The Current Utilization of Breast and Prostate Cancer Screening in Older Adults in Texas

Elizabeth Jaramillo, MD[1, 2], Alai Tan, MD, PhD[1, 3]

[1]Sealy Center on Aging, University of Texas Medical Branch, Galveston, TX

[2]Division of Geriatrics, University of Texas Medical Branch, Galveston, TX

[3]Department of Preventive Medicine and Community Health, University of Texas Medical Branch, Galveston, TX

ABSTRACT:

Objective: To determine the current utilization of breast and prostate cancer screening in Texas.

Methods: Two cohorts of Texas Medicare beneficiaries aged 67 years or older, one female (n=657,227) and the other male (n=532,338), were identified from the Texas Medicare data in 2008 and 2009, respectively. For females, Medicare claims during 2008-2009 were evaluated for screening mammography utilization. For males, Medicare claims in 2009 were evaluated for prostate-specific antigen (PSA) screening. Descriptive statistics and logistic regression models were used to evaluate screening utilization and associated factors.

Results: Among subjects aged 67-74 years, 52.3% of females received mammography screening in 2008-2009 and 46.3% of males received PSA screening in 2009. The screening rates varied greatly across Texas counties and health service regions. Younger age, non-Hispanic white, higher socio-economic status, and more comorbidities were associated with higher likelihood of receiving mammography or PSA screening. Among subjects aged 75 years or older and with limited life expectancy, 22.0% of females and 38.6% of males still received mammography and PSA screening, respectively. Even in those with limited life expectancy, subjects 67-74 years were more likely to receive screening than those 75 years or older.

Conclusion: Both under- and over-screening were observed in Texas. Screening rates varied greatly across Texas regions. It is evident that screening decisions were currently based primarily on age, not life expectancy. Systematic interventions aimed at healthcare and public health professionals are needed to increase appropriate cancer screening and avoid inappropriate screening.

Key words: cancer screening, preventive medicine, mammography, prostate-specific antigen (PSA), Medicare

BACKGROUND

Mammography is effective at detecting breast cancer at early stages and reducing breast cancer mortality among women aged 50-74 years.[1] Regular biannual mammography screening is recommended for women of this age group. Studies show that for women aged 50-74 years, about 270 would need to be screened to stop one breast cancer death from occurring. In contrast, for women younger than 50 years, over 2500 women must be screened to save one life.[2] Also, women younger than 50 years are more likely to have a false-positive screening test and to experience physical and psychological suffering associated with a false-positive result and follow-up tests.[1-3] Based on this published evidence, the United States Preventive Services Task Force (USPSTF) recommends starting mammography screening at age 50 years and screening every other year until 74 years. Evidence was insufficient to support recommending regular screening mammography in women aged 75 years or older. Mammography trials often exclude the very old population, although data are often extrapolated to this population. The rationale behind the age 75 years cutoff used by guidelines is that such women often have limited life expectancy. Studies have reported no survival differences between screened and unscreened women before seven years of follow-up.[4] There is at least a four year lag between screen-detected breast cancer and onset of clinical symptoms among women aged 65-74 years.[5] These findings suggest that older women with a life expectancy of less than seven years are less likely to benefit from early detection of breast cancer through screening, but quite likely to be diagnosed and treated with breast cancer that otherwise would not have been diagnosed and treated in their lifetime.[3, 6-9]

Similarly, prostate cancer screening with prostate-specific antigen (PSA) in men over 75 years has not been shown to effectively decrease prostate cancer specific mortality.[10-13] Harms of screening include false-positive results, follow-up biopsies, associated pain, bleeding, infection,[14-16] psychological distress, and temporary sexual dysfunction.[17] Moreover, diagnosis of and treatment for asymptomatic prostate cancer that would not become clinically significant in a patient's expected life span is potentially harmful.[14, 18] Currently, USPSTF recommends against PSA screening for all age groups and the American Cancer Society (ACS) recommends against PSA screening for men with less than ten years' life expectancy. Table 1 summarizes current ACS and USPSTF guidelines for mammography and PSA screening.

