Effects of comorbidity on screening and early diagnosis of cancer in elderly people

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There is currently little data showing that older adults can derive benefit from cancer screening. Advancing age is associated with an increasing prevalence of cancer and other chronic conditions, or comorbidity, and questions remain about the interactions between comorbidity and cancer screening in the elderly population. In this Review, we assess the available evidence on the effects of comorbidity on cancer screening in elderly individuals. In view of the high heterogeneity of existing data, consistent recommendations cannot be made. Decisions on cancer screening in older adults should be based on an appropriate assessment of each individual's health status and life expectancy, the benefits and harms of screening procedures, and patient preferences. We suggest that Comprehensive Geriatric Assessment might be a necessary step to identify candidates for cancer screening in the elderly population. Specific clinical trials should be done to improve the evidence and show the effectiveness and cost-effectiveness of cancer screening in older adults.

Introduction

Ageing is associated with an increased prevalence of diseases, of which cancer is one of the most common. About 43% of men and 30% of women above the age of 65 years will develop cancer.[1] The age of the global population is rapidly increasing (figure), leading to a simultaneous increase in cancer prevalence and mortality. Thus, early detection of cancer in the elderly population should provide the best outcomes in terms of cancer mortality and patient quality of life. However, little is known about the benefits and harms of cancer screening in this age group. By contrast, large randomised trials have shown screening efficacy for decreasing breast cancer mortality in women aged less than 70 years,[2] and for decreasing mortality from colorectal cancer before the age of 74 years.[3]

The application of data from randomised trials to individuals requires care, especially for older adults, because there is large health-status variability as a function of age. The ageing process induces two important effects: a greater number of individuals with chronic disease and, of those, an increasing number with more than one chronic disease.[4] As a consequence, the burden and severity of other chronic diseases might have a major role regarding the relevance of early cancer detection. More in-depth research is needed to identify relations between chronic disease and cancer screening in the elderly population.

Prof Jean Pierre Droz

Figure: **Is cancer screening effective in an ageing population?**

General characteristics and definitions

Cancer screening and early diagnosis

Screening is defined as the early detection of cancer in asymptomatic individuals.[5] Several screening procedures have already been studied, including mammography for breast cancer screening; faecal occult blood test (FOBT), colonoscopy, and sigmoidoscopy for colorectal cancer screening; Papanicolaou (Pap) smears for cervical cancer screening; and the prostate-specific antigen (PSA) test for prostate cancer screening. Recommendations for cancer screening in elderly people have been published by different groups, such as the American Cancer Society, the US Preventive Services Task Force, and the American Geriatrics Society (webtable 1).[6–14]

See Online for webtable 1

Comorbidity

Feinstein defined comorbidity as "the existence or occurrence of any distinct additional entity during the clinical course of a patient who has the index disease under study".[15] Currently, there is no valid method to assess

comorbidity in older patients with cancer.[16] Reports of comorbidity vary widely in the published work. Comorbid conditions can be listed according to the International Classification–ninth revision (ICD-9) or any other system; or translated into summary comorbidity measures focused on selected conditions, such as the Charlson index.[17] However, many papers focus on a single chronic disease that has shown either a frequent prevalence or a significant relation with death in the elderly population.

Moreover, some researchers use composite parameters, such as life expectancy, propensity to die, or patient health status, instead of comorbidity. For example, life expectancy decreases not only with increasing age, but also with the number and severity of chronic diseases and the level of functional decline.[18] Thus, life expectancy in elderly individuals is highly variable. The distribution of life expectancy in different quartiles might serve as a proxy for the comorbidity burden. Other researchers take for granted that the health-status parameter reflects a combination of comorbidity and functional status (webtable 2).

