Review Article

Evidence-Based Follow-up for Adults With Cancer

Ulrich Dührsen, Karl-Matthias Deppermann, Christian Pox, Axel Holstege

Summary

Background: The objectives of follow-up care for cancer patients include psychosocial assistance and the detection of health problems. The concept of follow-up care rests on the assumption that the early detection of cancer recurrences and disease- or treatment-related complications is beneficial to patients. In this article, we provide an overview of the scientific evidence supporting current recommendations for the follow-up care of patients with colorectal cancer, lung cancer, and lymphoma.

Methods: This review is based on pertinent publications that were retrieved by a selective search in PubMed, supplemented by the authors' own experience in patient care and guideline creation.

Results: As recurrences usually arise soon after initial treatment, the recommended follow-up interval is shorter in the first two years (3–6 months) and longer thereafter (6–12 months). The question of which particular follow-up studies should be performed has only been systematically analyzed in a few cases. For patients with colorectal cancer, colonoscopy is the most important study. Intensive follow-up care is associated with a statistically non-significant increase in the survival rate compared to minimal follow-up care (77.5% versus 75.8%). Intensive diagnostic follow-up studies have been found to lead to a doubling of the frequency of operations for recurrence with curative intent, yet without any effect on the average survival time. The findings in lung cancer are similar. However, after tumor resection with curative intent, regularly repeated CT scanning leads to a survival advantage. In lymphoma patients, the longer the interval from primary treatment, the greater the likelihood of treatment-related secondary illnesses. It is not yet known how follow-up care should be provided to these patients in order to help them best.

Conclusion: The evidence supporting the efficacy of currently recommended modalities of follow-up care for cancer patients is weak. Until more data from clinical studies become available, the current guidelines should be followed.

Cite this as:

Dührsen U, Deppermann KM, Pox C, Holstege A: Evidence-based follow-up for adults with cancer. *Dtsch Arztebl Int* 2019; 116: 663–9. DOI: 10.3238/arztebl.2019.0663

Follow-up is the medical care of patients once their treatment has been completed. The goals of follow-up include providing psychosocial support in the reintegration of patients into family and professional life, as well as detecting relapses and complications that may be due to their disease or treatment. It is assumed that early recognition of disorders is beneficial.

All patients that are able to participate in rehabilitation following their treatment should be offered rehabilitative measures. The intervals of subsequent follow-up are shorter in the first years compared to those later, since prompt psychosocial support is required and recurrence is generally rapid. Possible follow-up measures include patient history, physical examination, laboratory tests, instrument-based methods, and referrals to other medical specialties (1). Who provides which services and when in order to achieve follow-up goals in an optimal manner has been systematically investigated in only very few cases. Current follow-up plans are largely based on clinical experience and expert consensus.

Evidence is defined as the state of knowledge on which the recommendation for a medical intervention is based. A number of scales that overlap in essential features are used to classify evidence (2). The highest level of evidence is obtained from prospective randomized studies, followed by retrospective investigations, case reports, and expert opinions. Based on the available evidence, a number of institutions in Germany have formulated recommendations on the follow-up care of cancer patients. These range from the short *Onkopedia* guidelines issued by the German Society for Hematology and Medical Oncology (*Deutsche Gesellschaft für Hämatologie und Medizinische Onkologie*, DGHO) (3) to the comprehensive S3 guidelines of the Association of the Scientific Medical Societies in Germany (*Arbeitsgemeinschaft der Wissenschaftlichen Medizinischen Fachgesellschaften*, AWMF), in the formulation of which numerous disciplines have participated according to strictly defined rules (4). National and international guidelines (e.g., the European Society for Medical Oncology and the US National Comprehensive Cancer Network) concur in many, but not all, aspects of follow-up design.