Our objectives were to evaluate the current utilization of breast and prostate cancer screening in older adults in Texas, the appropriateness of the screening, and the associated factors.

METHODS:

Data Sources

The 100% Texas Medicare claims data from 2006-2009 were used in this study and included Medicare enrollment files, Carrier files, Outpatient Statistical Analytic Files (OUTSAF), and Medicare Provider Analysis and Review (MEDPAR) files.

Study Subjects

We identified two cohorts, one for evaluating screening mammography utilization and the other for evaluating PSA screening utilization.

The cohort for screening mammography (N=657,227) was selected from female beneficiaries aged 67 years or older and residing in Texas in 2008. The cohort included only those with full Medicare Parts A and B coverage and without Health Maintenance Organization (HMO) coverage during 2006-2009. Women with HMO coverage were excluded because their claims are not routinely included in Medicare claims. Subjects with any claims for diagnosis of breast cancer or breast mass (International Classification of Diseases, 9th revision, Clinical Modification [ICD-9-CM] codes: 174xx, 2330, 61172) during 2006-2007 were excluded.

The cohort for PSA screening (N=532,338) was selected from male beneficiaries aged 67 years or older and residing in Texas in 2009. The cohort included only those with full Medicare Parts A and B coverage and without HMO coverage during 2007-2009. Men with any claims for diagnosis of prostate cancer (ICD-9-CM codes: 185, V104.6, 222.2, 233.4 or 236.5) during 2007-2008 were excluded.

We used a two-year look-back period to identify patients with previous breast or prostate cancer. This is to ensure that the mammography and PSA testing in the study subjects was done for screening, not diagnostic purposes. The sensitivity of the Medicare data to identify breast and prostate cancers is approximately 90% using a two-year look-back period.[19] Using a longer look-back period may identify more cancer patients. Given no claim for cancer care in the most recent two years, such patients might have been cured of cancer. Thus, mammography and PSA screening in such patients is more likely for screening than for diagnostic purposes. This study was approved by

Table 1. Current American Cancer Society (ACS) and U.S. Preventive Services Task Force (USPTF) Guidelines for Breast and Prostate Cancer Screening.

Current Recommendations		
Age (years)	**ACS**	**USPTF**
Breast Cancer		
40-49 50-74 75 and older	Annual mammograms starting at age 40 and continuing for as long as a woman is in good health. There is no specific upper age at which mammography screening should be discontinued. The decision to stop regular mammography screening should be made on an individual basis based on the potential benefits and risks of screening within the context of a patient's overall health status and estimated longevity.	Recommends against routine screening mammography in women aged 40 to 49 years. Recommends biennial screening mammography for women between ages 50 to 74 years. Insufficient to assess the additional benefits and harms of screening mammography in women aged 75 years and older.
Prostate Cancer		
40-45 45-50 50 and older	PSA +/- DRE in men at higher risk (more than one first-degree relative diagnosed with prostate cancer under 65) PSA +/- DRE in men at high risk (African Americans and men with a first-degree relative diagnosed with prostate cancer under 65) PSA +/- DRE in men at average risk of prostate cancer and expected to live at least 10 years	Recommend against PSA based screening in any age group

PSA, Prostate-Specific Antigen; DRE, Digital Rectal Exam

the Institutional Review Board of the University of Texas Medical Branch at Galveston.

MEASURES

Screening mammography and PSA testing

We tracked each woman in the mammography cohort to identify whether she had a screening mammogram during 2008-2009. We followed the algorithm developed and validated by Randolph and Freeman[20, 21] to identify whether a mammography claim was done for screening purposes. A screening mammogram was defined as: a bilateral mammogram (Carrier files with Current Procedure Terminology [CPT] codes of 77056, 77057 or Healthcare Common Procedure Coding System [HCPCS] codes of G0204 and G0202), or for those who received no mammogram, CPT codes 77055, 77056, 77057 or HCPCS codes of G0206, G0204 or G0202 appearing in the previous 11 months. Similarly, we tracked each man in the PSA cohort to identify whether he had a PSA test during 2009. PSA testing was identified by CPT codes 84152-54, 86316 or HCPCS code G0103.