Relations between comorbidity and receipt of cancer screening or diagnosis

Effects of comorbidity burden

Vaeth and co-workers[19] studied the relation between comorbidity, leading to a restricted ability to undertake basic activities of daily living, and breast cancer stage at diagnosis in 731 women with a median age of 65 years (range 40–85). Breast cancer stage was dichotomised as local or advanced (regional and distant) disease. Five comorbid conditions were shown to independently predict functional limitation in logistic regression analyses (ie, arthritis, and gastrointestinal, eye, respiratory, or kidney conditions). Patients were distributed according to the number of limiting conditions (ie, 0, 1, or ≥2). Bivariate analyses showed a weak relation between having no limiting conditions and receiving a diagnosis of advanced-stage breast cancer. In the multivariate analysis, women with two or more limiting conditions were less likely to be diagnosed with advanced-stage cancer than those without limiting conditions.

A cross-sectional study addressed the effect of patient age on physicians' recommendations for colorectal cancer screening in primary care.[20] Comorbidity was assessed by use of the Charlson index and categorised into two groups (ie, 0 and ≥1 comorbid conditions), and patients aged 50 to 80 years were stratified by age (ie, 50–64 years and 65–80 years). Recommendations for colorectal cancer screening included FOBT, colonoscopy, double-contrast barium enema (DCBE), and flexible sigmoidoscopy. In the oldest age group, no significant association was noted between comorbidity and screening recommendation. Older patients with coexistent depression were less likely to receive FOBT or colonoscopy recommendations. The researchers noted that depression in elderly people led to physicians less often recommending colon cancer screening, because they considered that the most urgent medical need was to treat the depression. Fisher and co-workers[21] noted no association between Charlson scores and use of FOBT—except in the case of severe illness burden, where there was a significant decrease in the odds of having FOBT, corresponding to a score of at least 10—in a sample of 77 268 veterans with a median age of 68 years.[21] In another study, the relation between comorbidity, distributed into categories based on Charlson score (ie, 0, 1, 2, and ≥3), and completion of colonoscopy or DCBE within 12 months after positive FOBT was assessed in patients aged 70 years or more.[22] No association was shown between Charlson score and either referral to gastroenterology for follow-up or performance of complete colon examination. Gross and co-workers[23] studied the relation between life expectancy after diagnosis of early stage colorectal cancer and age or comorbid conditions in a retrospective cohort of 35 755 patients with colorectal cancer, aged 67 years or more. Chronic conditions were selected by use of previously published indices.[24] Patients were divided into three groups according to the number of chronic diseases (ie, 0, 1–2, and ≥3). The percentage of patients with a diagnosis of early stage colorectal cancer was shown to be around 25–30%, regardless of age or coexistent disease.

See Online for webtable 2

The performance of PSA screening was studied in 597 642 men aged 70 years or more.[25] Patients were stratified according to Charlson scores into three health groups: best (score=0), average (1–3), and worst health (≥4); and into four age groups (70–74, 75–79, 80–84, and ≥85 years). A high proportion of PSA screening (56%) was noted in the study cohort, ranging from 64% for men aged 70–74 years to 36% for men aged 85 years or older. Increased Charlson scores were associated with only a small decrease in PSA screening. Multivariate analyses confirmed the weakness of the effect of comorbidity on PSA screening. These findings were consistent with those reported in a study published in 2003,[26] which aimed to identify the use of PSA screening in men aged 75 years or more. Comorbidity was assessed by use of the Charlson index. Comorbidity scores were not shown to have an important role in the decision to provide screening in elderly men (webtable 2).

Effects of common individual chronic diseases

A retrospective cohort study assessed the relations between mammography use and age, three self-reported health-related variables, including comorbidity, and functional status.[27] More than 2000 women aged 75 years or more self-reported a history of hypertension, myocardial infarction, stroke, diabetes, Alzheimer's disease, or a broken hip. Bivariate analyses showed a significant association between a history of stroke, hip fracture, or dementia and mammography use (webtable 3). In the subgroup of women with functional limitations, those with a broken hip, were significantly

See Online for webtable 3

less likely to receive mammography (odds ratio [OR] 0·45 [95% CI 0·25–0·84]) and there were similar findings for stroke and dementia.