This article presents the recommendations on and scientific bases for follow-up care in colorectal cancer, lung cancer, and lymphoma. These diseases

Department of Haematology, University Hospital Essen: Prof. Dr. med. Ulrich Dührsen

Department of Pneumology, Sana Kliniken Düsseldorf: Dr. med. Karl-Matthias Deppermann

Medical Clinic, Krankenhaus St. Josef-Stift Bremen: PD Dr. med. Christian Pox

Medical Clinic 1, Klinikum Landshut: Prof. Dr. med. Axel Holstege (Emeritus)

TABLE 1

Follow-up care in colorectal cancer (6, 7)

Colon cancer	
UICC stage I	Colonoscopy after 1 year; if normal, every 5 years
UICC stages II and III	Colonoscopy after 1 year; if normal, every 5 years
	Patient history, abdominal ultrasound, CEA testing
	(first and second year: every 6 months, from the third year: annually)
Rectal cancer	
As in colon cancer plus additional annual chest radiography	

CEA, carcinoembryonic antigen; UICC, Union Internationale Contre le Cancer

illustrate well the range of tasks and the problems associated with follow-up care. Since the framework here extends beyond a single form of cancer, the overall scope is limited and therefore does not permit an exhaustive discussion of all three cancers. The evidence was obtained by means of a PubMed search using the terms “follow-up,” “colorectal cancer,” “lung cancer,” and “lymphoma,” as well as systematic literature searches conducted during the formulation of the AWMF guidelines in which the authors were involved (4).

Colorectal cancer

Incidence and disease course

With 61 000 new cases per year in Germany, colorectal cancer is the third most frequent form of cancer in men and the second most frequent in women. Approximately a third of these cancers are localized in the rectum (5). Treatment generally comprises resection of the affected segment of the colon, as well as radiotherapy or chemotherapy, depending on localization and stage. Similarly, 5-year survival rates also depend on stage: these are over 95% in Union Internationale Contre le Cancer (UICC) stage I, in contrast to around only 10% in stage IV, i.e., with evidence of distant metastases. Likewise, the risk of recurrence is stage-dependent and is around 30% in the first 5 years following curative surgery. A distinction needs to be made between metachronous second tumors (1.5–10%), local or locoregional recurrences (3–24%), and distant metastasis (25%) (6). Distant metastasis most commonly occurs in the liver, followed by the lungs.

Current follow-up recommendations

Follow-up recommendations are based on the AWMF S3 guideline “*Kolorektales Karzinom*” (colorectal cancer) (6, 7). In general, follow-up is only beneficial if the detection of recurrence leads to treatment. The extent of follow-up depends on how advanced the cancer is (Table 1). Since distant metastases are rare in UICC stage I, endoscopic follow-up only is recommended for the detection of metachronous neoplasms. Structured

follow-up is recommended in stage IV cancer following curative resection of distant metastases; however, due to a lack of evidence, no information is available on extent or procedure. The German S3 guideline recommends imaging and carcinoembryonic antigen (CEA) testing. These should be performed every 3 months in the first 2 years and every 6 months thereafter (Table 1). In UICC stage II and III, a patient history is taken and abdominal ultrasound and CEA testing performed every 6 months in the first 2 years and every 12 months thereafter. In the case of rectal cancer, annual chest X-ray is additionally recommended due to the increased incidence of lung metastasis. Colonoscopy should be performed within 6 months of surgery if pre-operative colonoscopy was incomplete, in other cases after 1 year. The intervals of further follow-up depend on the results of colonoscopy. The recommendations on polyp follow-up apply (7). If initial follow-up colonoscopy is normal, subsequent colonoscopy should be carried out at 5-year intervals.

The evidence for current follow-up recommendations

In order to compare follow-up strategies, randomized studies were conducted. The extent and intensity of follow-up vary significantly between investigations. Studies that investigated the stage-dependent approach favored in Germany are not available.

The overall effectiveness of follow-up appears to be marginal, with a mean absolute improvement in survival of 1% in patients receiving follow-up (8). According to the results of a meta-analysis, 370 positive follow-up tests (imaging, colonoscopy, CEA, as well as others) and 11 surgical procedures for recurrence were required in order to confer 5-year survival on a single patient (9). A Cochrane analysis of 15 studies revealed that intensive compared to minimal follow-up is associated with slightly improved overall survival (hazard ratio [HR] = 0.90; percentage of surviving patients, 77.5% versus 75.8%) and colorectal cancer-specific survival (HR = 0.93; percentage of surviving patients, 86.7% versus 85.7%); no statistically significant differences

TABLE 2

Follow-up care in lung cancer (12)

