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Perceived effectiveness of cancer screening among family medicine and internal medicine physicians in the United States

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ABSTRACT

Family and internal medicine physicians play an important role in cancer screening, yet there are limited data on their beliefs regarding effectiveness of screening tests, which may affect physicians' likelihood to recommend such tests. The study purpose was to assess current beliefs among family medicine and internal medicine physicians regarding effectiveness of various types of cancer screening. A national sample of 582 physicians from the American Medical Association's Physician Masterfile were surveyed. Participants were asked about their perceived effectiveness of screening for colon, lung, breast, prostate, and cervical cancer among average, healthy individuals. Chi-square tests were conducted to assess relationships between perceiving screening tests to be 'very effective in reducing cancer-related mortality' and demographic characteristics. A substantial majority of physicians perceived colonoscopy (83.8%) and Pap smear (82.9%) to be very effective. Perceiving low-dose computed tomography (LDCT), Pap smear, and prostate-specific antigen (PSA) as 'very effective' differed by gender, with females less likely to endorse LDCT and Pap smear but more likely to endorse PSA. Perceiving PSA as 'very effective' differed by age and graduation year, with younger or more recently graduated physicians being less likely to perceive PSA as 'very effective'. Non-Hispanic Black/African-American physicians were more likely to perceive mammography as 'very effective' than other groups. Physicians' perceived effectiveness about cancer screening tests varies widely and may influence their recommendations or usage of these tests. Understanding physicians' beliefs can help in improving uptake of evidence-based screening tests by providers and patients to promote early detection and successful treatment.

1. Introduction

Cancer screening is critical for early detection, treatment, survival, and quality of life (Peterson et al., 2016). Certain types of cancer such as colorectal, lung, breast, prostate, and cervical can be detected early, often improving prognosis and reducing mortality rates (Schiffman et al., 2015). Despite its benefits, cancer screening remains underutilized (Bonafede et al., 2019). A key determinant of cancer screening is whether a primary care provider/physician recommends it to their patient. Physicians' attitudes and beliefs towards screening can influence referral rates, and incorrect recommendations may result in missing potentially eligible patients.

Few studies have examined US physicians' beliefs about the effectiveness of cancer screening in the last 10 years. For example, one study at a large academic medical center found that in 2013, 293 primary care providers rated perceived effectiveness (very or moderate) of colonoscopy as 99%, Papanicolaou smear 95.7%, mammography 92.9%, lung cancer screening 41.9%, and PSA testing 27.4%. Several studies have assessed perceived effectiveness of lung cancer screening and found varied perceived effectiveness, ranging from 42 to 87% (Khairy et al., 2018; Lewis et al., 2015; Raz et al., 2018), which may depend on differences across studies in geographic locale, practice setting, and

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physician specialty. Finally, primary care providers ($n = 1,281$) within four healthcare systems in California, Washington, and Texas completed a survey in 2017–2018. For patients 50–74 (screening eligible), 82.9% of providers rated colonoscopy as very effective (Ghai et al., 2020). These prior studies had various limitations such as older data, a relatively small sample size, limited geographic reach, and/or focus on only one screening type. The current study updates and extends this work by assessing the perceived effectiveness of screening for colon, lung, breast, prostate, and cervical cancers among a relatively large national sample of family medicine and internal medicine physicians.

2. Methods

This study was part of a self-administered cross-sectional survey that focused primarily on physicians' knowledge, attitudes, and communication about tobacco use and treatment (Schaer et al., 2021). A random sample of 750 physicians from each of four specialties (family medicine, internal medicine, obstetrics and gynecology, pediatrics) was drawn from the American Medical Association's (AMA) Physician Masterfile. As the most comprehensive database of physicians, the Physician Masterfile contains data on more than 900,000 physicians, residents, and trainees from the United States. Physicians from this database include both AMA members and nonmembers of all medical specialties and practice types. To be eligible, physicians must have been board-certified in the target specialty and actively treating outpatients in the United States. Survey fielding occurred from April through June 2019. More detail is reported elsewhere (Delnevo et al., 2021; Delnevo and Singh, 2021; Schaer et al., 2021).