Heflin and co-workers[28] did a survey to assess the association between the type and number of chronic conditions and the receipt of cancer screening in patients aged 65 years or greater. More than 2500 patients with a mean age of 79 years self-reported the receipt of four screening methods (mammography, clinical breast examination [CBE], Pap smear, and FOBT) and the existence of eight comorbid conditions: myocardial infarction, stroke, cancer, hip fracture, hypertension, arthritis, chronic lung disease, and diabetes. Data on cognitive function and depression were also recorded. Comorbidity was divided into two categories (0–2 and ≥3 comorbid illnesses). Hip fracture was significantly associated with low receipt of mammography. Similarly, cognitive impairment was associated with low receipt of FOBT and a trend towards limited receipt of mammography, CBE, and Pap smear. By contrast, hypertension was associated with a significantly higher receipt of CBE, Pap smear, and FOBT, and a trend towards higher receipt of mammography, than in the absence of hypertension. Patients with three or more comorbidities were more likely to receive mammography, CBE, and Pap smear than patients with less than three comorbidities.

See Online for webtable 4

Kiefe and co-workers[29] investigated the role of chronic disease as a barrier to screening for breast and cervical cancer in 724 women attending either general primary care or family practice clinics. Data included information on receipt of mammography, CBE, and Pap smears, and on twelve chronic conditions. In the youngest age group (65–74 years), angina and gastrointestinal bleeding were significantly associated with lower receipt of mammography and peptic ulcers were associated with a lower receipt of Pap smears than in women without these disorders. Women aged 75 years or greater with osteoarthritis were more likely than those without osteoarthritis to have mammography and Pap smears. Congestive heart failure decreased the use of mammography.

Another paper aimed to establish whether comorbidity affects the stage at which breast cancer is diagnosed.[30] The study focused on data from the Surveillance, Epidemiology and End Results (SEER) programme for 17468 women with breast cancer, aged 67 years or more. Comorbidity was reported in 24 categories, based on the most prevalent disease in the studied population. Multivariate models showed that women with cardiovascular disease, musculoskeletal disorders, mild-to-moderate gastrointestinal disease, or benign breast disease had a 13%, 7%, 14%, or 24% lower OR, respectively, of being diagnosed with advanced breast cancer than those without these disorders. Conversely, women with diabetes, other endocrine disorders, psychiatric disorders, or haematological disorders were associated with a 19%, 11%, 20%, and 19% increased odds ratio, respectively, of being diagnosed with late-stage disease than those without (webtable 3).

Effects of selected conditions

Patients with end-stage renal disease (ESRD) on dialysis

Stages of cancer at diagnosis were compared between 1629 patients (66% of patients aged ≥65 years) with ESRD on dialysis and the general population.[31] Cancer stages were categorised as localised (in situ or localised) and non-localised (regional or distant). In Medicare-eligible patients aged 65 years or greater, colorectal cancers were significantly more likely to be diagnosed earlier in the ESRD group than in the non-ESRD group. Conversely, prostate cancers were significantly more likely to be diagnosed at a later stage in the ESRD group. No significant differences in stage at diagnosis were noted for breast cancer, bladder cancer, renal carcinoma, lung cancer, or lymphoma (webtable 4).

Psychiatric illness: schizophrenia

In a subgroup of women aged 65 to 79 years with schizophrenia, Pap test and mammography were received less compared with women without schizophrenia, although these findings were not significant (webtable 4).[32]

Alcohol and tobacco-related comorbidity (ATC)

A study assessed opportunities for an early diagnosis of head and neck cancers in 11312 patients aged 65 years or more, characterised by ATC.[33] The ATC index described elsewhere[34] included 11 conditions and was collapsed into two groups (0 and ≥1 comorbidity). In patients without ATC, higher numbers of physician visits were independently associated with a decreased risk of advanced-stage disease at diagnosis, especially for pharyngeal and laryngeal tumours. By contrast, in patients with one or more ATC, medical visits were only associated with a significantly decreased risk of late-stage disease at diagnosis in laryngeal tumours (webtable 4).