Age, Comorbidity, and Life Expectancy

Each subject's age was calculated from that at the beginning of the study year (1/1/2008 for the mammography cohort and 1/1/2009 for the PSA cohort). We categorized subjects into those 67-74 years and those 75 years or older.

Comorbidity was assessed using Quan's adaption of the Elixhauser comorbidity method.[22, 23] This method identifies 31 individual comorbid conditions based on outpatient, inpatient, and carrier claims in the previous 12 months (1/1/2006-12/31/2007 for the mammography cohort and 1/1/2007-12/31/2007 for the PSA cohort). We grouped subjects by number of comorbidities (none, 1, 2 and 3+).

We calculated the life expectancy of each subject based on gender-specific Cox proportional hazard models developed and validated by Tan et al.[24] These models combine predictors of age and Elixhauser comorbidities to accurately predict patient life expectancy and risk of mortality for any time point within ten years. Based on results from the models, we grouped subjects into those with limited and those with longer life expectancy. Cut-off points of seven-year and ten-year life expectancy were used for mammography and PSA cohorts, respectively. These cut-offs were chosen based on evidence from randomized trials that subjects with a life expectancy shorter than the cut-off years were unlikely to benefit from screening.[3, 4, 12]

Other Measures

Race/ethnicity was extracted from the denominator file from the Part D enrollment file and was categorized as non-Hispanic White (NHW), non-Hispanic Black (NHB), Hispanic, and Other. Medic-

aid eligibility was extracted using the state buy-in indicators in the denominator file. The percentage of high school graduates in the zip code area in which a subject resided was extracted from US census data. Medicaid eligibility (yes vs. no) and percent of high school graduates in the patient's zip code area were used as proxy measures of patient socio-economic status. The health service region (HSR) and county of each subject were identified based on the county code in the denominator file of the claims data. HSR is a defined geographic subdivision of a state based on geographic population clusters. The regional HSR headquarters, administered under the Department of State Health Services, is responsible for bringing comprehensive public health services to the citizens of the HSR. The 11 Texas HSRs and their headquarter locations are: 1-Lubbock, 2 and 3- Arlington, 4 and north part of 5- Tyler, 6 and south part of 5- Houston, 7-Temple, 8-San Antonio, 9 and 10-El Paso, and 11-Harlingon.

Statistical Analysis

Descriptive analysis was used to summarize the sample characteristics and screening rates (screening mammography and PSA testing) for the study cohorts. Screening rates in Texas were mapped by HSR and by county. Multiple logistic regression models were used to assess factors associated with cancer screening for older adults in Texas. Screening utilization by race/ethnicity (NHW, NHB, Hispanic, and Other), age (<75 vs. 75+ years), and life expectancy were cross-tabulated. The age effects on screening use were estimated using logistic regression modeling by race/ethnicity and life expectancy. SAS version 9.2 (SAS Institute, Cary, NC) was used for all statistical analyses.

RESULTS:

Table 2 shows the sample characteristics and cancer screening utilization rates. Among Texas Medicare beneficiaries, overall, 41.8% of females received mammography screening in 2008-2009 and 43.1% of males received PSA screening in 2009. The mammography and PSA rates were 52.3% and 46.3%, respectively, among subjects aged 67-74 years. Both mammography and PSA screening rates were higher among subjects of younger age, non-Hispanic whites (NHW), higher socio-economic status (ineligible for Medicaid and residing in areas with higher proportions of high school graduates) and those having 1-2 comorbidities. Many subjects over 75 years were still being screened for breast or prostate cancer (34.5% and 39.3%, respectively). Among subjects with limited life expectancy, 22.4% of females and 39.9% of males received mammography or PSA screening, respectively.

Table 2. Sample characteristics and screening utilization rate (%) for breast (2008-2009) and prostate (2008) cancer in Texas.