Curative surgery or radiotherapy		
Treatment monitoring	4–6 Weeks after completion of treatment	
Follow-up interval	Year 1 and 2	3 Months
	Year 3 and 4	6 Months
	From year 5	12 Months
Measures	Chest X-ray, computed tomography where appropriate Abdominal ultrasound Laboratory tests (according to the treating physician, tumor markers not recommended) Low-dose computed tomography (once a year)	
Palliative radiotherapy or systemic therapy		
Treatment monitoring	4–6 Weeks after completion of treatment	
Follow-up interval	3 months	
Measures	Chest X-ray, computed tomography where appropriate Abdominal ultrasound Laboratory tests (according to the treating physician, tumor markers not recommended)	

were seen (10). The rate of curative-intent surgical procedures for recurrences was almost double in the case of intensive follow-up, while the rate of recurrences diagnosed on the basis of symptoms went down by around 40% (7.5% versus 12.5%). Both findings differ in a statistically significant manner. A cohort study conducted in the US found no statistically significant difference between the time to detection of recurrence using an intensive versus less intensive post-treatment imaging surveillance strategy (15.1 versus 16.0 months). In that particular study, 25% of participants had stage I cancer and a low risk of recurrence (11).

In the absence of randomized trials, the value of individual elements of follow-up remains unclear (5, 6, 9). For example, cancer recurrence was confirmed in only 26 of 370 patients with positive follow-up tests (9). Nevertheless, retrospective analyses appear to suggest that certain measures are beneficial (*Table 1*) (5, 6).

Lung cancer

Incidence and disease course

Lung cancer is one of the most common cancers in Germany. In 2014, its incidence was documented to be 34 560 cases for men and 19 280 for women. The prognosis remains poor. The percentage of lung cancer-related deaths among men is 24% (29 560 deaths), and thus the highest of all cancers. The percentage among women is 15% (15 524 deaths), making it the second most common cancer-related cause of death (5). Following curative treatment, the most important goal of follow-up is the early detection of possible recurrence or secondary tumors, which can then be managed

by means of curative-intent surgery. Following non-curative treatment, symptom control and quality of life take priority.

Current follow-up recommendations

All patients should be offered support with smoking cessation. In addition to patient history and a physical examination, instrument-based follow-up methods are also available. Bronchoscopy is indicated in the case of a high risk of local recurrence, e.g., following cuff resection. Chest X-ray is suitable for the assessment of rate of growth, while computed tomography of the chest yields additional information on local extent. Alongside computed tomography, abdominal ultrasound also permits visualization of liver and adrenal metastasis and para-aortic lymphomas. Magnetic resonance tomography is used in the case of brain and bone metastasis. Positron emission tomography/computed tomography is the best method for the identification of metastasis prior to thoracic surgery. Tumor marker determination is not recommended.

The type and goal of primary treatment determine follow-up, the principles of which are set out in the AWMF guideline “*Lungenkarzinom*” (lung cancer) (*Table 2*) (12).

The evidence for current follow-up recommendations

Only a handful of mostly retrospective studies deal with follow-up care in lung cancer. To ensure prompt initiation of treatment, complications and toxicities should be assessed 4–6 weeks following completion of local or systemic treatment. Following surgical resection, these primarily include bronchial stump

FIGURE 1

The effect of screening method (conventional chest X-ray versus low-dose CT) on the cumulative number of detected cases of lung cancer (a) and lung cancer mortality (b) in high-risk patients investigated in a screening study (National Lung Screening Trial) (modified from [20]). Although the superiority of CT was demonstrated in a screening study under randomized conditions, it should apply in the same way to follow-up.

insufficiency, pleural fistulas, pneumonia, and empyema. Chronic pain and the loss of lung tissue play a role in lung capacity and quality of life. Following radiotherapy, esophagitis and pneumonitis, as well as effects on the skin, heart, and bone marrow, take the foreground (13). After systemic treatment, the side effects typical of the class of drug used (chemotherapeutic agents, immunotherapeutic agents, targeted substances) should be assessed during follow-up.

Clinical studies examine follow-up with a strict time plan versus symptom-oriented follow-up. Focus is also put on intensive versus less intensive surveillance and cost-benefit analyses. The findings of the available studies are controversial. Shorter follow-up intervals or more intensive surveillance did not improve outcomes. Cost-benefit analyses for the German healthcare system are lacking.

In their randomized study, Moore et al. (14) compared medical follow-up with monthly assessments by specialist nurses (in the outpatient setting or by telephone). Patient satisfaction was greater among patients receiving nurse-led follow-up compared to those receiving conventional medical follow-up. Close surveillance reduced the number of physician visits; there were no significant differences in duration or quality of life.