Diabetes mellitus

Two studies addressed the use of screening services in elderly women with diabetes.[35,36] Data concerning women aged 67 years or more with or without diabetes were extracted from the SEER-Medicare database.[35] Charlson scores, with the exclusion of diabetes, were categorised into three groups (0, 1, and ≥2). Elderly diabetic women were less likely than those without diabetes to receive mammography or colorectal-cancer screening. Moreover, in elderly women with diabetes, those with Charlson scores of 2 or greater were less likely to receive mammography, and colorectal-cancer screening. These findings are similar to those from a case–control study of women with diabetes compared with those without diabetes (mean age 64 years [SD 7·6]). Mammography rates were significantly lower in diabetic women

(OR=0·63; 95% CI 0·47–0·85). A trend was also found towards lower mammography use in patients with stage 2 or 3 diabetes compared with those with stage 1 (webtable 4).[36]

Cognitive decline

Cancer screening in elderly people with cognitive impairment raises ethical considerations.[37] A study was done in 6053 female respondents to the 1998 National Health Interview Survey (NHIS) who were aged 50 years or older.[38] The women self-reported the use of mammography, cognitive limitations, and the following comorbid conditions: hypertension, coronary artery disease, myocardial infarction, and stroke. Comorbidity was categorised as 0, 1–2, and 3–4. Around 35% of the women were aged 70 years or more, of whom more than 50% self-reported cognitive limitations. Women with cognitive limitations were less likely to report mammography screening than those without cognitive decline. Data did not show any effect of increased comorbidity on the use of mammography.

Two studies explored patterns of care in older patients with dementia and breast or colon cancer.[39,40] One reported the use of breast cancer care in female patients aged 65 years or more with or without Alzheimer's disease. Elderly women with dementia were more likely to be diagnosed with late-stage breast cancer than patients without dementia (10·8% of 1935 *vs* 6·6% of 3202 patients at stage III, p<0·001).[39] The second study showed that older patients with dementia were twice as likely as those without dementia to have colon cancer reported after death (by autopsy or noted on death certificate).[40] In those diagnosed before death, older patients with dementia were twice as likely to be diagnosed by use of non-invasive procedures than by histological methods (webtable 4).

Relations between patient-health outcomes and cancer screening or diagnosis

Mortality

Comorbidity and cancer are competing risk factors for mortality. Gonzalez and co-workers[41] explored the effect of comorbidity on cancer stage at diagnosis in a cohort of 32 074 patients, mostly aged 65 years or more. Increased comorbidity was associated with a late-stage diagnosis of colorectal cancer, breast cancer, prostate cancer, and melanoma. For each tumour type, survival was lower for patients with comorbidity than for those without. Findings suggested that the higher mortality noted in elderly patients with cancer was mainly a consequence of co-morbidity rather than late-stage at diagnosis (webtable 5).

Life expectancy

Walter and Covinsky[42] published a proposal of framework for decision making with respect to screening in elderly individuals. The researchers used quantitative estimates of life expectancy, divided in upper, middle, and lower quartiles.

This concept was used by Schonberg and co-workers[43] to assess the relation between breast cancer screening and life expectancy in 882 women aged 80 years or more. Elderly women were expected to derive benefit from mammography if their life expectancy was more than 5 or 10 years. Patients self-reported history of heart disease, stroke, diabetes, cancer, chronic lung disease, and kidney failure. Comorbidity burden was distributed into three categories—0, 1, and 2 or more conditions. Patients were categorised into one of the three life expectancy quartiles. There was no significant relation between increased comorbidity burden and mammography use. Most women with life expectancies of 10 years or more received mammography or a physician recommendation. Around 40% of women with life expectancies of less than 5 years and more than 50% of those with life expectancies between 5 and 10 years were screened.

A similar design was used in elderly patients to establish the risks and benefits of three different colorectal cancer screening methods.[44] The researchers assumed that individuals with estimated life expectancies of less than 5 years would not undergo screening. A cross-sectional study was done in 1244 individuals undergoing screening colonoscopy to determine estimated life-years saved in very elderly (ie, 80 years or older) and younger people.[45] Although the prevalence of colon cancer increases with age, the adjusted mean extension of life expectancy and the percentage of patients who benefited from screening colonoscopy were low in the elderly group (1·7% and 16%, respectively; webtable 5).