	Cohort for Screening Mammography (2008-2009)		Cohort for PSA Screening (2008)	
	N	% Screened	N	% Screened
All	657,227	41.8	532,338	43.1
Age (years)				
67-74	269,836	52.3	287,688	46.3
75+	387,391	34.5	244,650	39.3
Race/Ethnicity				
Non-Hispanic White	500,526	44.2	406,712	44.9
Non-Hispanic Black	46,956	36.9	31,777	34.9
Hispanics	96,630	33.1	81,401	37.0
Other	12,659	34.2	12,258	43.8
Medicaid Eligibility				
No	547,311	45.0	473,693	43.8
Yes	109,916	25.7	58,645	37.3
% High School graduate				
<75%	193,269	36.3	143,999	39.3
75-89%	270,627	42.4	207,016	43.4
90+%	160,886	47.5	123,922	47.7
Comorbidity*				
0	188,009	38.8	191,066	33.2
1	161,888	49.0	113,426	53.8
2	134,214	45.9	93,996	51.9
3+	173,116	35.2	133,850	41.9
Life Expectancy**				
limited[$]	177,100	22.4	265,245	39.9
longer[$]	480,127	49.0	267,093	46.3

*Comorbidity was assessed with Quan's adaption of Elixhauser comorbidity method.
** Life expectancy was assessed using gender-specific Cox proportional hazard models.
[$]For screening mammography, a cutoff of seven-years was used to define women as having a limited vs. longer life expectancy. For PSA screening, a cutoff of ten-years was used to define men as having a limited vs. longer life expectancy.

Figure 1 shows cancer screening rates for older adults in Texas by HSR and county. Texas HSR 3 (Arlington) and HSR 7 (Austin) had the highest percentage of older women receiving a screening mammography (45.0% and 45.7%, respectively) and HSR 3 (Arlington) and HSR 4 (Tyler) had the highest percentage of older men screened with PSA (46.2% and 47.4%, respectively). Mammography screening was most concentrated in northeast and central Texas. PSA screening was most concentrated in northeast Texas.

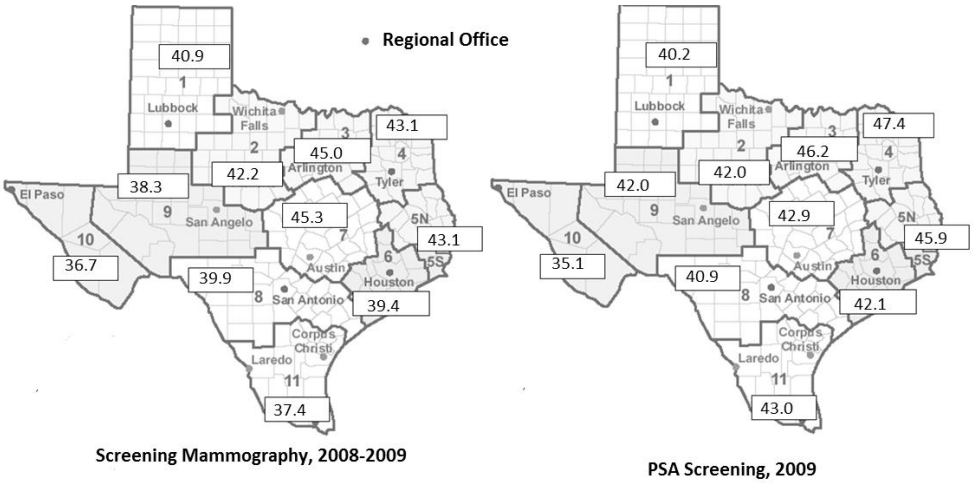
Table 3 shows factors associated with screening of older adults, adjusting for other factors. Compared to those aged 75 years or older, those under 75 years were significantly more likely to be screened (Odds Ratio [OR]: 2.11, 95% Confidence Interval [CI]: 2.09-2.13 for mammography; OR: 1.34, 95% CI: 1.28-1.40 for PSA). Those of NHW ethnicity, higher income, and higher education level were also more likely to be screened. Also, having comorbidities was associated with higher likelihood of receiving screening.