A retrospective investigation of 1398 patients with resected lung cancer compared follow-up carried out by thoracic surgeons with that carried out by chest physicians (15). The latter included chest computed tomography scans twice a year in addition to an X-ray examination. This correlated with a significant prolongation of survival (median 71 versus 111 months).

However, the study design was such that it was not possible to distinguish between a true prolongation of life and prolongation of life in the case of recurrence detected at an earlier stage (lead-time bias).

In their retrospective study, Virgo et al. (16) were not able to show a benefit for intensive compared to conventional follow-up. A similar approach by Westeel et al. (17) found a benefit for the detection of recurrence in asymptomatic versus symptomatic patients (3-year survival 31% versus 10%).

A retrospective study conducted by Younes et al. (18) compared a strictly scheduled follow-up plan with symptom-oriented follow-up. Although there were no differences in survival parameters, morbidity (use of emergency care, frequency and duration of inpatient stays) was higher in symptom-oriented follow-up. A systematic review was unable to demonstrate superiority of one follow-up strategy over the other (19).

High-risk patients that have undergone treatment with curative intent (age ≥ 55 years, smoking history ≥ 30 pack-years) should be offered annual low-dose computed tomography scans to detect recurrences or secondary tumors. This recommendation stems from the National Lung Screening Trial, the largest randomized screening study to date in which low-dose computed tomography reduced lung cancer-related mortality by 20% and overall mortality by 6.7% compared to conventional radiographic examination in a similarly defined risk group (Figure 1) (20, 21).

Research is much needed in order to improve follow-up care in lung cancer, particularly in view of novel treatment strategies.

TABLE 3

Follow-up care in lymphoma

Lugano recommendations (23)			
Follow-up interval	Curable lymphoma	Year 1 and 2	3 Months
		Years 3–5	6 Months
		From year 6	12 Months
	Incurable lymphoma	Year 1 and 2	3 Months
		From year 3	3–6 Months
Measures	Patient history		
	Physical examination		
	Blood tests (blood count, creatinine, electrolytes, blood glucose, lactate dehydrogenase)		
Other useful measures			
Screening tests offered by statutory health insurances	Early cancer detection (cervix, breast, prostate, colon, skin)		
	Health check-up (cardiovascular risk factors)		
Cervical radiotherapy (risk of hypothyroidism: 35%)	TSH in serum every 12 months		
Chest radiotherapy in women <30 years (breast cancer risk: up to 30%)	Early breast cancer screening, beginning: 8 years following radiotherapy		

TSH, thyroid-stimulating hormone

Lymphoma

Incidence and disease course

Lymphoma is the sixth most frequent type of cancer in Germany in both sexes. It includes Hodgkin's (1340 and 1030 annual new cases, respectively) and non-Hodgkin's lymphoma (9160 and 7880 new cases, respectively) (5). The latter are subdivided into aggressive diseases, which rapidly result in death if left untreated, and indolent forms, which often span decades. Cytostatic agents, antibodies, targeted substances, and radiotherapy are used as treatment methods. Hodgkin's and aggressive non-Hodgkin's lymphoma are essentially curable, with long-term remission rates of 90% and 60%, respectively. The majority of relapses occur within the first 2 years. Indolent lymphoma is considered incurable once spread has occurred. Long-term remission can be achieved in cases requiring treatment.

Current follow-up recommendations

Proposals on lymphoma follow-up were made in the late 1980s at the Cotwolds Meeting and are still considered standard today in modified form (22). The current Lugano recommendations date back to 2014 (Table 3) (23). The DGHO *Onkopedia* publications include guidelines for nine lymphoma entities. The AWMF has made an S3 guideline for Hodgkin's lymphoma available (24).

In terms of follow-up intervals, the guidelines adhere to the Lugano recommendations. Patient history, physical examination, and blood tests form part of

each follow-up appointment (Table 3). Routine computed tomography is not recommended (25, 26).

Chemotherapy and radiotherapy cause cell and organ damage, which needs to be taken into account during follow-up (27). Alkylating agents, topoisomerase II inhibitors, and radiation induce leukemia in about 1–5% of patients, generally in the first 2–10 years (28). The development of solid tumors is primarily attributed to radiotherapy. The rate of secondary neoplasms after 40 years in Hodgkin's lymphoma is almost 50% (28). Every third female patient receiving thoracic radiotherapy before the age of 25 develops breast cancer (29). This warrants the recommendation for early breast cancer screening (Table 3). With regard to other secondary neoplasms, regular early-detection screening should be performed. Patients should stop smoking, since it promotes the development of lung cancer following chest radiation (29).