Health status

A cross-sectional study aimed to establish the relation between health status and use of mammography or Pap smears in women aged 70 years or more.[46] Health status was assessed by use of the SF-12 Physical Summary Scale (PCS-12). The use of mammography and Pap smears decreased with advancing age. Within each age group, the proportion of women reporting both screening methods did not significantly decrease with worsening health status. Multivariate logistic regression analysis confirmed that health status was not an independent predictor of mammography or Pap smear use.

Associations between self-reported health status and mammography use were studied in 1772 women aged 50 years or more (50% of patients were aged 65 years or greater).[47] Health status was categorised into three groups—good or better; fair; or poor. In logistic regression analyses, there was no significant association between self-reported health status and mammography use after adjustment for age and other covariates, such as education level, race, smoking, or insurance status.

See Online for webtable 5

Bynum and co-workers[48] examined the variation of mammography screening with age, race, and health status.

The investigators determined individuals' health status by estimating their probability of dying within 1 year. They then stratified patients into quintiles of increasing probability of death and into five age groups (ie, 65–69, 70–74, 75–79, 80–84, and 85 or more years). In 722 310 female Medicare beneficiaries, the mammography screening was done in 42% of women aged 65–69 years and 26% of women aged 85 years or more when adjusted for propensity to die. 70% and 19% of the youngest women within the best and worst quintiles, respectively, were screened, compared with 48% and 5% in the oldest age group. With the same health status, younger women were 1·61 times more likely to be screened than elderly women.

A mail survey of primary care physicians was done to estimate the effect of health status on physicians' recommendations regarding breast and cervical cancer screening in elderly patients.[49] Health status was divided into three groups according to comorbidity and functional status, (ie, healthy, moderately ill, and frail). Scenarios describing older patients with estimated life expectancy were constructed on the basis of a previously described model.[42] Worsening health status was significantly associated with a lower likelihood of offering screening by mammography and Pap smears. However, 30% and 13·4% of physicians indicated a high likelihood of offering mammography or Pap smears, respectively, to a frail 90-year old woman.

A cohort study aimed to assess the frequency of self-reported receipt of mammography and Pap smears in older women.[50] Two age cohorts were included in the study—50–64 years and 70–89 years. Explanatory variables included self-reported health (fair or poor, excellent, very good, or good), self-reported cognitive impairment, and subjective life expectation coded as high, medium, or low according to the answer to the following question: "What do you think are your chances that you live another 5 years?" In the oldest age group, multivariate regression analyses showed that women with self-reported poor or fair health status were less likely to receive Pap tests than those with self-reported excellent, very good, or good health status, whereas women with cognitive impairment were less likely to receive mammography than those without. Women with medium life expectation were more likely to receive mammography than those with lower or higher life expectations (webtable 5).

Screening efficiency

Walter and co-workers[51] assessed the potential burden of breast cancer screening in a cohort of 216 frail older women aged 55 years or more (mean age 81 years). Most patients had five or more comorbidities; 49% had cognitive impairment. Few women (18%) had an abnormal mammography, but did have burden from screening mammography (ie, false-positive mammograms, pain, or psychological distress). Four women were diagnosed with either invasive cancer (n=3) or ductal carcinoma in situ (n=1). Only two of these women were expected to derive benefit from cancer screening.

The cost-effectiveness of screening was assessed by use of a simulation model integrating life expectancy as a proxy for physiological age.[52] The investigators estimated expected incremental costs per life-years saved (LYS). Extending screening to age 79 years saved an additional 2·4 and 24·9 days of life per woman, for the general population and in women destined to develop breast cancer, respectively, with an incremental cost of more than US$82 000 per LYS. Extending screening to lifetime would save an additional 1·1 and 12 days of life for the general population and for women destined to develop breast cancer, respectively, and costs more than $151 000 per LYS. From a societal perspective, the cost-effectiveness of breast cancer screening is too low to be offered on an annual basis beyond the age of 70 years. However, the suggested screening model remains cost effective beyond age 79 years for elderly women in the top 25% of life expectancy. These findings are consistent with those published earlier by Kerlikowske and colleagues,[53] who noted that continuing mammography screening to age 79 years would provide 2·1 additional days of life expectancy and prevent 9·4 deaths only in women with higher bone mineral density (webtable 5).

