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Physical and Psychosocial Issues in Lung Cancer Survivors

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Lung cancer emerged during the 20th century as an epidemic of enormous proportions.[1] A rare disease at the beginning of the past century, lung cancer continues to be one of the most common cancers in the world, affecting 174,470 Americans (92,700 men and 81,770 women) in 2006.[2] Mirroring changes in smoking patterns, the incidence of lung cancer among men continues to decline. Large-scale smoking among women occurred almost 20 years after men in the United States, with a subsequent delay in increased cases, peaking in the 1990s. Encouragingly, the most recent evidence demonstrates that lung cancer incidence among women is declining, as are death rates.[3] In 2000, approximately 13% of men and 17% of women (age-adjusted, 15% overall) diagnosed with lung cancer were expected to survive at least 5 years (an estimated 26,065 Americans each year).[2]

There has been minimal (albeit statistically significant) increase in the overall percentage of survivors over the past 30 years (13%, 1974–1976; 14%, 1983–1985; 15%, 1992–1999).[2] The focus of this chapter is on the emerging data describing the long-term medical and psychosocial consequences of survival from lung cancer and its treatment. In addition to length of survival, the physical, psychologic, social, and existential components of heath-related quality of life (HRQOL) data have been recognized as important outcome measures of lung cancer treatment for more than 30 years.[4,5] These measures are now a common part of clinical trials of patients with lung cancer,[6] but there is limited information about HRQOL of long-term survivors. In an extensive review of literature on HRQOL in patients with lung cancer, 151 studies were identified covering 1970–1995.[7] Almost all these studies focused on patients in treatment. Only one focused on patients with early-stage disease treated by surgery,[8] and only one study was identified with long-term survivors.[9] Since that review, there have been several additional reports[10–14] on survivors of lung cancer who were disease free and off treatment at the time of the data collection. Details of these studies and others focused on recovery after curative treatment are displayed in Table 13.1.

Lung cancer survivorship, in contrast to breast cancer survivorship, which has shaped the quantity and quality of survivorship research, is in its infancy. For the purposes of this chapter, studies published (in English) since 1980 that provide data about the physical functional status, HRQOL, symptoms, and other issues experienced by survivors after curative treatment are reviewed. Studies that only addressed cardiopulmonary function in the brief postoperative period are not included.

Survivorship and Lung Cancer

There are many survivors of lung cancer as a result of the high incidence of this disease when using the National Coalition of Cancer Survivors' definition, which is "from the point of diagnosis forward." However, with a definition that sets a defined time frame of "5-year survival" or "disease-free survival," the field of survivors is narrowed to a smaller number of patients and, thus, a more-limited opportunity for research. Survival following a diagnosis of non-small cell lung cancer depends primarily upon stage and effective treatment. Only 16% of patients are diagnosed with localized disease, 36% with regional disease, and 38% with distant metastasis.[3] Although more than 80% of patients with surgically resected stage IA disease may have 5-year disease-free survival, expectation of survival diminishes progressively through stages II and III and is rare in stage IV. If untreated, few patients, even with small peripheral stage IA tumors, survive 5 years.[15,16] The statistics for long-term survivors of limited-stage small cell lung cancer are even less optimistic. Only 6% of 144 patients with limited-stage disease treated in Canada survived longer than 5 years.[17]

Long-Term Impact of Curative Surgical Interventions

The majority of HRQOL studies including patients with lung cancer have focused on symptoms of and issues facing patients with advanced disease.[7] The quality of lung cancer survivorship and resulting physical impairment has been minimally addressed. The majority of medical issues surrounding lung cancer survivorship are related to curative surgical therapy and tend to be short term. A major consequence of the successful treatment of lung cancer arises from the

TABLE 13.1. Studies documenting symptoms, functional status, and quality of life of lung cancer survivors since 1980 (in chronologic order).

Author	*Sample[a] characteristics: mean age[b], sex, ethnicity[c], education, marital status, health status*	*Disease characteristics/treatment/ follow-up period*	*Purpose/method Comparison group*	*Findings related to survivorship*
Nou and Aberg[71]	$N = 69$ (34% of whom received surgery for cure, $n = 21$, 30%, survivors) Age: 62 years Ethnicity: Swedish Health status: ND	Histology: bronchial carcinoma (1967 WHO classification) Stage: mixed Surgery: 27% pneumonectomy, 62% lobectomy, 13% nonresectional thoracotomies Follow up: 3–8 years Disease-free status not clear	Purpose: describe HRQOL and symptoms postthoracotomy, 1-month and at 3-month intervals Method: prospective evaluation of performance status by physicians Instruments: Carlens vitagram index (performance level, including working capacity, ambulation, symptoms, hospital treatment) Comparison groups: 28% nonresectional thoracotomy, 72% deceased patients	Good HRQOL among 5-year survivors: most capable of full-time work Initial preop HRQOL highest for long-term survivors Noncurative resection associated with lower HRQOL Specific information about symptoms not provided
Pelletier et al.[33]	$N = 47$ Age: 58 Sex: majority male Ethnicity: Canadian Health status: ND	Histology: ND Stage: ND Surgery: 43% pneumonectomy, 57% lobectomy Follow-up: approximately 3 months (mean 73 days postlobectomy, 62 days postpneumonectomy, range 29–200 days)	Purpose: evaluate impact of lung resection on pulmonary and exercise capacity Method: prospective pre- and 3 months postop Instruments: Borg scale Spirometry, exercise testing Comparison: No	Lobectomy: 20% reduction in exercise capacity Pneumonectomy: 28% reduction in exercise capacity due to dyspnea Leg discomfort contributed to decreased exercise capacity postop; none were limited by thoracic pain Decrease in PF is a poor predictor of exercise capacity
Dajczman et al.[40]	$N = 56$ (91% with malignant disease) Age: 62 Sex: 50% male Health status: ND	Histology: ND Stage: ND Surgery: lateral thoracotomy by 1 surgeon; 13% received postoperative radiation Rx Follow-up: median 19.5 months (range 2 months–5 years), disease free at time of interview	Purpose: describe prevalence and impact of postop pain Method: cross-sectional Instrument: interview about presence, intensity, functional impact of postthoracotomy pain, and influencing factors; VAS for pain Comparison: none	Persistent pain: 55% 1 year, 45% >2 years postsurgery, 38% >3 years, 30% >4 years Pain group: 33% had constant pain, 43% numbness, 23% shoulder pain Pain interfered with daily lives (44%) Five used medication, 3 had undergone nerve block NS differences in demographic or disease/ treatment variables in groups with or without pain Patients with no pain reported functional limitations, numbness
Dales et al.[8]	$N = 91$ with lung cancer (of 117) Age: 65 Sex: 71% male Ethnicity: Canadian Health status: 14% had	Histology: ND Stage: ND Surgery: 73% Lobectomy, 20% Pneumonectomy Follow-up: up to 9 months	Purpose: compare pre and post (1, 3, 6, and 9 months) operative HRQOL Method: Prospective self-report Instruments: QL-Index, Sickness Impact Profile Clinical Dyspnea Index, Pneumonconiosis Research Unit Index	Dyspnea peaked at 3-months (34%), but continued for 10% at 6 and 9 months Patients with cancer had 2× decrease in HRQOL at 1, 3 months postop ADL returned to baseline at 6, 9 months HRQOL scores similar for all groups preop,
patients	moderate/severe dyspnea preoperatively Tobacco use: 25% current smokers, 72% former smokers		Comparison: $n = 26$ who underwent thoracotomy without lung cancer	with cancer had significantly greater deterioration postop Extent of resection and cancer dx associated with deterioration in HRQOL in SIP Older age associated with poorer scores on