In brief, sampled physicians were mailed an invitation letter via UPS, inviting them to participate in the survey via web by providing a survey link and unique PIN for accessing the survey. If needed, a reminder postcard and a reminder letter were sent to physicians who had not responded; a fourth and final mailing included a paper copy of the survey and a prepaid return envelope. The American Association for Public Opinion Research's Response Rate 3 was 59.1% and 59.3% for family medicine and internal medicine specialties, respectively (American Association for Public Opinion Research, 2016). Rutgers Institutional Review Board approved the study procedures, which met the institution's guidelines for protection of human subjects concerning their safety and privacy.

Supplemental specialty-specific modules were included in the web-based survey; for internal and family medicine physicians, this was a module about cancer screening, given their likelihood of counseling patients on the variety of available cancer screening tests. As such, the analytic sample is restricted to 582 family medicine and internal medicine physicians who received the additional questions on perceptions of cancer screening tests.

2.1. Measures

For each of the cancer screening practices, providers were asked "How effective or ineffective do you believe the following screening practices are in reducing cancer-related mortality in the average, healthy individual for whom they are recommended?" with response options of 1 = not effective to 4 = very effective. The cancer screening tests included colonoscopy for colon cancer, low-dose computed tomography (LDCT) for lung cancer, mammography for breast cancer, prostate specific antigen (PSA) for prostate cancer, and Pap smear for cervical cancer. Participants answered questions on their demographic characteristics, including age, gender, race, graduation year, and medical specialty (family or internal medicine).

2.2. Data analysis

The final analyses included only participants who responded to the screening perception questions. Descriptive statistics were calculated to describe the analytic sample. Bivariate chi-square statistics were computed to assess relationships between perceiving cancer screening tests as 'very effective' and each of the physician characteristics. All analyses were conducted using SAS software version 9.4 (SAS Institute, Cary, NC, USA) with a significance level of 0.05.

3. Results

The sample was 54.7% female and 63.5% non-Hispanic white with median age of 51 years (Table 1). A substantial majority of physicians perceived colonoscopy (83.8%) and Pap smear (82.9%) to be very effective (Table 2). About 60% of physicians perceived mammography to be very effective compared to 35% of them perceiving LDCT to be very effective. About 18% of physicians perceived PSA to be very effective.

Physician specialty was not significantly associated with perceiving any screening test as 'very effective' (Table 3). Women were less likely to endorse LDCT and Pap smear but more likely to endorse PSA. Younger and more recent graduates were less likely to perceive PSA as 'very effective'. Non-Hispanic Black or African-American physicians were more likely to perceive mammography as 'very effective' than other groups.

4. Discussion

This study provides important information about beliefs among American family medicine and internal medicine physicians regarding effectiveness of various types of cancer screening. Overall, the rates of perceived effectiveness were lower than other reports in the last decade (Ghai et al., 2020; Khairy et al., 2018; Lewis et al., 2015; Raz et al., 2018), perhaps related in part to the fact that the current data are more recent and from a national sample. Results suggest that a majority of physicians support colonoscopy for colorectal cancer screening, which is consistent with previous studies and recommendations (Brown et al., 2015). Use of colonoscopy has been associated with a 65% reduction in mortality risk in the right colon and a 75% reduction in mortality risk for rectal cancers (Doubeni et al., 2018). Colon cancer screening, including colonoscopy and other methods, has been rated by the United States Preventive Services Task Force (USPSTF) with a Grade A risk–benefit ratio for ages 50–75 years and Grade B for ages 45–49 (USPSTF, 2021). More than 80% of respondents also perceived Pap smear to be very effective. Current evidence recommends Pap smear be used in combination with human papillomavirus testing in individuals aged 25 to 65

Table 1
Sample Descriptives (N = 582).

	n	%
Age, years[a]		
Median [IQR]	51 [15.00]	
Gender		
Females	309	54.7
Male	256	45.3
Race/Ethnicity		
White, Non-Hispanic	359	63.5
Black/African American, Non-Hispanic	26	4.6
Hispanic	27	4.8
Asian/Pacific Islander	81	14.3
South Asian	43	7.6
Other	29	5.1
Graduation year[b]		
Median [IQR]	1995 [15.00]	
Specialty		
Family Medicine	334	57.4
Internal Medicine	248	42.6

[a]Imputed for 2 respondents as median age within same specialty and graduation year.
[b]Imputed for 17 respondents as median year within same specialty and age.
Frequencies may not total 582 due to item nonresponse.