Discussion

The presence of concurrent conditions, or comorbidity, has been thought to have important implications for cancer screening in elderly people. We have shown that reports of comorbidity and its severity seem to be extremely variable in the published work. Most studies unfortunately consider comorbidity as a binary variable (ie, present or absent), without taking severity into account. Moreover, the accuracy of data collection is not consistent across all studies. For example, many older people fail to mention sensory or osteoarticular impairments, because they consider them to be part of normal ageing. This high heterogeneity makes analysis of the findings from different studies difficult.

Studies have shown that diabetes, cognitive decline, psychiatric disorders (ie, schizophrenia and depression), or hip fracture might negatively affect the receipt of cancer screening independently.[20,27,28,32,35–40] However, we noted that the presence of several comorbid conditions might increase the opportunity of receiving cancer screening or diagnosis, because of more frequent contact with health-care providers.[28–30] Conversely, patients with ATC comorbidity or diabetes did not seem to derive similar benefit from increased physician visits.[33,35,36] In these cases, comorbidity and its cumulative health effects might dominate clinical care, and health providers might believe that cancer screening or diagnosis would only moderately affect the life span of these patients. Patients with ESRD also have a high frequency of physician visits, which seemed to have different effects on cancer stage at diagnosis.[31] Colorectal cancer was more likely to be

diagnosed at an early stage, whereas prostate cancer was twice as likely to be diagnosed at a distant stage. Anaemia is a common symptom in patients undergoing dialysis. The frequent gastrointestinal workup to identify digestive blood loss can lead to the incidental discovery of malignant lesions. By contrast, patients with ESRD frequently have no urinary output, and thus no urinary tract symptoms leading to the detection of prostate cancer.

Receipt of cancer screening was shown to be related to the comorbidity burden. But the invasiveness of screening modalities might also affect physicians' decision to recommend them. Thus, PSA screening only slightly decreased with increased Charlson scores whereas colonoscopy was less likely to be offered because of the potential risk of perforation, dangerous preparation, or difficulty to maintain a defined position.[54]

The benefits of cancer screening are not immediate. In randomised trials of FOBT and mammography, a decrease in cancer-related mortality was not seen until at least 5 years after the start of screening.[2,3] Cancer leading to death within 5 years of diagnosis might be too aggressive for patients to benefit from early detection and treatment. Hence, older individuals with a life expectancy less than 5 years would not derive survival benefit from cancer screening. An estimation of the life expectancy can be obtained from national life tables with regard to comorbidity burden and functional status.[55] By use of the estimated life expectancy variable, Ko and Sonnenberg[44] defined age subgroups that would not derive benefit from colorectal cancer screening. However, Schonberg and co-workers[43] noted that many elderly women with life expectancies less than 5 years or between 5 and 10 years received mammography screening.[43] These findings emphasise the difficulty for many physicians to estimate an individual's life expectancy. Similar inappropriate rates of screening were also reported for colorectal cancer.[21] Although Charlson scores were strongly associated with survival, increasing scores did not affect the use of FOBT in elderly veterans. The expected gain in life seemed low in elderly patients undergoing colonoscopy screening,[45] thus advocating careful consideration of potential benefits and risks before recommending such screening in the older population. Furthermore, comorbidity seemed to have a greater effect on survival than late-stage colorectal cancer at diagnosis.[41]

Findings from studies that assessed health status as a predictive factor for life expectancy were more perplexing. Health status combines comorbidity burden and function level, both of which are major determinants of life expectancy.[56] In some reports, decreasing health status assessed by use of the PCS-12 scale or theoretical case scenarios did not show a significant association with decreasing use of mammography screening,[46,49] whereas other studies showed that worsening health status, assessed by self-report questionnaires or a propensity to die, correlated with decreased receipt or recommendation of mammography screening.[48,50]

Because the estimation of individual health status or life expectancy seems to be difficult, with no validated methodology, we noted both overscreening and underscreening in the elderly population.[57,58] Moreover, physician recommendations have been shown to have a significant effect on screening behaviours.[27] These findings suggest that, to promote adequate use of cancer screening in the older population, efforts should be made to enhance physicians' knowledge on the risks and benefits of screening.