				QL-Index
Schag et al.[9]	$N = 57$ Mean age: 62 Sex: 56% male Ethnicity: 93% white Education: 68% ≥ HS Marital status: 61% married Health status: 41% hypertension, 32% heart disease, 11% diabetes, 7% skin cancer, 11% alcohol use	Histology: ND Stage: disease-free Surgery: 84% had surgery (details not described) Follow up: Mean 3.4 years since diagnosis, $n = 33$ short-term (>2–5 years), $n = 24$ long-term (>5 years) survivors	Purpose: describe and compare HRQOL among lung, colon, and prostate cancer survivors Method: cross-sectional, self-report Instruments: Cancer Rehabilitation Evaluation System (CARES), HRQOL–LASA Comparison: survivors of colon ($n = 117$) and prostate cancer ($n = 104$)	Lung cancer survivors had more problems than other cancer survivors Disruptions in physical function and pain were frequent and severe problems (46% chronic pain from scars) Short-term survivors noted depression (51%) and anxiety (63%), and distress with body changes (35%), 28% report feeling overwhelmed by cancer 17%–45% report difficulties with partners (e.g., communication, expressions of affection), 79% decreased sexual contact and problems, 7%–27% difficulty in dating, 63% difficulty with memory, 25%–32% with difficulty with thinking clearly Of the 1/4 working at the time of diagnosis, 96% of short-term survivors quit work due to disease and treatment
Cull et al.[48]	$N = 64$, >2 years in remission Age: 61 (median) Sex: 51% male Ethnicity: Scottish Education: 19% > HS Health status: ND	Histology: SCLC Stage: 95% limited-stage disease Treatment: 80% PCI (50% with concurrent chemo) Follow-up: 2 to >8 years	Purpose: describe HRQOL and prevalence of neuropsychologic disturbances in long-term survivors Method: Instruments: clinical and neurologic examination, CT scan, neuropsychologic testing, HRQOL (RSC, HADS)	Abnormal neuro exams (24% of $n = 37$), 16% with ataxia, 11% cognitive deficits; no association with abnormalities found on neuropsych testing: 81% (of 59) impaired on ≥1 exam, 54% ≥ 2 Most common HRQOL disruptions: fatigue (64%), lack of energy (59%), difficulty sleeping (54%), problems with concentration (54%); >1/3 had dryness of mouth, tingling hands/feet, pain/burning in eyes; psychologic distress similar to normative data for cancer survivors HADS (borderline/case level): 19% anxiety, 15% depression
Landreneau et al.[39]	$N = 142$ VATS, $N = 97$ thoracotomy (<1 year) $n = 36$ VAT, $n = 68$ thoracotomy (>1 year postoperative) Age: 60 (VATS), 59 (thoracotomy) Sex: 56% men (VATS), 42% men (thoracotomy) Health status: ND	Histology: malignant group: 66% of thoracotomy patients, 42% VATS Stage: ND Surgery: VATS, thoracotomy Follow-up: <1 year postop, >1 year postop	Purpose: compare prevalence and severity of chronic pain post-VATS vs. lateral thoracotomy Method: cross-sectional Instruments: Visual analogue scale to assess presence and intensity of discomfort, and shoulder limitations on the side of the operation Use of medication: Comparison: None	<1 year postop, VATS group had significantly less pain and shoulder dysfunction, but similar use of pain meds No significant differences >1 year postop
Hendriks et al.[23]	$N = 100$, $N = 31$ with HRQOL data (48%) response ND for HRQOL subset	ND for subset	Purpose: describe HRQOL 2.5 months postthoracotomy Methods: mailed questionnaire Instruments: EORTC QLQ = 30 Comparison: none	Good/excellent global HRQOL (56%) Poor/very poor HRQOL (26%) Higher percent of patients with pneumonectomy had lower scores Dyspnea (29%), pain (29%) no clear relationship of sx to extent of resection

(*continued*)

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Author	*Sample[a] characteristics: mean age[b], sex, ethnicity[c], education, marital status, health status*	*Disease characteristics/treatment/ follow-up period*	*Purpose/method Comparison group*	*Findings related to survivorship*
Zieren et al.[34]	$N = 52$ (12 months postoperative), $n = 20$ (pre- and postoperative data) Age: 61 years Sex: 73% male Ethnicity: German Marital status: 12% partnered Health status: ND	Histology: NSCLC Stage: ND Treatment Surgery: 81% Lobectomy, 10% pneumonectomy Adjuvant treatment: 25% radiation therapy Follow-up period: 1 year, 19% with recurrence	Purpose: describe HRQOL post surgery Method: mix of cross-sectional and prospective Instruments: EORTC HRQOL, Psychologist-rated Spitzer HRQOL Index Comparison: none	Dyspnea at exertion and pain continued at 12 months Physical dysfunction returned to preoperative level at 12 months postsurgery Emotional, social, and financial dysfunction was less severe, but continued postop Pneumonectomy was associated with more symptom distress and limitations in physical function, but not with greater emotional, social, or financial dysfunction NS differences based upon adjuvant treatment. HRQOL rated as higher by the external rater as compared to the patient. 12% employed full time Recurrence negatively impacted postop HRQOL
Bolliger et al.[30]	$N = 68$ Age: 61 Sex: 84% males Ethnicity: Swiss Health status: Preoperative $FEV_1 = 2.38$ (lobectomy), 2.50 (pneumonectomy)	Histology: ND Stage: ND Surgery: 74% lobectomy, 26% pneumonectomy Follow-up: 3 and 6 months postop	Purpose: compare effect of lobectomy and pneumonectomy on PFT, exercise capacity, and perception of symptoms Method: prospective, pre, 3, 6 months postsurgery Instruments: PFT Comparison group: none	Lobectomy: no change in exercise capacity; PFT significant decreased at 3 months and significant increased at 6 months (10% permanent loss) Exercise capacity limited by leg muscle fatigue and deconditioning Pneumonectomy: 20% reduction in exercise capacity; PFT significant lower at 3 months and did not recover at 6 months (30% permanent loss); significantly lower than lobectomy, exercise capacity limited by Dyspnea
Larsen et al.[28]	$N = 57$ with pre and post assessments Age: 59 (pneumonectomy); 67 (lobectomy) Sex: 72% male Ethnicity: Danish Health status: ND	Histology: NSCLC Stage: ND Surgery: 28% pneumonectomy, 72% lobectomy	Purpose: describe postop changes in cardiopulmonary function Methods Instruments: exercise testing, pulmonary function, arterial blood gas	Lobectomy: minimal change in lung function or exercise capacity Pneumonectomy: decrease in PF, but compensation due to better oxygen uptake; decrease in exercise values less than expected Change in FEV_1 was a poor predictor of change in exercise capacity Variable changes in PF and exercise capacity with some patient improving postop, some worsening, and some with little change
Mangione et al.[42]	$N = 123$ with lung cancer Age: 64 Sex: 54% male Ethnicity: 97% white Health status: 94% with at least 1 comorbid condition, 49% with >3	Histology: NSCLC Stage: ND Surgery: thoracotomy Follow-up: 6 and 12 months postsurgery	Purpose: examine HRQOL changes over time and compare HRQOL of patients undergoing elective surgery Method: prospective, pre- and postsurgery Instruments: SF-36, Specific Activity Scale, health transition questions and rating of general health Comparison: $n = 236$, with total hip arthroplasty, $n = 95$, repair of abdominal aortic aneurysm	Significant declines in health perceptions, physical function, role-physical, bodily pain, vitality, social function at 6 and 12 months after surgery Improvement in mental health and role-mental function over time By 12 months, physical function, bodily pain, health perceptions were lower than preop levels, but similar to population-based norms Compared to other groups, lung cancer patients continued to have the lowest health perceptions, lower role-physical and social function ratings

Nezu et al.[26]	$N = 82$ (including $n = 10$ undergoing lobectomy with hemodynamic data) Lobectomy: Age: 64 Sex: 84% male Ethnicity: Japanese Pneumonectomy: Age: 62 Sex: 90% male Ethnicity: Japanese Health status: FEV_1% predicted: 86 (lobectomy) $n = 6$ hypertension, $n = 2$ chronic bronchitis	Histology: ND Stage: "operable" Surgery: $n = 20$ pneumonectomy, $n = 62$ lobectomy Follow-up: 3, >6 months postop	Purpose: assess effects of resection on exercise limitation Method: prospective, pre- and postop Instruments: exercise testing, spirometry, Borg scale (dyspnea) Comparison: none	Improvement in exercise capacity 3–6 months postop for lobectomy but not pneumonectomy patients Mean loss of exercise capacity (VO_2 max) after 6 months: 28% pneumonectomy, 13% lobectomy Changes in PF did not correlate with exercise capacity Dyspnea was a limiting factor in exercise testing for pneumonectomy (65% at 3 months, 60% after 6 months), leg discomfort continued as the limiting factor for the lobectomy group (58% at 3 months, 64% after 6 months)
Nugent et al.[36]	$N = 106$, $n = 53$ with follow-up data Age: 61–64 (by surgical procedure) Ethnicity: Irish sample Health status: Preoperative FEV_1 % predicted ranged from 71% to 82%	Histology: not reported Stage: ND Surgery: $n = 13$, pneumonectomy, $n = 26$, lobectomy/wedge resection, $n = 13$ thoracotomy (inoperable tumor) Follow-up: 3 and 6 months	Purpose: describe and compare the effects of different types of lung resections and thoracotomy alone (inoperable tumor) on exercise capacity Method: prospective, pre-, postsurgery Instruments: PF, exercise testing, Borg dyspnea scale Comparison:	Thoracotomy alone did not significantly affect exercise capacity Pneumonectomy: exercise capacity reduced by 28% Lobectomy: exercise capacity unchanged No significant difference in Borg dyspnea rating pre and post any procedures
Miyazawa et al.[27]	$N = 8$ Age: 67 Health status: FEV_1% predicted = 67.2, VC = 3.47 Tobacco use: all had quit smoking after surgery (never smokers were excluded); smoking "piece-years" range 600–1,600	Histology: ND Stage: potentially resectable Surgery: lobectomy Follow-up: 4–6 months, 42–48 months	Purpose: to examine postop changes in cardiopulmonary function Method: prospective Instruments: PF, exercise testing, hemodynamic monitoring, Fletcher, Hugh–Jones' dyspnea index Comparison: none	None had any symptoms before surgery 63% had increased dyspnea scores at 4–6 months; at 42–48 months, all had decreased to preop levels except for 1 patient Symptoms not directly related to physiologic outcomes FEV_1% predicted increased postop (77% at 4–6 months; at 72% 42–48 months); airway resistance at preop levels over time Long-term decrease in cardiopulmonary function
Sugiura et al.[41]	N=22 VATS, N=22 thoracotomy Age: 62 (VATS), 61 (thoracotomy) Sex: 83% men (VATS), 38% thoracotomy Health status: ND	Histology: NSCLC Stage: stage I Surgery: VATS, thoracotomy Follow-up: mean 21 months (VATS), 30 months (thoracotomy)	Purpose: describe and compare HRQOL post-VAT with thoracotomy Method: prospective; Instruments: self-report questionnaire regarding chest pain, arm/shoulder limitations, time to return to preop activity, satisfaction Comparison: none	NS differences in patient characteristics Significantly decreased in chronic pain, return to ADL, and improved satisfaction with VATS At 12 months, no patient who received the VATS reported postthoracotomy pain; 4 patients in thoracotomy group required narcotics at 12 months
Uchitomi et al.[14]	$N = 223$ with successful surgical resection Age: 63 years Ethnicity: Japanese Marital status: 82% married Education: 21% ≥ HS Health status: 23% < 70% predicted FEV_1 6% history of depression Tobacco use: 41% current smokers, 24% former smokers	Histology: 68% adenocarcinoma, 21% squamous carcinoma; Stage: 92% stage I or II Treatment: 96% lobectomy, 5% pneumonectomy Follow-up: 1 and 3 months postresection	Purpose: to describe depression at 1, 3 months post curative resection Method: prospective; Instruments: Psychiatric interview at baseline using criteria from the DSMMD, Profile of Mood States	Major or minor depressions: at 1 month (9.0%), at 2 months (9.4%), at 3 months (5.8%) Education level related to depression in the perioperative phase Depression preop was related to subsequent depression Lack of confidence in confidants (social support), pain and diminished performance status significantly associated with depression at 3 months