Table 4 shows the screening rates by race/ethnicity for subjects aged 67-74 years (within guideline age limits), for subjects aged 75 years or older (regular screening not recommended by guidelines), and for subjects 75 years or older with a limited life expectancy (recommended against by guidelines). For all groups, NHWs had significantly higher screening rates for mammography and PSA, compared to non-Hispanic Blacks (NHBs) and Hispanics. Even among subjects aged 75 years or older with a limited life expectancy, 22.0% of females and 38.6% of males received screening.

Figure 2 shows the effect of age (<75 vs 75+ years) on mammography and PSA screening by life expectancy and race/ethnicity. For both mammography and PSA screening, age less than 75 years was associated with significantly higher odds of receiving screening than age 75 years or older (all the ORs significantly differ from one, except those for PSA in race/ethnicity other than white, black, and Hispanic). This finding persisted in those with limited life expectancy compared to those with longer life expectancy. The odds ratio among subjects aged <75 vs. 75+ years of receiving mammography screening were 2.14 (95% CI: 1.92-2.37) for women with limited life expectancy, compared to OR of 1.69 (95% CI: 1.63-1.74) for women with longer life expectancy. The age effect was greater for screening

Figure 1. Breast and prostate cancer screening for older adults in Texas, by health service region (HSR) (panel A) and by county (panel B).

Panel A.



Panel B.

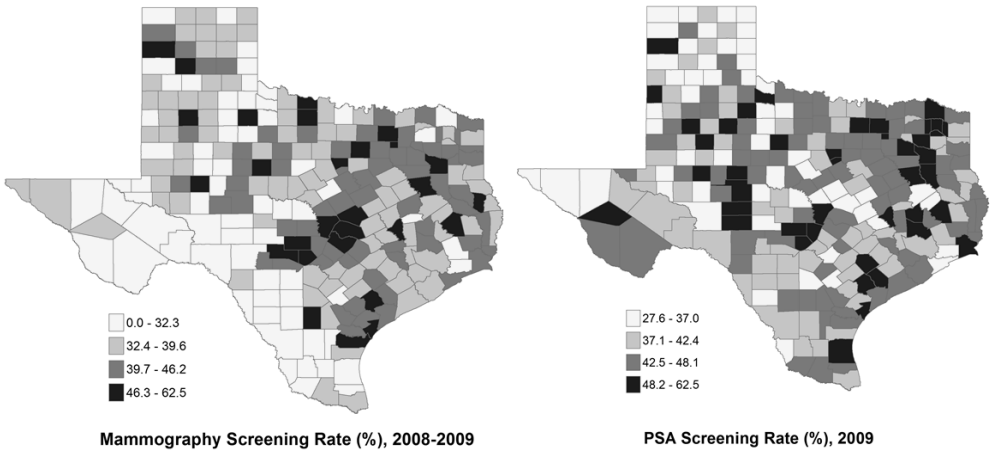


Table 3. Factors associated with cancer screening in older adults in Texas, as determined by multiple logistic regression analysis.

