Methods | Using the 20% random sample of fee-for-service Medicare beneficiaries aged 65 years or older in the carrier and enrollment data from 2008 through 2012, we assessed $^{99m}$Tc radiotracer use in the approximately 2 million cardiac stress tests with SPECT-MPI performed during these years, using codes A9500 and A9502 to identify $^{99m}$Tc-labeled radiotracer.

Discussion | Recent shortages of $^{99m}$Tc were associated with major shifts in its use during cardiac stress testing and an increase in downstream cardiac catheterization. Although changing referral patterns could contribute, we did not observe meaningful deviations from long-term trends in use of SPECT-MPI or alternative imaging tests during the shortage. This is supported by data from a Canadian hospital where downstream testing during the shortage of $^{99m}$Tc increased by 77% and radiation exposures to patients doubled.3 Our study extends this finding to the United States nationally and raises a new concern of decreasing $^{99m}$Tc use overall. Thallium Tl 201 is associated with higher radiation exposure4 and lower specificity relative to $^{99m}$Tc.

Given tension between medical applications of HEU and potential for nuclear weapons proliferation, the US Congress authorized $143 million from 2011 to 2014 to encourage domestic production of $^{99m}$Tc from sources other than HEU but has not renewed funding. Export of HEU fuel will be banned starting in 2020, which could severely curtail production of $^{99m}$Tc. These converging pressures on the $^{99m}$Tc supply chain have substantial clinical implications and underscore the importance of developing new production approaches and encouraging alternative testing approaches.

Conflict of Interest Disclosures: All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Dr Murthy reported receiving a grant from the Intersocietal Accreditation Commission; holding stock in General Electric, Cardinal Health, and Mallinckrodt Pharmaceuticals; and receiving a grant and nonfinancial support from INVIA Medical Imaging Solutions. Dr Nallamothu reported receiving a grant from the Intersocietal Accreditation Commission; serving as associate editor for the American College of Cardiology (ACC.org) and the American Heart Association (Circulation: Cardiovascular Quality and Outcomes); and serving on an advisory board for UnitedHealthcare. No other disclosures were reported.

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Trends in Palliative Care Use in Veterans With Severe Heart Failure Using a Large National Cohort

Although palliative care (PC) improves quality of life in heart failure (HF),1-3 there is a paucity of data describing PC use in HF. The objective of this study was to describe trends in PC use in veterans with severe HF using a large national cohort.

Methods | We conducted a cross-sectional analysis of patients from fiscal years 2007 to 2013 using Veteran Affairs External Peer Review Program data. A detailed description of the Veteran Affairs External Peer Review Program has been previously published.4 The International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) was used to select patients with a diagnosis of HF (codes 402.01, 402.11,
402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, and 428.x). Patients 70 years or older with brain-type natriuretic peptide levels exceeding 1000 pg/mL and creatinine levels exceeding 1.5 mg/dL were selected (to convert brain-type natriuretic peptide level to nanograms per liter, multiply by 1.0; creatinine level to micromoles per liter, multiply by 88.4). We indicated use if the patient was seen by PC (ICD-9-CM code V66.7) within 1 year after the index HF hospitalization. Patients with missing data, who accounted for less than 1.5% of data, were excluded. This study was approved by Stanford University’s Human Subjects Institutional Review Board.

Independent demographic variables included age, sex, and ethnicity. Clinical variables included laboratory values and comorbidities. The primary outcome was PC use. Bivariate analyses were performed using χ² test and analysis of variance. Analyses of fiscal years were performed using Mantel-Haenszel test. Multivariable logistic regression models were used to determine adjusted predictors of PC use.

Results | Over the 7-year period, 4474 patients with severe HF were identified. Among these patients, 7.6% (338 of 4474) were seen by PC. Compared with patients not seen by PC, those seen by PC were similar in age (mean [SD] age, 83.6 [6.4] vs 81.8 [6.2] years), were equally likely to be male (98.8% [334 of 338] vs 99.1% [4097 of 4136]), had a higher mean (SD) brain-type natriuretic peptide level (5260 [12 622] vs 4213 [8496] pg/mL), and had a similar percentage with left ventricular ejection fraction of less than 35% (44.7% [142 of 318] vs 46.7% [1790 of 3830]). Patients seen by PC had the following comorbidities coded in the prior 2 years: hypertension (93.2% [315 of 338]), chronic obstructive pulmonary disease (45.0% [152 of 338]), diabetes (48.5% [164 of 338]), cerebrovascular accident (29.9% [101 of 338]), malignancy (30.2% [102 of 338]), and acute myocardial infarction (26.6% [90 of 338]).

There was a significant trend toward increased PC use over time (Figure). Overall, 51.2% (2292 of 4474) of patients with HF died within 1 year of hospitalization. Those who died were more likely to have been seen by PC (10.7% [246 of 2292] vs 4.2% [92 of 2182], P < .001). Those seen by PC had a 1-year mortality of 72.8% (246 of 338) compared with 49.5% (2046 of 4136) among those who were not seen by PC (P < .001). On multivariable analysis, age, year, malignancy, and renal disease were significant predictors of PC use.

Discussion | A strength of our study is an analysis of the largest integrated health care system (the Veteran Affairs Healthcare System) in the United States and an assessment of PC use up to 1 year after HF hospitalization. While use rates doubled during the study period, the absolute rate remained low (7.6% [338 of 4474]). Palliative care use in HF was specific (72.8% [246 of 338 of patients seen by PC died within 1 year]) but not very sensitive (10.7% [246 of 2292] of patients who died within 1 year were seen by PC). Absolute rates of PC use in HF were less than the published rate in oncology (17%) and were similar to the published rate in chronic obstructive pulmonary disease (5%).

This study has several limitations. We analyzed a predominantly male population in an integrated health care system, which may limit generalizability. We lacked data on symptoms or patient preference, which would influence which patients may qualify for PC. Errors in coding are possible, including overcoding or undercoding of PC use in HF. However, interrater reliability assessments are performed quarterly for each abstractor to ensure the accuracy of coding. Our rates of PC use in HF are consistent with prior single-center literature, suggesting external validity.

In conclusion, the use of PC in veterans with severe HF increased over the study duration, with absolute rates similar to chronic obstructive pulmonary disease and lower than cancer. Our data suggest the potential to improve use of PC in severe HF.

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Study concept and design: All authors.

Acquisition, analysis, or interpretation of data: Anant Mandawat, Heidenreich, Aditya Mandawat.

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