Anthracyclines contribute to the development of heart failure (29). Mediastinal radiotherapy can induce coronary heart disease, as well as damage to the heart muscle or heart valves, often after decade-long latency (28). Radiation in the vicinity of vessels can cause stenosis. In order to minimize additional adverse effects, cardiovascular risk factors need to be assessed and, where appropriate, treated (29).

Alkylating agents cause—at least temporarily—sterility in men (30). In women, ovarian reserve is reduced, which, depending on age, can lead to infertility or the risk of premature menopause (31).

FIGURE 2

Cumulative development of second malignancies in curatively treated patients with non-Hodgkin's lymphoma in relation to the number of computed tomography (CT) scans performed in the first year following diagnosis. (Modified from [33]; reprinted with kind permission from John Wiley and Sons)

Patients need to be informed prior to treatment of the risk of infertility and the possibilities of fertility-preserving measures. Fertility issues are also relevant in follow-up when it comes to family planning. Fatigue needs to be differentiated from radiation-induced hypothyroidism (29).

The evidence for current follow-up recommendations

The follow-up intervals shown in Table 3 have not been investigated for their usefulness (25). Systematic investigations on the follow-up specialty are lacking.

Medical consultation and physician availability are of paramount importance in the detection of lymphoma relapse, since the first signs of recurrence are usually detected by the patients themselves due to lymph node swelling or symptoms (26). Only a small number of recurrences are discovered on routine computed tomography. There are no differences in survival between patients with symptomatic and those with asymptomatic recurrence (25, 26). A randomized follow-up study showed chest X-ray and abdominal ultrasound to be equally sensitive in the detection of Hodgkin's lymphoma relapse as positron emission tomography/computed tomography, which often yielded false-positive findings (32).

The unfavorable effects of routine computed tomography include creating insecurity in the patient, radiation exposure, and costs (26). A study that investigated 4874 non-Hodgkin's lymphoma patients made a correlation between the incidence of secondary primary malignancies and the number of computed tomography scans performed (Figure 2) (33).

It is extremely rare for blood tests to be a determining factor in the detection of lymphoma relapse (26). The relevance of individual methods for the detection of secondary malignancies and cardiovascular disease has not been systematically analyzed (25). Whether early detection of asymptomatic cardiovascular disorders confers a benefit is currently being investigated (28).

Conclusions

The most important goal of follow-up from the patient's perspective is to obtain the greatest possible reassurance with regard to disease relapse. This explains patients' wishes for frequent screening, extensive testing, as well as long-term physician continuity (34). As discussed above, extensive follow-up measures are not beneficial in the majority of situations. Moreover, they are a source of recurring anxiety and insecurity (35).

In addition to disease relapse, patients are also at risk of late adverse effects of treatment, the type and timing of which are not always aspects with which the treating physician is familiar. Individual follow-up plans (survivorship care plan) formulated on the basis of the treatment that has been performed and the available scientific evidence could be a remedy to this by providing guidance on beneficial follow-up measures, health-promoting behaviors, and possible late sequelae (28).

Increasing life expectancy and improved treatment outcomes lead to a steady rise in the number of cancer patients undergoing follow-up (1). It is the case in numerous diseases that lifetime following treatment exceeds the duration of therapy many times over. In light of this, the virtual lack of high-quality evidence on follow-up design is surprising. The assumption on which the follow-up concept is based, i.e., that early detection of asymptomatic health disorders has a beneficial effect on the further course of life, has been investigated and confirmed in only a handful of events as yet. Carefully planned and adequately financed clinical studies are required to improve the evidence.

Conflict of interest statement

PD Dr. Pox received lecture fees from Falk, Hitachi, and Roche.

Prof. Holstege received travel cost reimbursement and lecture fees from the Falk Foundation and Recordati Pharma GmbH.

The remaining authors state that they have no conflicts of interest.

Manuscript submitted on 10 April 2019, revised version accepted on 19 July 2019

Translated from the original German by Christine Rye.

References

1. Kenzik KM: Health care use during cancer survivorship: review of 5 years of evidence. *Cancer* 2019; 125: 673–80.
2. Burns PB, Rohrich RJ, Chung KC: The levels of evidence and their role in evidence-based medicine. *Plast Reconstr Surg* 2011; 128: 305–10.
3. Deutsche Gesellschaft für Hämatologie und Medizinische Onkologie: Onkopedia-Leitlinien. www.onkopedia.com/de/onkopedia/guidelines (last accessed on 18 February 2019).