Table 2
Perceived effectiveness of various cancer screenings among a sample of internists and family physicians, N = 582.

	Not effective		Minimally effective		Moderately effective		Very effective		Average Score*			
	n	(%)	n	(%)	n	(%)	n	(%)	Mean	± SD	Median	[IQR]
Colonoscopy for colon cancer screening	0	0.0	2	0.4	92	15.9	485	83.8	3.83	0.38	4.00	0.00
Pap smear for cervical cancer screening	0	0.0	8	1.4	91	15.7	480	82.9	3.82	0.42	4.00	0.00
Mammography for breast cancer screening	1	0.2	23	4.0	207	35.6	351	60.3	3.56	0.58	4.00	1.00
LDCT for lung cancer screening	4	0.7	85	14.6	286	49.2	206	35.5	3.19	0.70	3.00	1.00
PSA for prostate cancer screening	54	9.3	236	40.6	187	32.1	105	18.0	2.59	0.89	3.00	1.00

Frequencies may not total 582 due to item nonresponse.

Table 3
Prevalence of perceiving screening tools as 'very effective' by demographic characteristics, N = 582.

	Colonoscopy			LDCT			Mammography			Pap Smear			PSA Test		
	n	%	p-value*	n	%	p-value*	n	%	p-value*	n	%	p-value*	n	%	p-value*
Age, years [a]															
Younger than 50 years	203	82.5	0.5636	86	34.8	0.9579	151	61.1	0.5641	206	83.7	0.76	32	13.0	0.0168
50 years or older	264	84.4		110	35.0		185	58.7		259	82.8		65	20.6	
Gender															
Female	255	82.8	0.643	95	30.7	0.013	185	59.9	0.945	245	80.1	0.05	64	20.7	0.0393
Male	214	84.3		104	40.8		154	60.2		221	86.3		36	14.1	
Race/Ethnicity															
White, Non-Hispanic	295	82.9	0.4889	122	34.1	0.9591	198	55.2	0.017	292	81.8	0.24	66	18.4	0.8358
Black/African American, Non-Hispanic	23	88.5		9	34.6		21	80.8		25	96.2		6	23.1	
Hispanic	24	88.9		11	40.7		16	59.3		20	74.1		4	14.8	
Asian/Pacific Islander	72	88.9		30	37.0		58	71.6		69	86.3		13	16.1	
South Asian	33	76.7		17	39.5		29	67.4		35	81.4		6	14.0	
Other	25	86.2		10	34.5		18	62.1		26	89.7		7	24.1	
Graduation year [b]															
1995 or later	237	83.8	0.8954	102	35.9	0.6228	168	59.2	0.7576	236	83.4	0.89	35	12.3	0.0018
Before 1995	230	83.3		94	33.9		168	60.4		229	83.0		62	22.3	
Specialty															
Family Medicine	279	83.8	0.9887	124	37.1	0.3279	209	62.6	0.1948	278	83.5	0.67	59	17.7	0.784
Internal Medicine	206	83.7		82	33.2		142	57.3		202	82.1		46	18.6	

*Chi-square.
[a] Age was imputed for 2 respondents as median age within same specialty and graduation year.
[b] Graduation year was imputed for 17 respondents as median year within same specialty and age.

years (Fontham et al., 2020). Cervical cancer screening, including Pap smear, has been rated Grade A by the USPSTF.