(*continued*)

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Author	*Sample[a] characteristics: mean age[b], sex, ethnicity[c], education, marital status, health status*	*Disease characteristics/treatment/ follow-up period*	*Purpose/method Comparison group*	*Findings related to survivorship*
Uchitomi et al.[60]	*N* = 226 patients with curative disease Age: 62 years Sex: 61% male Ethnicity: Japanese Education: 66% > JHS Marital status: 82% married Health status: 22% < 70 & FEV_1% predicted 31% with prior history of depression, 43% with moderate/severe dyspnea	Histology: NSCLC, Stage: 76% stage I, 16% stage II Surgery: curative resection Follow-up: 3 months	Purpose: describe impact of physician support on psychologic responses post curative surgery Method: prospective; Instruments: Structured interviews 1 and 3 months after surgery using DSM-III-R, Profile of Mood States, Mental Adjustment to Cancer	Depression: 9% at 1 month, 6% at 3 months postop; 26% had hx of depression History of depression was related to psychologic distress postsurgery Dyspnea, FEV_1, and PS related to psychologic distress at 3 months 24% used the physician and 4% used nurses for social support Physician support related to decreased psychologic distress, helplessness/ hopelessness, and increased fighting spirit, not related to depression Physician support was the sole factor in a multivariate regression related to increased fighting spirit for females and patients with no hx of depression
Handy et al.[29]	*N* = 139, *n* = 103 with 6-month data Age: 62 years Sex: 59% male Health status: Respiratory function: mean predicted FEV_1 76% Comorbid conditions: 30%, cardiac, 16% diabetes, 15% peripheral vascular disease Tobacco use: 40% smoking within 8 weeks of surgery	Histology: ND Stage: 67% had stage I or II Surgery: pneumonectomy (8%), lobectomy (78%) 58% had open thoracotomy, 1% video-assisted thoracotomy, 5% muscle-sparing thoracotomy Follow-up: 6 months (12% died within 6 months), includes 7 with metastatic disease	Purpose: compare functional status and QOL preop and 6-month post lung resection. Design: prospective Methods: prospective; Instruments: Short-Form 36, Ferrans and Powers Quality of Life Index Control: Age-matched healthy controls	Functional health status impaired Preop pain, impaired physical status, role function, social functioning, and mental health were present 6 months postsurgery Dyspnea significantly worse postop General health status, energy level unchanged Postthoracotomy/neuropathic pain was an issue for 8 subjects No age or gender differences Pre-operative DLCO (<45% predicted), not FEV_1, predicted postop HRQOL Adjuvant treatment, 6-minute walk, extent of resection, complications did not predict HRQOL 6 months after surgery
Li et al.[44]	*N* = 51 Age: 63 years (VATS), 67 years (thoracotomy) Sex: 74% male Ethnicity: Chinese Marital status: 71% married	Histology: 55% adenocarcinoma, 20% squamous Surgery: VATS (*n* = 27), thoracotomy (*n* = 24) Follow-up: minimum of 6-months postsurgery (range 6–75 months: for VAT (mean 34 months), for thoracotomy (mean 39 months)	Purpose: compare HRQOL and symptoms between VATS and thoracotomy Design: cross-sectional Instruments: EORTC-C30 core questionnaire, EORTC QLQ-LC13 (Chinese versions) Investigator developed additional surgery-related questions	NS differences in HRQOL or symptoms between VATS group and open thoracotomy group According to EORTC ratings: good to high level of functioning Symptoms continued, including fatigue, coughing, dyspnea, thoracotomy pain (74% VATS, thoracotomy, 75%) Most severe symptoms included coughing, fatigue, and arm/shoulder pain; 44% reported financial difficulties
Sarna et al.[10]	*N* = 142 (5-year minimum disease-free survivors of NSCLC) Age: 71 years Sex: 46% male Ethnicity: 83% Caucasian Marital status: 47% married Education: 28% ≥ HS Health status: 50% FEV_1 < 70% 60% had at least 1 comorbid condition, 50% reported 2 conditions (heart disease, 29% and cataracts, 35%, most	Histology: 59% adenocarcinoma; 35% squamous Stage: 80% stage I and II Surgery: 12% pneumonectomy, 74% lobectomy, 11% segmental/wedge Follow-up period: 10 years, range 5–21 years	Purpose: describe HRQOL Method: cross-sectional Instruments: HRQOL-Survivor, SF-36, CES-D, spirometry Comparison group: population-based norms	Majority reported positive attitudes: 71% described as hopeful; 50% described cancer as contributing to positive life experiences; 22% depressed (CES-D ≥ 16) Most serious issues: fatigue (27%), pain (24%), anxiety (30%), changes in self-concept (21%), changes in appearance (20%), 34% reported families experienced significant distress Lower HRQOL associated with depressed mood and being Caucasian Lower physical HRQOL linked to older age, poorer PF, living alone, longer time since diagnosis, depressed mood, more comorbid conditions

	common); 9% with second primary lung cancer, 17% with history of other cancers Tobacco use: 76% former smokers, 13% current smokers			
Evangelista et al.[13]	As described above	As described above	Purpose: describe health perceptions and risk behaviors of survivors Method: cross-sectional Instruments: Perceived health status item (from Short-Form 36), self-report and biochemical verification of tobacco use, self-reported alcohol use, spirometry, BMI Comparison group: none	Most survivors had healthy lifestyles. Good/excellent health (37%), fair/poor health (30%) NS difference based upon clinical or demographic characteristics. 67% of smokers quit after diagnosis; 16% never smokers Current smokers (13%) more likely to be male (32%) and single (60%), 28% exposed to secondhand smoke, 58% used alcohol (16% quit after diagnosis), 51% overweight (BMI ≥ 25); 16% obese (BMI ≥ 30) Current smoking, exposure to second-hand smoke, current drinking, and BMI ≥ 25 were significant predictors of poor health perceptions
Maliski et al.[12]	I = 29 survivors within another study[10] Age 72, 55% men Marital status: 55% married Ethnicity: 69% white Education: 52% >HS Health status: FEV_1 % predicted, 59.8% Average of 1.75 comorbid conditions Tobacco use: 10% current smoking, 79% former smokers	Histology: 48% adenocarcinoma, 48% squamous cell, Stage: 72% stage I, 10% stage II Surgery: 79%, lobectomy/wedge resection Follow-up period: mean 11 years	Purpose: describe the survivorship experience in long-term survivors Method: cross-sectional, qualitative interviews, self-report questionnaires, pulmonary function Instruments: Interview questions about survivorship experience CES-D Spirometry Comparison group: none	Themes related to physical and emotional well-being: (1) appreciation for life and a changed outlook, (2) taking control and appreciation of health, (3) overcoming and rationalizing changes in physical ability, (4) changed lifestyle, (5) giving and receiving support. 31% met CES-D criteria for potential depression and those in that group had more negative views of survivorship
Myrdal et al.[35]	$N = 112$, NSCLC Age 67 Sex: 57% male Ethnicity: Swedish Health status: Preoperative pulmonary function: 33% < 60% FEV_1 Tobacco use: 70% former, 11% current smokers	Histology: ND Stage: 67% stage I, 17% stage II. Surgery: 22% pneumonectomy, 76% lobectomy Follow-up: mean 48 months, range, 4–48 months	Purpose: describe symptoms and HRQOL postsurgery Method: cross-sectional, mailed survey. Instruments SF-36, HADS, assessment of pulmonary symptoms Comparison group: $N = 121$ post-CABG	Bodily pain was the only SF-36 subscale similar to a normative cohort HRQOL scores comparable to patients who underwent CABG except for physical function, which was significantly lower Social and mental health scores similar to normative standards Dyspnea on exertion higher among those with lung cancer. 20% of patients had possible depression Compared to never and former smokers, smokers had lower mental health (SF-36) and higher ratings of depression and anxiety
De Leyn et al.[20]	$N = 77$ Age: ND Sex: ND Ethnicity: Belgian Health status: ND	Histology: bronchogenic ca Stage: Surgery: sleeve-lobectomy Follow-up: early postop recovery, 45.6% at 5 years	Purpose: to describe postop complications Instruments: medical record Comparison: none	Exercise tolerance and HRQOL acceptable and better than that reported for pneumonectomy Five developed an anastomotic suture and required subsequent pneumonectomy

