- management of primary lung tumors. *J Thorac Cardiovasc Surg.* 2008;135:247-54.
9. Rueth NM, Parsons HM, Habermann EB, Groth SS, Virnig BA, Tuttle TM, et al. Surgical treatment of lung cancer: predicting postoperative morbidity in the elderly population. *J Thorac Cardiovasc Surg.* 2012;143:1314-23.
 10. Warren JL, Klabunde CN, Schrag D, Bach PB, Riley GF. Overview of the SEER-Medicare data: content, research applications, and generalizability to the united states elderly population. *Med Care.* 2002;40(8 Suppl). IV-3-18.
 11. Greene F, Page D, Fleming I, Fritz A, Balch C, Haller D, et al, eds. *AJCC Cancer Staging Handbook: From the AJCC Cancer Staging Manual.* 6th ed. New York: Springer-Verlag; 2002.
 12. Deyo RA, Cherkin DC, Ciol MA. Adapting a clinical comorbidity index for use with ICD-9-CM administrative databases. *J Clin Epidemiol.* 1992;45:613-9.
 13. Klabunde CN, Potosky AL, Legler JM, Warren JL. Development of a comorbidity index using physician claims data. *J Clin Epidemiol.* 2000;53:1258-67.
 14. SEER-Medicare: Calculation of comorbidity weights [homepage on the Internet]. 2010. Available at: <http://healthservices.cancer.gov/seermedicare/program/comorbidity.html>. Accessed July 1, 2013.
 15. Hu Y, McMurtry TL, Wells KM, Isbell JM, Stukenborg GJ, Kozower BD. Post-operative mortality is an inadequate quality indicator for lung cancer resection. *Ann Thorac Surg.* 2014;97:973-9.
 16. R: A language and environment for statistical computing [homepage on the Internet]. Vienna, Austria: R Foundation for Statistical Computing; 2013. Available at: <http://www.R-project.org/>. Accessed June 1, 2013.
 17. Freeman RK, Dilts JR, Ascoti AJ, Dake M, Mahidhara RS. A comparison of length of stay, readmission rate, and facility reimbursement after lobectomy of the lung. *Ann Thorac Surg.* 2013;96:1740-6.
 18. Varela G, Aranda JL, Jimenez MF, Novoa N. Emergency hospital readmission after major lung resection: prevalence and related variables. *Eur J Cardiothorac Surg.* 2004;26:494-7.
 19. Handy JR Jr, Child AI, Grunkemeier GL, Fowler P, Asaph JW, Douville EC, et al. Hospital readmission after pulmonary resection: prevalence, patterns, and predisposing characteristics. *Ann Thorac Surg.* 2001;72:1855-60.
 20. Maniar HS, Bell JM, Moon MR, Meyers BF, Marsala J, Lawton JS, et al. Prospective evaluation of patients readmitted after cardiac surgery: analysis of outcomes and identification of risk factors. *J Thorac Cardiovasc Surg.* 2014;147:1013-8.
 21. McDevitt J, Kelly M, Comber H, Kelleher T, Dwane F, Sharp L. A population-based study of hospital length of stay and emergency readmission following surgery for non-small-cell lung cancer. *Eur J Cardiothorac Surg.* 2013;44:e253-9.
 22. Costantino ME, Frey B, Hall B, Painter P. The influence of a postdischarge intervention on reducing hospital readmissions in a Medicare population. *Popul Health Manag.* 2013;16:310-6.
 23. Fernando HC, Landreneau RJ, Mandrekar SJ, Hillman SL, Nichols FC, Meyers B, et al. Thirty- and ninety-day outcomes after sublobar resection with and without brachytherapy for non-small cell lung cancer: results from a multicenter phase III study. *J Thorac Cardiovasc Surg.* 2011;142:1143-51.
 24. Kozower BD, Sheng S, O'Brien SM, Liptay MJ, Lau CL, Jones DR, et al. STS database risk models: predictors of mortality and major morbidity for lung cancer resection. *Ann Thorac Surg.* 2010;90:875-83.
 25. Howlader N, Noone AM, Krapcho M, Garshell J, Neyman N, Altekruse SF, et al. *SEER Cancer Statistics Review, 1975-2010.* Bethesda, MD: National Cancer Institute; 2013.
 26. D'Agostino RS, Jacobson J, Clarkson M, Svensson LG, Williamson C, Shahian DM. Readmission after cardiac operations: prevalence, patterns, and predisposing factors. *J Thorac Cardiovasc Surg.* 1999;118:823-32.
 27. Ferraris VA, Ferraris SP, Harmon RC, Evans BD. Risk factors for early hospital readmission after cardiac operations. *J Thorac Cardiovasc Surg.* 2001;122:278-86.

EDITORIAL COMMENTARY

The crisis of readmissions: Symptom or disease?

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See related article on pages 2261-7.