When studying attitudes towards the continuation of cancer screening later in life, Lewis and co-workers[59] noted that most older, well-educated, adults were in favour of continuing screening throughout their lives, even against their doctor's recommendation,[59] and most believed that elderly people living in nursing homes, or those with Alzheimer's disease or who are totally dependent, should continue to be screened. These findings suggest that efforts should also be made to better educate older individuals about the potential risks and benefits of screening. The prevalence of cognitive impairment increases with age and cancer screening poses an important ethical question for people with cognitive decline. Studies have shown that older patients with dementia are less likely to receive cancer screening.[27,28,37–40] Raik and co-workers[37] have proposed a framework for mammography decision making in cognitively impaired women, which can be extended to other screening scenarios.[37] The researchers have taken into consideration the severity of dementia, life expectancy, potential risks and benefits of cancer screening, and patient or surrogate preferences, if known. When screening leads to life-prolonging therapy or better quality of life, the researchers recommend screening.

In addition to the importance of comorbidity burden, some investigators emphasise the key role of functional status. Limitations in activities of daily living have been shown to decrease the use of mammography screening in elderly women.[27,38,41,49,51] Because functional status is a more important predictor of longevity than comorbidity, this parameter should be considered when recommending cancer screening in elderly people.

A major limitation of cancer screening in the elderly population is the absence of consistent guidelines. Up to now, only one organisation recommends prostate cancer screening in men aged 50 years or older.[7,9,12] It is important to note that there are no negative guidelines for breast, colorectal, and cervical cancers. The increasing incidence of colon, breast, and prostate cancers could justify the continuation of screening in elderly patients. By contrast, the incidence of cervical cancer decreases with age, discouraging the use of such screening tests in older women.

The true benefits of cancer screening in the elderly population remain uncertain, both in terms of survival

Search strategy and selection criteria

A search of Medline was done using combinations of the terms "comorbidity", "chronic diseases", "cancer screening", "early diagnosis", "elderly", "older patients", "diabetes", "heart disease", "mammography", "Prostate Specific Antigen", "faecal occult blood test", and "colonoscopy". Articles were selected that dealt with entire popultaions or subgroups aged 65 years and older. Only papers published in English between January, 1997, and December, 2007, were included.

improvement and cost-effectiveness. Discontinuation of cancer screening is recommended for patients with severe comorbidity, limited life expectancy, or poor health status.[6–14]

Conclusion

Up to now, there are no established guidelines on cancer screening in elderly people due to the paucity of clinical trials including a sufficient proportion of older patients. Nonetheless, some recommendations can be derived from this review of the published work. The presumed benefits of early cancer detection, in terms of improved survival and quality of life, must be balanced against possible negative consequences, such as no improvement of disease-specific mortality, and also against underlying life expectancy concerns. Decisions about screening need accurate estimation of the benefits and risks for each person. Health and functional status, and comorbidity are the most appropriate indicators of expected life span, compared with chronological age alone. Healthy elderly people seem to benefit from continuing cancer screening. Conversely, the use of screening tests might be inappropriate in frail older individuals. For physicians, the major challenge is the crucial identification of appropriate candidates for cancer screening. Consequently we propose that a Comprehensive Geriatric Assessment should be done before recommending cancer screening. This would provide a complete picture of the health status of elderly individuals and would help avoid under-screening in healthy people and over-screening in frail individuals. Further clinical trials should be done to show the effectiveness and cost-effectiveness of cancer screening in the elderly population, and physicians and older people should be informed of these issues to make appropriate individual decisions.

Conflicts of interest

The authors declared no conflicts of interest.

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