(*continued*)

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Welcker et al.[135]	$N = 65$ ($n = 22$ with 1-year follow-up data) Age: 65 Sex: 71% male Ethnicity: German Health status: ND	Histology: NSCLC Stage: surgery for surgical intent Surgery: variety of surgical procedures ($n = 2$ pneumonectomy, $n = 36$ lobectomy) Follow-up: 1+ year postsurgery	Purpose: to examine cost and quality of life after thoracic surgery Methods: retrospective, cross-sectional, mailed survey Instruments: SF-36, cost indicators, Qualys Comparison: none	SF-36 ratings for 2-year survivors generally lower than normative scores for those with COPD and with cancer Gain of 4.62 Qualys, with higher costs associated with resection with more-advanced stages and complexity of surgery
Nomori et al.[32]	$N = 220$ VATS: 28 ALT: 28 AAT: 28 PLT: 28 Age: 61–62/group Sex: 71% male	Histology Stage: 65% stage I, 10% stage II Surgery: VATS, ALT, AAT, PLT Follow-up: pre-, 1, 2, 4, 12, 24 weeks postsurgery for PF; 1	Purpose: compare differences in functional impairment by type of surgery Methods: retrospective Instruments: PFT, 6MW Comparison:	VC in all groups increased over time PLT had the greatest impairment in VC 24 weeks after surgery and in 6MW 1 week postsurgery; better functional recovery was associated with VATS and ALT procedures
Pompeo et al.[21]	$N = 16$ Age: 65 Ethnicity: Italian Health status: All had severe and diffuse emphysema before surgery	Histology: 9 adenocarcinoma, 5 squamous, 2 large cell Stage: 11 (T1N)M0, 5, T2N0M0 Surgery: VATS ($n = 5$ LVR, $n = 3$ wedge resections, $n = 2$ segmentectomy), open thoracotomy ($n = 6$ lobectomy) Follow-up: 46 months	Purpose: describe HRQOL in lung cancer patients with emphysema who underwent resection plus lung volume reduction Method: prospective assessments: preop, 6 ($n = 16$), 12 ($n = 15$), 24 ($n = 13$), 36 months ($n = 9$) Instruments: SF-36, Medical Research Council Dyspnea Index, 6-minute walk test, self-report postthoracotomy pain Spirometry Control: $n = 16$ healthy adults	Patients with end-stage emphysema and stage 1 lung cancer benefited from surgical resection Significant improvement HRQOL domains and dyspnea at 6 months, continuing through 36 months Some differences based upon type of resection No differences between lobectomy and VATS patients Pain peaked at 6 months and continued for a small subset throughout the assessment period 68% 5-year survival Analysis includes patients with recurrence and metastasis
Sarna et al.[11]	As described above[10]	As described above[10]	Purpose: describe respiratory symptoms and PF of long-term survivors Method: cross-sectional Instruments: self-report of respiratory symptoms, spirometry, SF-36 Control: none	2/3 of survivors reported respiratory symptoms: 39% dyspnea, 31% wheezing, 28% phlegm, 25% cough; 21% reported that they stayed most of the day in bed because of symptoms % predicted FEV_1 68%; 21% % predicted <50% FEV_1 36% moderate/severe obstructive and/or restrictive ventilatory impairment Survivors exposed to secondhand smoke 3× more likely to have respiratory symptoms Respiratory symptoms related to reduced physical function, role-limits physical, vitality, social functioning, general health, and increased bodily pain

ND, no data; NS, not significant, ADL, activities of daily living; SF-36, Short form-36; PF, pulmonary function, VAS, visual analogue scale; Qualys; quality-adjusted life years; VATS; video-assisted thoracoscopic surgery; MST, muscle-sparing thoracotomy; AAT, anteroaxillary thoracotomy; ALT, anterior limited thoracotomy; PLT, posterolateral thoracotomy; 6MW, 6-minute walk; SCLC, small cell lung cancer; PCI, prophylactic cranial irradiation; CT, computed tomography; neuropsych, neuropsychometric testing; HRQOL, health-related quality of life; RSC, Rotterdam Symptom Checklist; HADS, Hospital Anxiety Depression Scale.

[a] All available data reported.

[b] Mean age.

[c] In most cases denotes country of study.

requirement for partial ablation of a vital organ. The pneumonectomy has been used successfully for lung cancer treatment since the 1930s.[18] Evidence-based strategies to enhance HRQOL, improve symptom control, and support recovery after curative surgery for lung cancer are almost nonexistent. Although the normal healthy individual can sustain the loss of one entire lung (pneumonectomy), most patients with lung cancer have comorbid illness. Many patients have sustained cardiopulmonary damage from long-term smoking and have increased risk of mortality following pneumonectomy (or in some cases even after lobectomy or limited resection). When comparing sleeve lobectomy with pneumonectomy, a meta-analysis of published studies from 1990 to 2003, using quality-adjusted life years (QALYS) as one of the outcomes, found that sleeve lobectomy resulted in better survival, and for patients who did not have recurrence, better HRQOL.[19] Other studies also support the superiority of lobectomy over pneumonectomy in terms of physical recovery.[20]

One recent advance in the treatment of early-stage lung cancer is limited resection performed by video-assisted thoracoscopic techniques (VAT) in patients with poor lung function. Patients with limited respiratory reserve are at increased risk for perioperative respiratory complications. Recent experience with the use of thoracoscopic procedures in benign lung disorders, especially emphysema, confirms that limited thoracoscopic lung resections can be performed safely in this setting, under select circumstances. Thoracoscopic pulmonary resection requires less time in hospital and reduces the duration of postoperative pain and disability. Better understanding of pulmonary function tests (PFTs) and limits of resection now allow resection of small peripheral tumors in patients with poor pulmonary function via open segmental resection, thoracoscopic wedge resection, or a combination of reduction pneumoplasty with wedge resection in carefully selected patients. The lung cancer surgery can even serve as a lung volume reduction intervention for these compromised patients. In a small study of 16 stage I non-small cell lung cancer survivors with severe emphysema who underwent a variety of surgical resections, including lung volume reduction, 68% had 5-year survival. These carefully selected patients had improved HRQOL (as measured by the SF-36), especially in physical functioning and reduction in dyspnea 2 years after surgery.[21]

As displayed in Table 13.1, a number of studies have identified lingering symptoms and issues faced by lung cancer survivors in the months and years after potentially curative treatment. Some prospective studies suggest a pattern of symptom resolution with full recovery 6 months after surgery, but others point to ongoing problems years later. Some studies have included comparison groups of patients with other forms of cancer or patients without cancer who underwent similar surgical procedures (e.g., thoracotomy). Although some studies have included mixed stage and histology of patients with lung cancer, the majority of studies address the issues of survivors of non-small cell lung cancer who underwent surgical resection with minimal attention to those with small cell lung cancer or those who have undergone adjuvant treatment. These posttreatment data, including both physical as well as emotional well-being, identify a range of issues faced by survivors of lung cancer and underscore the need to develop supportive care interventions. The perceptions of HRQOL by survivors are important, as they are linked to severity of symptom distress and have been associated with long-term survival.[22] Pneumonectomy has been more clearly associated with ongoing symptoms and reduced HRQOL.[23] Because of the lack of prospective data, few studies have reported patterns of symptom occurrence and resolution after curative treatment. A cross-sectional study of patterns of symptom distress studied 117 patients with lung cancer, enrolled within 100 days of diagnosis and receiving a variety of treatments. It found that those patients receiving surgery (n = 45) were noted to have decreased symptoms over a 6-month period.[24]

Available data describing the prevalence and patterns of lingering symptoms (dyspnea, pain, altered functional status/fatigue, emotional distress, cognitive difficulties, relationships, sexual dysfunction, and alterations in communication abilities) reported in long-term lung cancer survivors are described next.

Dyspnea and Pulmonary Impairment

The loss of functional lung tissue as a result of lung cancer surgery may result in transitory and permanent reductions in pulmonary function and, for some, physical disability. Pulmonary function can be affected by lung cancer and its treatment, by the consequences of the patient's past tobacco use, and by comorbid disease.[25] Changes in pulmonary function are variable and not a clear predictor of exercise capacity,[26] severity of dyspnea,[27] patients' perceptions of physical disruptions in day-to-day activities,[28] or even HRQOL outcomes.[10,29,30] Larsen et al.[28] note the variability of performance of lung cancer patients after resection. Based upon physiologic differences, resection of the right lung (contributing to 55% of overall lung function) might lead to more severe pulmonary consequences.[18] There are clear differences based upon the extent of resection. Bolliger et al.[31] reported reduction in PFT in the immediate postoperative period with recovery at the 6-month period for patients who underwent lobectomy. This recovery was not seen for patients who underwent pneumonectomy, similar to findings by Nezu et al.[26] Several studies support the benefit of the VATS procedure in improved functional recovery as compared to other approaches.[32]

Although dyspnea is not always a consequence of surgical treatment, the majority of studies reported ongoing problems of breathlessness in some survivors, often linked with reduction in exercise capacity.[8,21,23,26,27,29,30,33–35] Dales et al.[8] reported an increase in the prevalence of severe dyspnea in the first 3 months postthoracotomy, with reductions at 6 and 9 months, but with the continuance of severe dyspnea for 10% of the patients. Nugent et al.[36] reported long-term deficits in exercise performance in patients undergoing a pneumonectomy, with limited changes after lobectomy. The symptom dyspnea was the limiting factor in performance in exercise tests for the pneumonectomy group. Pelletier et al.[33] cited dyspnea as a factor attributing to dropout in exercise programs postthoracotomy. Zieren et al.[34] also reported continued dyspnea at exertion 1 year after surgery. However, Nugent et al.[36] reported no changes in dyspnea after surgery.