The USPSTF recommends biennial mammography for women aged 50 to 74 years, USPSTF Grade B, and that for women under 50, mammography should be an individual decision (Siu on behalf of the USPSTF, 2016), USPSTF Grade C. Physicians in the current study perceived mammogram to be effective with 60% responding "very effective". In contrast, only 35% of physicians perceived LDCT to be very effective, despite also having Grade B recommendation. These variations in physicians' beliefs are interesting considering the evidence on effectiveness of LDCT screening is fairly strong. The USPSTF recommends that annual lung cancer screening with LDCT is *moderately advantageous* for individuals ages 50 to 80 years old, having at least a 20 pack-year smoking history and currently smoking, or who have quit within the past 15 years (Krist et al., 2021) (Grade B). In individuals with a tobacco history of at least 30 pack-years, LDCT has the potential to reduce lung cancer mortality by 20% (National Lung Screening Trial Research Team, 2011). The difference in perceived effectiveness between mammogram and LDCT could be due to the evidence for the LDCT test being more recent (Krist et al., 2021) and less disseminated in the healthcare culture.

Less than 20% of respondents perceived PSA to be very effective, suggesting that beliefs of physicians may have been affected by the 2012 USPSTF recommendation against the use of PSA in men of any age (Moyer on behalf of the USPSTF, 2012), which as of 2018 is rated USPSTF Grade C for men ages 55–69 years and Grade D for men 70 and older (USPSTF, 2018). Findings of a recent *meta*-analysis show that prostate cancer screening does not affect overall mortality and at best, may only lead to a small reduction in mortality risk (Ilic et al., 2018).

Perceived effectiveness of cancer screening was also found to be affected by other factors, including physician gender, graduation year, and race. Female physicians being less likely to perceive Pap smear to be 'very effective' corroborate prior research. Inadequate knowledge about Pap smear and cervical cancer and low perceived risk of cervical cancer have been cited as barriers to endorsing Pap smear (Ashtarian et al., 2017; Bennett et al., 2018). It was not surprising that younger or recent graduates were less likely to perceive PSA to be 'very effective' because of recent USPSTF recommendations against its use. Non-Hispanic Black or African-American physicians tended to perceive mammography to be very effective, potentially because of the significant racial disparities in breast cancer survival and mammography barriers that racial minority women face (Miller et al., 2019).

Unfortunately, the current study did not evaluate screening referral rates or to what extent these rates may be related to perceived effectiveness. It is likely that perceived effectiveness is associated with, but not identical to, screening referral rates. For example, one study found that 82.9% of primary care providers rated colonoscopy as very effective (Ghai et al., 2020), and 77.9% recommended colonoscopy to patients.

Additionally, it is well-known that screening recommendations or referrals do not necessarily translate into actual screening completion. More research is needed in this area.

This study has important implications. Results highlight the need to address provider-level beliefs about and barriers to cancer screening tests. American physicians' beliefs were largely aligned with USPSTF grades, except for LDCT. Educational and organizational efforts that have targeted physicians regarding shared decision-making with their patients for LDCT screening have had some preliminary success in modifying physician knowledge, attitudes, and screening behavior. These approaches have included a digital awareness campaign (Jessup et al., 2018), electronic eligibility form for patients (O'Brien et al., 2017), lectures and group-based learning (Ortmeyer et al., 2020), and a decision aid (McDonnell et al., 2018). Due to the lack of evidence regarding effectiveness of certain screening tests such as PSA, physicians should thoroughly discuss with patients the individual benefits versus the overall risks of screening.

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CRediT authorship contribution statement

Trishnee Bhurosy: Writing – original draft, Writing – review & editing. **Michelle T. Bover Manderski:** Data curation, Project administration, Writing – review & editing. **Carolyn J. Heckman:** Writing – review & editing. **Nishi J. Gonsalves:** Formal analysis. **Cristine D. Delnevo:** Conceptualization, Funding acquisition, Investigation, Methodology, Resources, Supervision, Writing – review & editing. **Michael B. Steinberg:** Funding acquisition, Investigation, Methodology, Supervision, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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