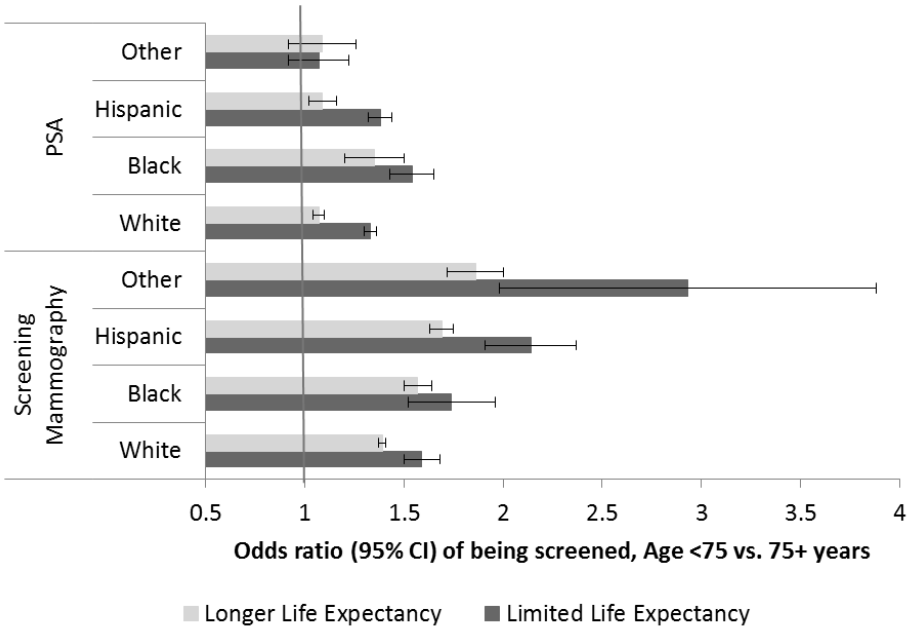
Factors	OR (95% CI)	
	Screening Mammography	PSA
Age (years)		
67-74	2.11 (2.09, 2.13)	1.34 (1.28, 1.40)
75+	ref	ref
Race/Ethnicity		
Non-Hispanic white	ref	ref
Non-Hispanic black	0.89 (0.87, 0.91)	0.69 (0.67, 0.71)
Hispanic	0.88 (0.87, 0.90)	0.80 (0.79, 0.82)
Other	0.78 (0.75, 0.81)	0.95 (0.91, 0.99)
Medicaid Eligibility		
No	2.09 (2.08, 2.12)	1.14 (1.11, 1.16)
Yes	ref	ref
% High School graduate		
<75%	ref	ref
75-89%	1.12 (1.11, 1.13)	1.07 (1.06, 1.09)
90+%	1.34 (1.32, 1.36)	1.26 (1.24, 1.28)
Comorbidity*		
0	ref	ref
1	1.70 (1.68, 1.72)	2.37 (2.33, 2.41)
2	1.60 (1.58, 1.63)	2.25 (2.21, 2.29)
3+	1.22 (1.10, 1.34)	1.57 (1.55, 1.60)

*Comorbidity was assessed with Quan's adaption of Elixhauser comorbidity method.

Table 4. Utilization of Mammography (2008-2009) and PSA (2008) screening in Texas, by race/ethnicity for subjects by age and life expectancy.

Screening by Race/Ethnicity	N (% Screened)		
	Age 67-74 years	Age 75+ years	Age 75+ and with a limited life expectancy
Mammography			
All	269836 (52.3)	387391 (34.5)	168864 (22.0)
Non-Hispanic white	201426 (54.9)	299100 (36.9)	129227 (23.3)
Non-Hispanic black	20408 (47.4)	26548 (28.8)	13104 (19.6)
Hispanic	41965 (43.3)	54665 (25.3)	24037 (17.1)
Other	5944 (44.6)	6715 (25.1)	2220 (14.3)
PSA			
All	287688 (46.3)	244650 (39.3)	213804 (38.6)
Non-Hispanic white	215137 (48.9)	191575 (40.5)	167533 (39.4)
Non-Hispanic black	19105 (37.6)	12672 (30.7)	10895 (30.8)
Hispanic	46146 (37.8)	35255 (36.0)	30900 (36.2)
Other	7250 (45.3)	5008 (41.7)	4343 (41.5)

Figure 2. The effect of age (<75 vs. 75+ years) on breast and prostate cancer screening use in older adults in Texas, by race/ethnicity and life expectancy, 2008-2009.



mammography than for PSA screening.

