening upon physician recommendation and encouragement
Provider's communication skills	Moderate effect on screening uptake and engagement increase
Team-based care and collaboration	Collaboration between team members and primary care – subspecialist coordination associated with higher screening rate
Provider-to-patient ratio	Higher provider-to-patient ratio is associated with higher a screening rate and lower provider burnout, which is associated with decreased quality of preventive care
Audit and feedback systems	Increased screening uptake
Reminders and recall systems	Increased participation with screening specific reminders, especially in previously compliant group
Invitation letters	Increase of screening uptake with fixed appointment date during office hours with an option to reschedule. Providing additional information about screening did not increase screening uptake
Patient navigation	Increased screening uptake

Ugly Value in cancer screening

Ugly-Value is an original concept to describe factors that, instead of increasing the value of provided care, does not influence the quality of care and can even decrease it. This concept was originally created by the Medical and Diagnostic Centre (MDC), a primary healthcare institution in Siedlce, Poland. It has four possible reasons: uncountable or undetectable factors directly influencing care, overuse and overspending on care, inefficient management and organisational immaturity. Tackling the Ugly Value is one of the main themes of the MDC's efforts and one of the solutions implemented during its 20 years of operations for patients.

U – uncountable/undetectable

The lack of quality indicators or measuring indirect indicators because of a lack of correct infrastructure or systems results in a gap in knowledge and insufficient grounds for decision making. Current low-value care indicators measure only a selective part of the healthcare system [47]. Similarly, underuse of available systems to identify risk factors can be a limiting factor in determining low-value services. A 2018 study found that Electronic Health Records are a sufficient source for measuring the overuse of Pap smears in women younger than 21 years of age [48].

MDC is introducing a gradual grouping of patients – from the division of patients into those with and without chronic diseases, through the selection of patients who require home care, to the systematic implementation of tailored prevention and early diagnosis programmes. Patients are stratified into low, middle and high-risk groups based on identified risk factors and qualifications to the existing preventive programs, and they receive adjusted preventive care. MDC is additionally collecting data and performing analysis, e.g. quantitative evaluation of the incentive system for employees for achieving population targets in prevention programs.

G – gross

Although cancer screening programmes are characterised mostly by their underuse, there is also evidence of overuse of screening. Screening populations that are at a very low risk of developing a disease or testing patients who, because of advanced age or comorbidities, would not significantly benefit from screening can generate financial losses. Brenner et al., in their review, have confirmed this for colorectal cancer screening, in which overuse is mostly connected with screening older patients and those with pre-existing conditions, which is unlikely to increase the net benefit of screening [18]. Cervical cancer screening, including patients under 21 years of age, in spite of current guidelines, was connected with a high cost of treatment of positive results, with median costs over \$8,000 for those between 11–18 years of age [49].

MDC is implementing routine health check-ups, complex visits with an Individual Medical Care Plan (IMCP) adjusted to the risk level, and follow-up visits (with telemedicine use). Those checks are performed by the nursing and medical team, midwives and with the inclusion of appointment clerks. To counteract the overuse of screening, MDC is adjusting the delivery of cervical cancer screening according to risk factors. Identified risks are behavioural risks, no testing done at least once, immunodeficiency (including RA, HIV, diabetes, other), smoking, non-monogamous partners.

L – laziness

Laziness is characterised by incorrect resource management, low work efficiency, incorrect number of key processes in relation to complementary processes, lack of planning and gen-

erating waste. It goes hand in hand with overuse of resources and defines how the organisation is dealing with low-value care. There are multiple frameworks for reducing waste. One of these divides the types of needed interventions into: limiting ineffective care, “leaning” inefficient care (making it more efficient by adjusting provision or intensity) and adapting to meet patients’ needs and preferences by listening [50]. When designing interventions to improve screening uptake, multi-level factors should be taken into consideration.

MDC is conducting a systematic analysis of the acquired data against actual working time. Implemented improvement initiatives are:

- observation of productivity and optimisation of the utilisation of human resources, mainly nurses and midwives, for a fuller workload and tasks in accordance with competences,
- systematic improvement of the skills of medical appointment clerks to convert them to medical assistants and coordinators,
- systematic and consistent correction of the use of all paid working time,
- individual bonus system and bonuses for achieving team goals (team bonus).

Y – immaturity

The SCIROCCO Maturity Model for Integrated Care has identified 12 dimensions of organisational maturity to help identify the strengths and weaknesses of the practice. The model includes areas such as informatisation and access to eHealth services, removal of barriers, quality indicators and methods or evaluation and efficient innovative management [51]. Luxford et al. list similar factors facilitating high-value patient-centred care: “(i) strong, committed senior leadership, (ii) clear communication of strategic vision, (iii) active engagement of patient and families throughout the institution, (iv) sustained focus on staff satisfaction, (v) active measurement and feedback reporting of patient experiences, (vi) adequate resourcing of care delivery redesign, (vii) staff capacity building, (viii) accountability and incentives and (ix) a culture strongly supportive of change and learning” [52].

Facilities with lower organisational commitment to quality ranked lower in cancer screening uptake [20, 27].

MDC is building a system of cooperation based on local (mini-regional) cooperation of regional hubs (RH) – leaders in diagnostics and specialist consultations with peripheral family medicine practices – sub-clusters. Clusters are known to be

more resilient and find it easier to adjust to the changing reality, challenges and threats. Cooperation is built on an optimal resource utilisation plan, which is developed and implemented under the provision of central management and coordination group. Coordination group consists of management, development office, human resources and payroll, logistics, call centre. Plan includes information on adopted goals and expected deliverables.

Wherever possible, “cost-intensive” workers are replaced by “less cost-intensive” workers, e.g. a nurse replaces a doctor, an assistant-coordinator replaces a doctor and a nurse. Additionally, MDC is investing in patient education and the development of tools enabling self-care and disease self-management. MDC is currently building its own IT system to support organizational activities – “SZOK”.

Conclusions

Existing literature points to many different factors that can positively influence cancer screening uptake. Based on a literature search and our original concept, these factors can be divided into four different categories:

- 1) data gathering and data use (IT systems, meaningful use of Electronic Health Records to generate reminders and prompt healthcare professionals to refer patients for screening),
- 2) cost effectiveness (avoiding overuse of screening in low-risk populations),
- 3) innovative efficient management (use of effective interventions and thoughtful resources allocation, e.g. engaging nurses in patient navigation instead of assigning them to answer patient concerns about screening by telephone),
- 4) organisational system (team based, integrated care and patient navigation are ways to improve screening rates).

By identifying areas to improve, healthcare institutions can effectively design quality improvement initiatives and increase cancer screening uptake among their patients.

Appendix 1. Search terms for PubMed and comparable search terms for other databases: (breast cancer OR cervical cancer OR colorectal cancer) AND (cancer screening OR screening OR screen OR “Early Detection of Cancer” OR mammography OR mammogram OR sigmoidoscopy OR colonoscopy OR faecal occult blood test OR FOBT OR faecal immunochemical testing OR pap test OR pap smears) AND (screening uptake OR screening rate OR rate OR uptake).

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