4. AWMF online. Aktuelle Leitlinien. www.awmf.org/leitlinien/aktuelle-leitlinien.html (last accessed on 6 April 2019).
5. Zentrum für Krebsregisterdaten. Krebs in Deutschland 2013/2014. www.krebsdaten.de/Krebs/DE/Content/Publikationen/Krebs_in_Deutschland/krebs_in_deutschland_node.html (last accessed on 31 March 2019).
6. Schmiegel W, Buchberger B, Follmann M, et al.: S3-Leitlinie – Kolorektales Karzinom. *Z Gastroenterol* 2017; 55: 1344–498.
7. Leitlinienprogramm Onkologie: S3-Leitlinie Kolorektales Karzinom. Langversion 2.1 – Januar 2019. AWMF-Registernummer: 021/007OL. www.leitlinienprogramm-onkologie.de/fileadmin/user_upload/Downloads/Leitlinien/Kolorektales_Karzinom/Version_2/LL_KRK_Langversion_2.1.pdf (last accessed on 29 March 2019).
8. Kievit J: Colorectal cancer follow-up: a reassessment of empirical evidence on effectiveness. *Eur J Surg Oncol* 2000; 26: 322–8.
9. Kievit J: Follow-up of patients with colorectal cancer: numbers needed to test and treat. *Eur J Cancer* 2002; 38: 986–99.
10. Jeffery M, Hickey BE, Hider PN, See AM: Follow-up strategies for patients treated for non-metastatic colorectal cancer. *Cochrane Database Syst Rev* 2016; 11: CD002200.
11. Snyder RA, Hu CY, Cuddy A, et al.: Association between intensity of posttreatment surveillance testing and detection of recurrence in patients with colorectal cancer. *JAMA* 2018; 319: 2104–15.
12. Leitlinienprogramm Onkologie: S3-Leitlinie Prävention, Diagnostik, Therapie und Nachsorge des Lungenkarzinoms. Langversion 1.0 – Februar 2018. AWMF-Registernummer: 020/007OL. www.leitlinienprogramm-onkologie.de/fileadmin/user_upload/Downloads/Leitlinien/Lungenkarzinom/LL_Lungenkarzinom_Langversion_1.0.pdf (last accessed on 31 March 2019).
13. Colice GL, Rubins J, Unter M: Follow-up and surveillance of the lung cancer patient following curative-intent therapy. *Chest* 2003; 123: 272S–83S.
14. Moore S, Corner J, Haviland J, et al.: Nurse led follow up and conventional medical follow up in management of patients with lung cancer: randomized trial. *BMJ* 2002; 325: 1145.
15. Nakamura R, Kurishima K, Kobayashi N, et al.: Postoperative follow-up for patients with non-small cell lung cancer. *Onkologie* 2010; 33: 14–8.
16. Virgo KS, McKirgan LW, Caputo MC, et al.: Post-treatment management options for patients with lung cancer. *Ann Surg* 1995; 222: 700–10.
17. Westeel V, Choma D, Clément F, et al.: Relevance of an intensive postoperative follow-up after surgery for non-small cell lung cancer. *Ann Thorac Surg* 2000; 70: 1185–90.
18. Younes RN, Gross JL, Deheinzlin D: Follow-up in lung cancer: how often and for what purpose? *Chest* 1999; 115: 1494–9.
19. Schmidt-Hansen M, Baldwin DR, Hasler E: What is the most effective follow-up model for lung cancer patients? A systematic review. *J Thorac Oncol* 2012; 7: 821–4.
20. National Lung Screening Trial Research Team, Aberle DR, Adams AM, Berg CD, et al.: Reduced lung-cancer mortality with low-dose computed tomography screening. *N Engl J Med* 2011; 365: 395–409.
21. Stang A, Schuler M, Kowall B, Darwiche K, Kühl H, Jöckel KH: Lung cancer screening using low dose CT scanning in Germany—extrapolation of results from the National Lung Screening Trial. *Dtsch Arztebl Int* 2015; 112: 637–44.
22. Lister TA, Crowther D, Sutcliffe SB, et al.: Report of a committee convened to discuss the evaluation and staging of patients with Hodgkin's disease: Cotswolds meeting. *J Clin Oncol* 1989; 7: 1630–6.
23. Cheson BD, Fisher RI, Barrington SF, et al.: Recommendations for initial evaluation, staging, and response assessment of Hodgkin and non-Hodgkin lymphoma: the Lugano classification. *J Clin Oncol* 2014; 32: 3059–68.
24. Leitlinienprogramm Onkologie: Konsultationsfassung S3-Leitlinie Diagnostik, Therapie und Nachsorge des Hodgkin Lymphoms bei erwachsenen Patienten. Langversion 0.2.0 – Dezember 2017, AWMF-Registernummer 018/029. www.leitlinienprogramm-onkologie.de/fileadmin/user_upload/Downloads/Leitlinien/Hodgkin/Version_2/LL_Hodgkin_Lymphom_Langversion_Konsultationsfassung_0_2_0.pdf (last accessed on 18 February 2019).