DISCUSSION:

Our results show that recommended breast cancer screening was under-used in older Texans with longer life spans. For women aged 67-74 years for whom screening mammography is generally recommended, the mammography screening rate was 52.3%, much lower than the Healthy People 2020 objective of over 80% breast cancer screening rate for women aged 50-74 years.[25] The appropriate use of PSA screening is controversial. ACS recommends PSA screening for men aged 50+ years and with a life expectancy of 10+ years. Under ACS guidelines, only 46.3% of older men with 10 or more years of life expectancy received PSA screening. However, these may be classified as overuse under USPTF USPSTF guidelines that no man of any age group should receive PSA screening.

Consistent with the literature,[26] we found that being NHW and having higher socio-economic status (ineligible for Medicaid and residing in areas with higher proportions of high school graduates) were associated with higher screening mammography utilization. Those with 1-2 comorbidities were more likely to be screened, possibly due to their increased visits to physicians. Studies have shown that more physician visits are associated with a higher likelihood of receiving cancer screening.[27] Also, great geographic variations in cancer screening were observed across Texas HSRs and counties. Mammography screening was most concentrated in northeast and central Texas. PSA screening was most concentrated in northeast Texas. More in-depth investigations on the distribution of health resources among Texas regions and its association with screening utilization are needed to reduce geographic disparities.

On the other hand, our data show clear evidence of over-utilization of breast and prostate cancer screening in Texas. Currently, PSA screening is not recommended for subjects older than 75 years and screening mammography for women older than 75 years should be jointly decided by patient and primary care providers based on a woman's individual risks and health status.[28-30] The 75-year cutoff is used in the guidelines as a proxy of limited life expectancy without considering the increasing heterogeneity among older populations in health status and life expectancy. However, it is the consensus that both mammography and PSA screening are not appropriate for subjects with limited life expectancy. We took the most conservative approach to evaluate over-utilization by assessing screening utilization in subjects older than 75 years and also with a limited life expectancy based on health status. Even in this population, about 22.0% of females received mammography screening and 38.6% of males received PSA screening. These screened patients may potentially be harmed by diagnoses of and treatment for cancer that would never be clinically symptomatic in their lifetime. Avoidance of over-screening will reduce potential harm to subjects with limited life expectancy, as well as free up health resources for increased cancer screening among appropriate target populations.

Multiple studies[31-34] have shown that screening should be based on life expectancy as there are populations of very healthy elderly and populations of much less healthy younger patients. However, most assume cancer screening should be based on age and many physicians practice in such a fashion. Indeed, our data showed that current screening decisions are primarily based on patient age without regard for life expectancy. For both mammography and PSA screening, being less than 75 years was associated with significantly higher odds of receiving screening, compared to being 75 years or more. The age effect was even greater among those with limited life expectancy. In other words, younger but very sick subjects were more likely to receive cancer screening than those older, but very healthy. This trend persisted among virtually all ethnic groups.

Systematic interventions are needed to increase cancer screening for appropriate target populations while also avoiding screening for inappropriate target populations. First, both the medical and public health communities need to be educated about the benefits as well as the harms of cancer screening. Current cancer screening advocacy

places nearly all emphasis on the benefits of screening and very little emphasis on the harms.[35] Second, varying guidelines have raised confusion about when and whom to test (Table 1). Using guidelines from different organizations will highly influence the population screened.[36] The fear of malpractice lawsuits often leads physicians to adopt more conservative screening guidelines as a part of defensive medicine.[37] Furthermore, current quality indicators measure how well a physician is doing based on how many screening tests are ordered without distinguishing appropriate screening from over-screening. Authorities have urged incorporation of both appropriate use and over-use in quality of care assessments.[6, 31] Finally, a decision tool needs to be developed and tested in a clinical setting which provides balanced information on potential benefits and harms of cancer screening based on patient health-accounted life expectancy.

In conclusion, both under- and over-screening were observed in Texas. Screening rates varied greatly across Texas geographic regions. In-depth investigations of the distribution of health resources among Texas regions and its association with screening utilization are needed to reduce geographic disparities. It is evident that screening decisions are currently based primarily on age, not life expectancy. Systematic interventions aimed at healthcare and public health professionals are needed to increase appropriate cancer screening and at the same time avoid inappropriate screening.

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