In a study comparing VATS to thoractomy, dyspnea (85% versus 75%) and cough (82% versus 75%) were continuing problems more than a year after surgery for both groups. Aging, tobacco use and comorbid conditions, in particular, may influence respiratory symptoms and level of pulmonary function. Uchitomi et al.[37] report the significant relationship of dyspnea to emotional distress in the postoperative period. This relationship was also reported by Sarna et al.[10] However, there is little research specifically looking at these issues in a systematic way. In addition to dyspnea, respiratory symptoms such as cough, phlegm, and wheezing continue to plague some long-term survivors and diminish HRQOL.[11]

Pain

In a recent review,[38] Rogers et al. reported on the incidence of chronic mild to moderate postthoracotomy pain, which was described as "under-rated" and affecting approximately 50% of patients. Chronic postthoracotomy pain along the incision line often has neuropathic features. It is less often associated with initial lung cancer surgery, but has been linked with tumor recurrence.[38] The etiology of long-term pain is not well established but may be caused by intercostal nerve damage. Several of the studies reviewed (see Table 13.1) describe persistent pain for some long-term survivors.[9,10,21,23,29,34,35,39–42] Not all studies are limited to patients with lung cancer; some included others who received a thoracotomy. Reports of lingering pain vary. Schag et al.[9] reported that 46% of survivors experience pain from scars postsurgery and 24% report aches and pains. In a study of 85 patients, 26 had moderate to severe pain 1 month after surgery. Gotoda and colleagues[43] reported that female gender and pain immediately postthoracotomy were predictive of pain 1 month and 1 year after surgery. Handy et al.[29] reported continued pain 6 months after surgery. Similarly, Pompeo et al.[21] and Zieren et al.[34] reported continued pain for some patients even 1 year after surgery. Pompeo et al.[21] also identified a subset of patients who continued to have lingering pain. However, Mangione et al.[42] and Myrdal et al.[35] reported that pain scores after surgery were similar to population norms 1 to 2 years after surgery.

Although the prevalence of chronic pain may be expected to differ by surgical procedure, especially with the emergence of the muscle- and nerve-sparing VATS procedure, reports do not consistently support significant differences. Landreneau et al.[39] reported less pain and shoulder dysfunction, but not a difference in use of pain medication.[44] Pain was reported by 71% of the thoracotomy group and 67% of the VATS group. Comparing the VATS with thoracotomy, specific type of pain included thoracotomy pain (74% versus 75%), chest pain (48% versus 29%), and arm or shoulder pain (59% versus 46%). One-third of both groups (33%) reported shoulder dysfunction. Neither Pompeo et al.[21] or Li et al.[44] report significant differences in pain when comparing lobectomy and VATS procedures. However, another study did support a beneficial difference.[41] Treatment strategies of postthoracotomy pain vary,[45] and reports for definitive treatment from clinical trials are not available.

Another painful and disabling condition is frozen shoulder, a potential postsurgical risk[46] affecting lung cancer survivors. However, there are no known studies describing the prevalence of this condition among survivors of lung cancer.

Altered Functional Status/Fatigue

Level of postoperative physical disability is an important consideration in examining the HRQOL of survivors. Although it is often related to dyspnea, decreased functional status may have other contributing factors as well, and the measurement is different. In fact, in surveying the views of a patient population at risk for lung cancer surgery ($n = 64$), many stated they would not undergo life-saving surgery if it resulted in permanent physical disability.[47] Early studies considering recovery from lung cancer surgery focused almost exclusively on pulmonary and cardiovascular function, exercise capacity, and predictors of those at risk for severe disability. Mangione et al.[42] note recovery of physical function after thoracotomy at 12 months, but never to preoperative levels. Compared to other surgical groups (hip replacement, repair of aortic aneurysm), survivors of lung cancer had lower physical function. In a small prospective study of recovery after lobectomy, Miyazawa et al.[27] reported that recovery to preoperative levels occurred approximately 1 year after surgery for most, but not all, patients. Improvement in exercise capacity also was noted by Nezu et al.,[26] but not for those who underwent pneumonectomy.

Many of these studies are limited in that a preoperative assessment was lacking and time since surgery in the postoperative assessment varied. Additionally, multiple factors, including comorbid conditions (e.g., emphysema) and impairments (e.g., arthritis), were not considered as contributors to physical function after surgery. When exercise performance is limited, deconditioning (often described as leg cramps) as well as dyspnea are factors.[33] In an older population of lung cancer survivors, comparison of physical function with other patient populations or normative standards is useful. In the 5-year survival group,[10] HRQOL scores for physical components showed a somewhat poorer status compared to norms of patients with cancer, older adults, and those with other chronic lung disease.

In addition to functional decline, fatigue has been identified as a troublesome symptom. It is unclear if these are associated with aging or comorbidity because few studies have comparison groups. In the study by Li and colleagues,[44] fatigue was the most commonly reported symptom more than 1 year postsurgery for patients who underwent a VATS (74%) or thoracotomy (92%), as was the case with long-term survivors of small cell lung cancer.[48] Fatigue also may accompany other symptoms. In a cross-sectional study assessing symptom distress in women with primary or recurrent lung cancer within the past 5 years, Sarna[49] found that when fatigue was present, 41% experienced frequent pain, 31% insomnia, 23% breathing difficulties, and 21% cough. No studies have reported fatigue after lung cancer surgery with adjuvant chemotherapy.

There appears to be a subset of survivors that reports reduction in energy and increased fatigue. In a cross-sectional study of 130 older patients with lung cancer 3 months after diagnosis (including 34 treated with surgery), risk for impaired physical functioning was strongly linked to preexisting physical impairment and symptom distress.[50] In Schag et al.'s study of lung cancer survivors,[9] almost all the shorter-term survivors reported significant decreases in their energy (84%). Fatigue also was the most common symptom reported by Sarna et al.[10] With the lack of age-matched comparison groups, it is difficult to tell how dissimilar these reports are from the population of older adults without cancer and with/or without other chronic illnesses. Schag reported on this issue comparing cancer patients to health controls using the same instrument. She notes that 84% of survivors had problems with functional health status compared to 22% of healthy controls in a previous study.[51]

Emotional Distress

Presenting evidence on the psychosocial issues and concerns of survivors of lung cancer is both a simple and complicated task. It is simple because there is a paucity of information and it is complicated by the absence of data and the clear definitions of survivor. It is important to note that positive as well as negative consequences may result from the experience of lung cancer.[52] In the qualitative study,[12] survivors described existential changes prompting them to "seeing life as a gift," "appreciating the little things in life," and "trying to live life to its fullest." However, some reflect that life after lung cancer is not a normal life, and there were multiple statements related to uncertainty. A review of available data provides support for the hypothesis that a subset of survivors experience ongoing psychologic distress such as anxiety and depression. Handy et al.[29] reported impaired mental health 6 months posttreatment, but Mangione et al.[42] noted improvement in mental health over time. Different measures were used to measure depression in the studies reviewed, and it is difficult to know whether the responses reflect a diagnosable depression (major or minor) or reflect a state of depressed feelings. Interestingly, in contrast to differences in physical function, pneumonectomy was not necessarily associated with greater emotional or social dysfunction.[34]

Depression

It may seem surprising to find reports of depression among the "fortunate few" who do survive lung cancer. The findings of disease-free survivors are surprisingly consistent with other studies that have looked at the global population of lung cancer patients which includes all stages of disease. Depression and emotional distress have been reported as higher among people with lung cancer than people with other cancers.[53] It is estimated that the incidence of depression in patients with lung cancer of all stages ranges from 15% to 44%.[7,14,54–57] Depressed mood in patients with cancer has been linked to increased reporting of symptoms.[8,57] In a study of 95 patients with newly diagnosed lung cancer of all stages, depression was linked to poorer prognosis.[58]

Interestingly, in a prospective study of survival and positive attitude (optimism) before a randomized clinical trial of chemotherapy and radiation therapy for unresectable non-small cell lung cancer,[59] mood did not influence or correlate with overall survival. According to Uchitomi's findings, depression did decrease over the year after surgery.[14,37,60] However Sarna et al.[10] reported that one of five long-term survivors required further workup for depression because of high CES-D scores and this score was also a major predictor of ratings of HRQOL. These reports underscore the importance of screening for depression as part of follow-up care. Depression is treatable, but it is unknown how many lung cancer survivors have this clinical diagnosis and are treated.

Anxiety and Fears of Recurrence

Many patients who survive a first lung cancer develop a second cancer, either a second primary lung cancer or a local recurrence. Additionally, patients with prior lung cancer are at high risk of development of second tobacco-caused cancers other than lung cancer. A few prospective studies[34] have noted significantly lower HRQOL scores for survivors who experienced recurrence compared to scores of those who remained disease free. The threat of recurrence is not unique to lung cancer survivors, and this fear has been noted in studies of disease-free survivors. In Schag et al.'s study,[9] 63% of lung cancer survivors reported anxiety, and 58% had worries about a cancer recurrence. Sarna et al.[10] reported 30% with anxiety, with 12% of survivors fearful of a second cancer, 11% fearful of a recurrence, and 11% fearful of metastatic disease.