Unexpected readmission after major lung resection is a relatively common occurrence and a major financial burden to the health care system. Although no clear data on lung cancer surgery are available, the Center for Medicare and Medicaid

Services estimates its annual costs for 30-day readmission to hospitals to be \$26 billion.¹ As Hu and colleagues have shown in their article in this issue of the *Journal*, the overall long-term burden to society goes well beyond direct costs, because readmissions are associated with a significantly elevated risk of 90-day mortality. As part of the Affordable Care Act's Hospital Readmissions Reduction Program, public reporting of readmission rates has now been mandated, with potential financial penalties for institutions with excessive readmissions. Thus without a doubt preventing and appropriately managing readmissions in thoracic surgery is not only a medical necessity but a financial imperative for programs. This is especially true because competing nonoperative techniques for treating lung cancer are almost entirely free from the burden of readmissions.

Hu and colleagues, as well as previous authors, have treated readmission both as an important outcome variable in and of itself and as a predictor variable for further downstream events (death, disability, etc). For statistical

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modeling, this approach is indeed understandable and appropriate. One must understand, however, that readmission is not a diagnosis but a sentinel event that is a marker of underlying medical and sometimes social conditions necessitating further contact with the health care system. Thus our goal should be to manage the issues leading to readmission. This is important, because an overemphasis on simply reducing readmission rates to avoid incurring penalties may lead to reluctance to readmit, with disastrous medical consequences.

An important finding of the study Hu and colleagues, also been reported by others, is that single-institution data miss at least 25% of readmissions. This may be especially true of larger academic programs, where patients travel considerable distances to get surgical care. On the other hand, it is also important to distinguish planned (unrelated) and unplanned readmissions. A patient with stage III lung cancer may undergo placement of venous access for chemotherapy after surgery and be recorded as a readmission in large databases. Additionally, the average patient with lung cancer has significant comorbidities that can lead to unrelated admissions to the hospital shortly after surgery. Nevertheless, the current enhanced scrutiny of the national “readmission crisis” calls for a 3-pronged approach to the problem: predict, avoid, and manage.

Patient-related factors associated with readmission include increasing age, male sex, lower socioeconomic status, and higher levels of comorbidity.² More complex operations, such as pneumonectomy and chest wall resection, are also risk factors. Finally, higher stage of cancer, a longer index hospitalization, and major postoperative complications are predictive of readmissions as well. Despite these recognized predisposing factors, the models developed to predict readmission after major cardiothoracic surgery have very modest discrimination (C statistic around 0.6), with a predictive ability only slightly greater than chance. This highlights a significant drawback of studies that use large data sets in which pertinent patient-specific information likely to impact readmission rates, such as lung function tests or functional status, is unavailable. Additionally, none of the available models account for the patient’s home support or the social circumstances at the time of discharge. Undoubtedly, future studies conducted with more granular information, possibly from clinical consortiums, will further refine these models to make them clinically meaningful.

More than 40 clinical trials have studied strategies to prevent readmissions, with modest overall success.³ Interventions studied range from enhanced discharge planning to increasing home-based support or even telemonitoring. Interventions with many components (bundles of care), those involving more individuals in care delivery (larger and more diverse health care teams), and those supporting patient capacity for self-care have had the most consistent success. Although most subjects studied are medical patients, the lessons learned are likely applicable in postoperative care. A number of groups have introduced fast-tracking protocols for lung cancer resection by implementing intraoperative and postoperative standardized care pathways. These measures include avoidance and prompt management of air leaks, early ambulation, vigilance in detecting and managing common postoperative complications, and, most importantly a well-organized team approach. Fast-track management pathways have successfully shortened stays while maintaining equivalent or even lower readmission rates.⁴ A much less discussed issue is patient education and preparation before surgery. Setting realistic expectations for the postoperative period can likely avoid some of the readmissions for such issues as postoperative pain, drain management, and wound care.

Finally, timely and appropriate care of readmitted patients should be an absolute priority in the postoperative period. Because circumstances of readmissions vary, few generalizations can be made, other than a recommendation for appropriate resource allocation. A well-managed readmission can be considered a “save,” and despite the associated financial burden to the health care system, it remains our foremost ethical obligation to care for individuals with hospital-acquired conditions.

References

1. Gonzalez AA, Abdelsattar ZM, Dimick JB, Dev S, Birkmeyer JD, Ghaferi AA. Time-to-readmission and mortality after high-risk surgery. *Ann Surg*. 2014;148:2261-7.
2. Varela G, Aranda JL, Jiménez MF, Novoa N. Emergency hospital readmission after major lung resection: prevalence and related variables. *Eur J Cardiothorac Surg*. 2004;26:494-7.
3. Leppin AL, Gionfriddo MR, Kessler M, Brito JP, Mair FS, Gallacher K, et al. Preventing 30-day hospital readmissions: a systematic review and meta-analysis of randomized trials. *JAMA Intern Med*. 2014;174:1095-107.
4. Salati M, Brunelli A, Xiumè F, Refai M, Pompili C, Sabbatini A. Does fast-tracking increase the readmission rate after pulmonary resection? A case-matched study. *Eur J Cardiothorac Surg*. 2012;41:1083-7; discussion 1087.