Key messages

- The goals of follow-up care include providing psychosocial support in the reintegration of patients into family and professional life, as well as detecting relapses and complications due to their disease or treatment.
- The variables of follow-up care include the professional group or medical speciality responsible for carrying it out, its timing, and the medical measures used.
- Guidelines on follow-up care have been drawn up and published by a number of German (e.g., the AWMF and the DGHO) and international institutions (e.g., the ESMO and the NCCN).
- Since only scant prospective data are available, current follow-up recommendations are predominantly based on clinical experience and expert consensus.
- Prospective clinical studies are required in order to improve evidence and bring follow-up concepts in line with advances in treatment.

25. Sussman J, Varela NP, Cheung M, et al.: Follow-up care for survivors of lymphoma who have received curative-intent treatment. *Curr Oncol* 2016; 23: e499–e513.
26. Hiniker SM, Hoppe RT: Post-treatment surveillance imaging in lymphoma. *Semin Oncol* 2017; 44: 310–22.
27. Scholz-Kreisel P, Kaatsch P, Spix C, et al.: Second malignancies following childhood cancer treatment in Germany from 1980 to 2014—a registry-based analysis. *Dtsch Arztebl Int* 2018; 115: 385–92.
28. Damlaj M, El Fakih R, Hashmi SK: Evolution of survivorship in lymphoma, myeloma and leukemia: metamorphosis of the field into long term follow-up care. *Blood Rev* 2019; 33: 63–73.
29. Ng AK, LaCasce A, Travis LB: Long-term complications of lymphoma and its treatment. *J Clin Oncol* 2011; 29: 1885–92.
30. Pryzant RM, Meistrich ML, Wilson G, et al.: Long-term reduction in sperm count after chemotherapy with and without radiation therapy for non-Hodgkin's lymphomas. *J Clin Oncol* 1993; 11: 239–47.
31. Elis A, Tevet A, Yerushalmi R, et al.: Fertility status among women treated for aggressive non-Hodgkin's lymphoma. *Leuk Lymphoma* 2006; 47: 623–7.
32. Picardi M, Pugliese N, Cirillo M, et al.: Advanced-stage Hodgkin lymphoma: US/chest radiography for detection of relapse in patients in first complete remission—a randomized trial of routine surveillance imaging procedures. *Radiology* 2014; 272: 262–74.
33. Chien SH, Liu CJ, Hu YW, et al.: Frequency of surveillance computed tomography in non-Hodgkin lymphoma and the risk of secondary primary malignancies: a nationwide population-based study. *Int J Cancer* 2015; 137: 658–65.
34. Brandenburg D, Berendsen AJ, de Bock GH: Patients' expectations and preferences regarding cancer follow-up care. *Maturitas* 2017; 105: 58–63.
35. Thompson CA, Charlson ME, Schenkein E, et al.: Surveillance CT scans are a source of anxiety and fear of recurrence in long-term lymphoma survivors. *Ann Oncol* 2010; 21: 2262–6.

Corresponding author

Prof. Dr. med. Ulrich Dührsen
Klinik für Hämatologie, Universitätsklinikum Essen
Hufelandstraße 55, 45147 Essen, Germany
ulrich.duehrsen@uk-essen.de

Cite this as

Dührsen U, Deppermann KM, Pox C, Holstege A:
Evidence-based follow-up for adults with cancer.
Dtsch Arztebl Int 2019; 116: 663–9.
DOI: 10.3238/arztebl.2019.0663