Ongoing and quality communication with the healthcare team is essential throughout to course of treatment and during recovery. Because lung cancer has been so frequently fatal for patients, communications around survivorship issues and HRQOL may seem less important than for other patients with a better prognosis. However, it is important to recognize that there are phases of treatment, and it may be important to identify fears and issues facing survivors that lead to education, information, and interventions. For example, discussions about the potential consequences of curative treatment do not have to be limited to informing patients of potential risks.[61,62] It also can be an opportunity to prepare patients for survivorship. Resources available for rehabilitative support, including psychologic support, can be included in the plan for care.

Cognitive Difficulties

A meta-analysis of seven clinical trials demonstrated that prophylactic cranial irradiation (PCI) increased disease-free survival and decreased risk of brain metastasis for patients with small cell lung cancer.[63] Since the 1980s neurologic toxicity has emerged as a concern for some long-term survivors.[64] These problems include a range of abnormalities including problems with memory, concentration, parasthesias, and gait.[48,65–67] However, the etiology of cognitive impairment is not clear, with suggestions of abnormalities present before treatment.[17,67] Comprehensive information about the impact of cognitive impairment on HRQOL is needed in this population.

Cognitive problems also have been reported in survivors of non-small cell lung cancer. In Schag's study[9] (including patients with both small cell and non-small cell lung cancer), the majority (63%) of the short-term survivors noted that they had difficulty remembering things. Diminished ability to think clearly was associated with a diminished interest or pleasure in a recent study evaluating somatic symptoms of patients with lung cancer with major depression.[68] Sorting out cognitive difficulties from the effects of depression is an ongoing issue in cancer research but may be particularly relevant for this population.

Relationships

There are limited data describing the impact of lung cancer on marital and other relationships. In many studies information about marital status or living situations is unknown. Difficulties with relationships with families and friends were uncovered both by Schag et al.[9] and Sarna et al.,[10] but it is hard to determine if social support changed and whether there is an ongoing impact. This is clearly an area that could use additional investigation. Additionally, information about the impact of lung cancer on employment is limited.

Sexual Dysfunction

Disruptions in sexual function may be an issue for survivors of lung cancer as a result of diminished physical functional status, but data are practically nonexistent. Schag's study[9] reported on a range of activities related to intimacy among married and single individuals. In a study of 69 women with lung cancer,[69] including 38% treated with curative intent, sexual disruptions were reported by more than 20% of the sample.

Communication Ability

Complications of surgical treatment of lung cancer also could include vocal cord paralysis, although data about the prevalence of this condition among long-term survivors are lacking. Recurrent laryngeal nerve damage resulting from pneumonectomy, mediastinoscopy, or tumor invasion can result in laryngeal paralysis or paresis, causing hoarseness and soft whispery voice. This problem can have a profound impact on communication and ultimately HRQOL. In a rare study of 28 patients with vocal cord paralysis from cancer or its treatment (including 25% with lung cancer), HRQOL improved after thryoplasty.[70] Cancer patients had HRQOL and voice improvement similar to that of patients who received treatment for benign conditions. Improvements in HRQOL included physical function aspects that could be negatively affected by glottic incompetency.

Economic Impact

A few studies reviewed noted employment status and the impact of the disease on work situation, although many patients were retired at the time of diagnosis.[9,10] In some studies, return to work was viewed as a proxy for HRQOL among long-term survivors.[71,72] The impact of altered physical functional capacity after curative treatment and the long-term economic consequences on these survivors are unknown.

Support and Psychosocial Intervention

There is limited evidence as to the impact of community resources on the recovery and adaptation of lung cancer survivors. Community-based and philanthropic organizations have historically provided cancer patients and their families with essential services that have been unavailable from traditional medical sources, and reliance on these organizations is growing. A recent study[73] evaluated the resources that are available nationwide to provide support for patients with cancer and their family members, how these resources are used, and whom they serve. The primary mission of the organizations that participated in the study (32 of the 41 identified) was information/referral centered. Of the 31 organizations reviewed, not 1 was devoted to patients with lung cancer, although two-thirds were specifically dedicated to patients with cancers other than lung. Problems identified for the one database of patients indicated that there is a strong need for assistance with personal adjustment to illness, financial concerns, home care, and transportation. The study also noted that the patients that are at the highest risk for developing cancer and dying of it are the least likely to utilize formal support networks. In addition, there were gaps noted in service provision. As medical environments provide less assistance for psychosocial needs, it will become incumbent upon these communities to provide assistance for patients, especially for those with lung cancer.

The Ted Mann Family Resource Center at UCLA's Jonsson Comprehensive Cancer Center has developed an approach to helping patients cope with the diagnosis of lung cancer at all phases of the disease. Funded by the surviving spouse of a patient who died of lung cancer, the Ann and John Nickoll Lung Cancer Support Program has established a variety of services for patients and family members. Patients and family members receive individual contact and psychosocial evaluation by a psychologist or social worker. Patients are offered a variety of services, including informational booklets with a library of resources, a support group for patients with lung cancer and their family members, lectures by healthcare professionals on the topic of lung cancer, individual and group programs to teach relaxation exercises and cognitive coping skills, and assistance with access to reliable web sites. Patients who are depressed receive individual counseling and are referred to psychiatry for medication evaluation if they are amenable to this type of intervention. Patients have welcomed this program of support. Some of the patients have commented, "Now we have what the breast cancer patients have," the standard by which all cancers are currently measured. The greatest difficulty that patients with lung cancer face, however, is the fact that so many cancers are found at a late stage, and patients must not only deal with the diagnosis of cancer but may have to grapple with declining function and the loss of their life in a relatively short period of time after the diagnosis. Although as yet untested, this resource may provide a model for comprehensive support for people living with lung cancer.

There is a small, but growing, network of patients and families who are participating in advocacy efforts that are primarily Internet based, as displayed in Table 13.2. Each of these organizations provides information about disease and treatment, organizes political advocacy efforts, and has a mission oriented toward better care and research for patients with lung cancer and links to other resources. These resources offer tips and suggest areas of need and intervention for survivors of lung cancer.

Although research on psychosocial interventions for a variety of types of cancer patients is not reviewed here, there is an extensive literature documenting the efficacy of a variety of interventions in diverse patient populations. These interventions are oriented toward improving the quality of life of patients with cancer through education, individual support, and groups. A recent meta-analysis of 37 published controlled studies that investigated the effectiveness of psychosocial interventions on HRQOL in adult cancer patients found that psychosocial interventions with durations of more

TABLE 13.2. Resources for lung cancer survivors.

Organization	*Web site*	*Purpose/mission*
Alliance for Lung Cancer Advocacy, Support, and Education	www.alcase.org	National not-for-profit organization dedicated solely to helping people with lung cancer, and those who are at risk for the disease, to improve quality of life through advocacy, support, and education
American Cancer Society	www.cancer.org	Nonprofit provides general cancer educational and support services, including a Lung Cancer Resource Center that describes lung cancer, its risk factors, prevention, causes, detection, symptoms, diagnosis, staging, and treatment
American Society of Clinical Oncology	www.asco.org; www.plwc.org	Site run by the American Society of Clinical Oncology; provides up-to-date scientific information about lung cancer treatment, including links to many patient-focused resources
Cancer Care	www.lungcancer.org	Informational website sponsored CancerCare
Lung Cancer Online Foundation	www.lungcanceronline.org	Focus on improving the quality of care and quality of life for people with lung cancer by funding lung cancer research and providing information to patients and families; provides a comprehensive, annotated directory to Internet information and resources for patients and families
Lung Cancer Survivors for Change	www.lchelp.com/mambo	An organization composed of ordinary people who have survived lung cancer as well as family members of people living with lung cancer
National Coalition of Lung Cancer Survivors (NCCS)	www.canceradvocacy.org	Survivor-led advocacy organization working exclusively on behalf of this country's more than 9 million cancer survivors and the millions more touched by this disease; founded in 1986, NCCS continues to lead the cancer survivorship movement
Roy Castle Foundation	www.roycastle.org	Provides patient support and information network throughout Great Britain; every lung cancer patient and their family will have access to a comprehensive support, information, and advocacy service for all issues concerning lung cancer
Ted Mann Family Resource Center, UCLA Jonsson Comprehensive Cancer Center	www.CancerResources.mednet.ucla.edu	Provides education through streaming video as well as articles on all phases of the disease, including survivorship, and caregiver-oriented materials
Women Against Lung Cancer	www.4walc.org	Special focus on women with lung cancer, educates the public and health care professionals about women and lung cancer; provides a web listing of many lung cancer resources

than 12 weeks were more effective than interventions of shorter duration.[74]

Health Behaviors

Little is known about the health behaviors (tobacco use, alcohol use, nutrition/weight) and changes that may occur in response to the diagnosis or the perceived health status of lung cancer survivors. In an analysis of these factors, Evangelista et al.[13] reported that 70% of 5-year survivors reported their health to be good to excellent. Continued smoking, exposure to second-hand smoke, current alcohol use, and being overweight (body mass index of 25 or more) were significant predictors of poor health perceptions.

Tobacco Use and Cessation

Assessment of current and former smoking of lung cancer survivors is relevant because of the potential impact on recurrence, second primaries,[75–80] and comorbid conditions. Smoking cessation can slow the decline in pulmonary function, and if smokers quit before extensive pulmonary damage, they may never develop clinically significant chronic obstructive pulmonary disease (COPD).[81] Approximately 90% of lung cancer cases are attributed to lifetime smoking.[82,83] Smoking continues to be the leading cause of preventable death in the United States,[84] and tobacco control is a priority for the American Society of Clinical Oncology.[85]

Rarely included in analysis of clinical trial data on survivorship are data about tobacco use. Amount of smoking (30 or more pack-years) has been shown to be an independent prognostic factor in a study of 375 patients who underwent complete surgical resection for stage I non-small cell lung cancer from 1981 to 1993.[86] Smoking is receiving special attention during clinical trials investigating efficacy of lung cancer screening.[87] At the time of surgery for lung cancer, many smokers may quit. However, some are unable to do so,[78,88–94] and others restart smoking during recovery. In Dresler et al.'s report,[93] 23% of patients who quit within the 2 weeks before surgery relapsed, and 61% who did not quit before surgery continued to smoke. She reports that 89% of smokers acknowledged receiving physician advice to stop smoking. Patients at highest risk for return to smoking were those with the briefest quit time before surgery. In a study of long-term survivors,[13] 13% continued to smoke after curative surgery. There have been several attempts to provide targeted smoking cessation interventions for survivors of cancer, including lung cancer.[79,95,96] However, it is important to note that former smokers continue to be at lifelong increased risk for lung cancer.[78,97] Minimal attention has been given to the risks of exposure to second-hand smoke, also a risk factor for lung cancer. This exposure was reported among 28% of disease-free survivors.[13]

Patients with lung cancer, including long-term survivors, may receive more attributions of blame and responsibility for their disease because of their smoking behavior. Clinically, patients have noted that they feel a judgment that comes from others (healthcare providers, family members, and friends) that they are responsible for their disease if they smoked. Additionally, patients who never smoked or who quit long before their diagnosis may feel unfairly judged. In a qualitative study of 45 patients with lung cancer, patients reported feeling stigmatized because of their smoking. Regardless of current smoking status, patients believed that that past or current smoking affected their quality of care, and for this reason, some concealed their diagnosis.[98] The individual smoker is blamed for his or her illness; even though he or she may have become addicted as a youth, little blame is aimed at the tobacco industry that misled the public about health risks. Only a few studies have explored causal attributions that might affect a patient's response to the diagnosis of lung cancer, especially in the case of a smoking history. There are data to suggest that medical staff's attitudes toward patients may be influenced by these factors as well.[99] In a study that looked at lung cancer patients' own attributions for the cause of their illness, it was found that while smoking cigarettes was the most frequently suggested causal factor, patients also tried to minimize the impact.[100] Eighty-one percent of patients put forward at least one statement that served to qualify or argue the relevance of smoking as the cause. For example, 41% of the patients indicated that "they didn't really know where the disease came from," others argued "they had always led a normal/healthy life, that non-smokers also got lung cancer, that there must be other causes for lung cancer, and that they had always been healthy." Patients are able to reduce their sense of guilt by diluting the cause of the disease; this allows the person to feel some responsibility without shouldering the full sense of blame. Despite the potential causes and responsibilities, there is a need to understand more about these processes and their impact on coping; however, understanding what patients must cope with is a significant concern.

Alcohol Use and Substance Abuse

Although tobacco use is associated with increased risk of alcohol use, few studies have reported on alcohol use or substance abuse among people with cancer, including lung cancer survivors. Among 5-year survivors,[13] 58% were reported to have had a drink in the previous month, with 3% reporting more than 8 drinks in one sitting. As described previously, alcohol use among survivors was associated with poorer perceptions of health.

Nutrition and Weight

There are limited data about weight, nutritional intake, and physical activity that can be used to recommend lifestyle changes for lung cancer survivors. Evangelista et al.[13] reported that 51% of survivors were overweight, including 23% with a body mass index of 30 or more. Recently, a panel of experts convened by the American Cancer Society reviewed the available scientific evidence regarding the benefit of nutritional and activity interventions to decrease recurrence, improve overall survival, and increase HRQOL. They concluded (with an indication of the strength of the evidence as "probable" or "possible" benefit) that lung cancer survivors should strive for a healthy weight during treatment and recovery, and increase fruit, vegetable, and omega 3 fatty acids uptake (especially in the face of weight loss).[101] Additionally, increased activity after treatment was recommended to increase overall survival and HRQOL. There was insufficient evidence for recommendations regarding total fat intake or intake of fiber or soy. The negative impact of tobacco use on decreasing nutrition was noted. Limited information is available about nutritional supplements and the lung cancer survivor, although two previous trials of beta-carotene pills demonstrated an increased risk of lung cancer in smokers.[102,103] A current clinical trial is investigating the potential benefit of selenium supplements in reducing risk of lung cancer recurrence.[104]

Factors Associated with Increased Problems

Although prognostic variables associated with survival have been well studied, factors associated with increased morbidity and diminished HRQOL among disease-free survivors have received limited attention. Age, sex, race/ethnicity, socioeconomic status, and comorbidity have been suggested to contribute to differences.

Age

Older age at diagnosis may influence recovery needs as well as occurrence of long-term sequelae. With the growing number of older Americans, many of whom have had a lifetime of tobacco use and exposure, lung cancer incidence among the elderly can be expected to climb along with the burden of other tobacco-related comorbidities.[84] In a study of patients with limited small cell lung cancer, older patients were more likely to have poorer performance status, more likely to experience poorer survival, and less likely to receive the full extent of optimal treatment.[105] However, older age and comorbidity were not directly related to survival. In Sarna's study,[10] older age was associated with poorer physical function. In a study of physical functioning among older cancer patients, patients who were 3 to 6 weeks post lung cancer surgery ($n = 32$) had significantly lower physical function and more limitations than older patients who had undergone surgery for breast, colon, or prostate surgery.[106] In a cross-sectional study of 133 older patients with lung cancer (over 65 years of age) with various stages of disease and treatment ($n = 26$, including 11 with adjuvant treatment), prior physical function, symptom severity, and older age were predictors of diminished physical functioning.[107]

Sex Differences

As reviewed by Patel et al.,[108] there are important sex differences in lung cancer that may affect survivorship, including the generally female advantage for long-term survival, and differential response to treatment. However, women may be at increased susceptibility to the carcinogens of tobacco[109] and are more likely to be diagnosed with adenocarcinoma.[108,110] Additionally, younger female nonsmokers appear to be at increased risk for lung cancer.[111] However, sex differences in physical and psychologic dimensions of HRQOL are less clear among long-term survivors. None of the studies reviewed supported sex differences in pulmonary function of exercise capacity, although many had only a small subset of women. Sarna et al.[10] reported that women survivors were more likely to live alone and had significantly higher ratings in the existential/spiritual domain of HRQOL as compared to men. In the study by Uchitomi et al.,[60] findings indicate that female patients, but not male patients, did benefit from physicians' social support.

Race/Ethnicity and Socioeconomic Status

Lung cancer incidence varies by race/ethnicity and social status, and these differences have been attributed to differences in lung cancer survivorship.[112] Over 45 million Americans continue to smoke. The gap between smoking among the higher and lower socioeconomic classes is widening, with 32.9% of those below the poverty line smoking as compared to 22.2% at or above the poverty level.[113] Lung cancer is fast becoming a cancer of the impoverished, poorly educated, and ethnic minorities,[114,115] but it is not clear how these factors influence survivorship. Tobacco use has been suggested as a cause of the large differential in male black cancer deaths over the past several decades.[116] African-Americans are less likely to be diagnosed with localized disease as compared to whites (14% versus 16%), and there has been minimal change in survivorship over time (1974–1976, 11%; 1983–1985, 11%; 1992–1999, 12%).[2] A variety of factors have been suggested to account for this disturbing difference, including differences in access to care. Using Surveillance, Epidemiology, and End Results (SEER) data between 1985 and 1993 for black ($n = 860$) and white ($n = 10{,}124$) patients with resectable non-small cell lung cancer, 12.7% fewer black patients in comparison with white patients received potentially curative resection.[117] This unequal treatment resulted in racial differences in survival, as has been reported by others.[118]

Long-term survivors of lung cancer are more likely to come from higher socioeconomic groups.[112] Socioeconomic status has been related to stage at diagnosis and, thus, survivorship.[118,119] Using SEER data for all races from 1995–1999, for those below the poverty rate, 25.3% and 59% of lung cancer patients were diagnosed with regional and distant disease, respectively. Additionally, in a prospective cross-sectional study of 129 newly diagnosed patients with non-small cell lung cancer (including 6 who received surgery), those with lower socioeconomic status, regardless of clinical status, had more health problems and poorer quality of life than those who were affluent.[120]

Comorbidity

In evaluating the HRQOL and health status of survivors, the presence of comorbid conditions, especially those associated with tobacco-related illnesses, may more directly affect HRQOL ratings than the cancer or its treatment. However, there has been limited investigation in this area. Few studies reviewed have adequately documented comorbid conditions among patients who have undergone surgery for lung cancer.[121] In a survey (including preoperative patient history) of 2,189 patients who underwent surgery for lung cancer in Spain, 73% reported at least one comorbid condition, including 50% COPD, 16.5% hypertension, 13.5% heart disease, 10% peripheral vascular disease, and 9% diabetes. Comorbidity was higher in older age groups, but smoking status was not reported. These findings of comorbidity were similar to findings of Sarna et al.[10] among 142 disease-free survivors, in which 70% reported one or more conditions: 28.9% heart disease, 17.6% COPD, 16.9% peptic ulcer disease, 13.4% diabetes, and 16% with reports of other cancers. Fewer comorbid conditions were significantly related to higher physical HRQOL scores, especially for survivors with known heart disease, and contributed to the statistical model for overall HRQOL. Schag et al.[9] found similar results: 32% cardiovascular disease, 41% hypertension, 11% diabetes, and 28% other illnesses; however, a comorbidity index was not predictive of HRQOL for the lung cancer survivors. The Karnofsky performance status was significant, which may be in part a surrogate for the combined effect of comorbid illnesses.

Long-term tobacco use can complicate recovery from lung cancer and its treatment[122] and increase the potential for other and tobacco-related comorbid conditions. Because smoking is a major risk for cardiovascular disease and increases the risk of disease in the presence of other risk factors (e.g., untreated hypertension),[123] the assessment of the impact of tobacco-related comorbidity is essential to survivorship concerns. Additionally, chronic obstructive pulmonary disease (COPD), now the fourth leading cause of death in the United States, continues to increase, especially among women.[123] Similar to lung cancer, more than 90% of cases of COPD are due to smoking; 15% of smokers develop significant COPD.[81] Additionally, COPD has been postulated as a risk factor for lung cancer.[124] Lung function declines more rapidly in smokers as compared to nonsmokers and is associated with progressive disability.[125] Twenty-five percent of patients with small cell lung cancer were noted to have COPD at diagnosis, and 15% had heart disease; however, the prevalence among the 60 long-term survivors is not reported.[72] In a cross-sectional study of 129 older patients with lung cancer at various stages of disease, an average of 3.1 comorbid conditions was reported.[107]

Limits to Current Studies of Lung Cancer Survivors

There are numerous limitations to the current studies describing issues facing lung cancer survivors. A variety of instruments have been used, limiting comparisons across studies. Several have used standardized instruments such as the Center for Epidemiology Status-Depression (CES-D) to assess depression that allow score comparison with normal populations. Other studies have allowed comparison of scores across cancer survivors. Comparing survivors of lung cancer to other populations of survivors of cancer and to populations without major illness is essential in evaluating generalizability of research among survivors. However, further qualitative studies also are needed that provide details about the survivors' lives, identifying positive and negative outcomes.

To determine if these findings are different from or similar to those in others with chronic illness or others with cancer, comparison groups are important. This differences are beyond the extent of surgery alone, as long-term survivors were noted to have higher preoperative HRQOL, when compared to those who suffered recurrence.[71] A health utility score, a global indicator of health reflecting HRQOL, allows for comparisons across studies. This strategy was used in a study using population-based cross-sectional data from the National Health Interview Survey (1998 cohort) of 692 long-term survivors recovering from surgical cancer treatment: breast (n = 377), colon (n = 169), melanoma (n = 92), and lung cancer (n = 54, 50% females). In the acute less than 1-year time period, the scores for the lung cancer survivors (0.42, with 1.0 indicating perfect health), were significantly lower than for the other survivor groups.[126] However, the scores in the longer term cohort (more than 5 years) increased by 47% to 0.62. The presence of pain and angina contributed to poorer scores in long-term survivors. In Schag's study,[9] there was a greater frequency of psychologic distress in patients with lung cancer than the survivors of colon and prostate cancer.

Recommendations to Support Recovery of Lung Cancer Survivors

Based on the available evidence, several interventions are essential to decrease morbidity and promote HRQOL among lung cancer survivors. As a diagnosis of any life-threatening illness such as lung cancer offers clinicians a "teachable moment", recovery can be the impetus for important life changes and behavioral interventions. (1) All lung cancer survivors who smoke must be offered/referred to support and resources to promote tobacco cessation. (2) Because a significant number of survivors experience serious emotional distress in the face of curative treatment, vigilant attention is needed in the ongoing assessment to detect psychosocial problems and to ensure referral for subsequent treatment of those with clinical symptomatology. (3) There should be ongoing assessment and treatment of postthoracotomy pain. (4) Physical rehabilitation must be promoted, especially among those with evidence of disability before curative treatment. (5) Interventions to provide interventions to support relief of dyspnea should be offered to those with this symptom. (6) Changes in lifestyle including healthy diet and activity to promote HRQOL and reduce disability should be supported. (7) There should be identification of and intervention with high-risk patients with known risk factors for morbidity after curative treatment.

A comprehensive wellness approach to survivorship requires that clinicians challenge existing nihilistic views of the curability of lung cancer in general, including negative attitudes toward investing in efforts to support HRQOL regardless of the length of survival. Many of these interventions may be synergistic, such as the decrease in depression associated with exercise. Additionally, those with stable disease may live for many years with lung cancer. Although they may not be "disease free," they should not be neglected in the efforts to improve coping and living with uncertainty while reducing physical and emotional distress.

Future Research

The excellent survival of individuals treated with adequate surgical resection in stage 1 non-small cell lung cancer suggests that increasing survivorship is linked with early detection. Henschke and her colleagues at Cornell University conducted a prospective single-arm trial of low-dose noncontrast spiral computerized tomography (CT) in high-risk patients and demonstrated that CT is three times as sensitive in the detection of small pulmonary nodules as chest roentgenogram and that 80% of lung cancer is detected by this methodology in stage IA.[127]

The National Lung Screening Trial is underway to evaluate current and former smokers aged 55 to 74 at risk for cancer.[128] Findings from standard chest X-rays will be compared with spiral computed tomography (CT) scans to see if early detection of small potentially curable lesions will result in reduced deaths from lung cancer. Thus, an increased number of disease-free survivors might be anticipated, making information about the issues associated with survivorship all the more important. Regardless of efforts to prevent tobacco use and to support cessation, former smokers will continue at higher risk. Hundreds of thousands of Americans will be at risk for lung cancer in the next decades. It is also important to acknowledge the lack of information about long-term survivors with advanced-stage disease. For example, in a few selected cases of patients with isolated brain metastasis, long term survival (more than 10 years) occurred after surgical removal of tumor.[129]

Much more evidence is needed to provide a clear understanding and support for interventions to prevent or reduce physical and psychosocial sequelae of lung cancer and its treatment.[130] Further research is needed to monitor the course of symptoms post treatment and to evaluate strategies for reducing overall symptom burden and improving HRQOL. The studies reviewed are limited primarily because of small sample size and the cross-sectional nature of the design. There are almost no prospective studies documenting the course of survivors who have received adjuvant treatment. Although Schumacher et al. reported that preoperative chemoradiation did not significantly reduce HRQOL in 54 patients in the immediate posttreatment time frame, data for long-term survivors were not available.[131] There is almost no information available about the issues of survivors of small cell lung cancer. Although smoking cessation is included in recommendations for follow-up and surveillance,[132] it is clear from this review of the literature that there is strong evidence to support monitoring physical and emotional well-being after treatment as well.

There are minimal reports of efforts to promote wellness after curative treatment or to examine the efficacy of rehabilitation programs for lung cancer survivors. Future research needs to address the wide range of problems with an eye toward developing a body of literature in which one study can be compared with another. Further research is needed to evaluate available instruments and determine how to get the most information, to provide opportunities for comparison and generalizations across studies, and to not overburden respondents. The work to date represents a start in the understanding of the needs of lung cancer survivors, but it raises more questions than it answers. Some have expressed concerns that if the perception of the physician is that surgery would result in substantial reduction in HRQOL, curative treatment would not be offered, regardless of the patient's view.[133] There are subsets of patients who have significant difficulties in a range of areas. More research is needed in nonwhite samples, from a variety of socioeconomic strata, and the inclusion of family members will provide a more complete view of the impact and needs of survivors.

Intervention studies such as targeting depressed patients might involve both psychologic interventions oriented toward cognitive coping as well as medication trials. The role of multidisciplinary care teams involved in the coaching, support, and physical reconditioning posttreatment need to be explored. The interaction between beliefs and behaviors on the part of the medical team with the patients' belief systems may lead to ways to create greater support and interaction. Additionally, the involvement of survivor participants in the development and monitoring of this research would be useful.

Limiting research for survivors of lung cancer to the disease-free period after 5 years is far too narrow. There is limited knowledge about the period after treatment is completed and before recurrence or second primaries. Newer therapies for advanced non-small cell lung cancer have resulted in improved HRQOL and symptom relief.[134] These needs and issues faced by these survivors with stable disease also need attention.

The evidence base for frequency and type of screening test is important. This information is important in exploring the need for rehabilitation and support. According to findings from available research, lung cancer survivors are diverse, with different profiles of comorbidity, and different vulnerabilities and needs for rehabilitation. Future studies are needed to explore the need to test tailored assessments and interventions so that those at highest risk are appropriately treated to prevent unnecessary short- and long-term morbidity. Because of the relatively small number of lung cancer survivors, the development of a database through a clinical trial mechanism would be useful. Additionally, the quality and the impact of the explosion of web-based sources for cancer survivors, including lung cancer survivors, on HRQOL has not been evaluated.

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