

# National Trends in Inferior Vena Cava Filter Placement and Retrieval Procedures in the Medicare Population Over Two Decades

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## Abstract

**Purpose:** To assess trends in inferior vena cava (IVC) filter placement and retrieval procedures in Medicare beneficiaries over the last two decades.

**Methods:** Using Physician/Supplier Procedure Summary Master Files from 1994 through 2015, we calculated utilization rates for IVC filter placement and retrieval procedures in Medicare fee-for-service beneficiaries. Services were stratified by provider specialty group and site of service.

**Results:** IVC filter placement rates increased from 1994 to 2008 (from 65.0 to 202.1 per 100,000 beneficiaries, compound annual growth rate [CAGR] +8.4%) and then decreased to 128.9 by 2015 (CAGR -6.2%). This decrease was observed across all specialty groups and sites of service. From 1994 to 2015, placement procedure market share increased for radiologists (from 45.1% to 62.7%) and cardiologists (from 2.5% to 6.7%) but decreased for surgeons (from 46.6% to 27.9%). Overall, procedures shifted slightly from the inpatient (from 94.5% to 86.5% of all procedures) to outpatient hospital (from 4.9% to 14.9%) settings. Between 2012 and 2015, retrieval rates increased from 12.0 to 17.7 (CAGR +13.9%). Retrievals as a percentage of placement procedures were similar across specialties in 2015 (range 13.0%-13.8%).

**Conclusion:** Despite prior dramatic growth, the utilization of IVC filters in Medicare beneficiaries markedly declined over the last decade, likely relating to evolving views regarding efficacy and long-term safety. This decline was accompanied by several filter-related market shifts, including increasing placement by radiologists and cardiologists, increasing outpatient placement procedures, and increasing retrieval rates.

**Key Words:** IVC filter, utilization, Medicare, physician specialty, health policy

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## INTRODUCTION

Prior works using different data sources demonstrated a substantial increase in the frequency of inferior vena cava (IVC) filter placement procedures in the 1990s and early

2000s [1-3]. Much of this growth was likely attributable to expanding relative indications for filter placement, increasing ease of placement, and the growing availability of retrievable devices.

Such growth, however, was accompanied by a range of concerns. The first randomized controlled trial of filter use failed to demonstrate improved patient survival [4]. In addition, awareness of serious complications from chronic indwelling filters has increased; these include migration, filter fracture, IVC perforation, and filter thrombosis [5]. Moreover, retrieval rates in clinical practice were observed to generally be low [1]. These considerations all contributed to an emerging shift in the management of thromboembolic disease, with thought leaders encouraging more cautious placement of permanent

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filters and closer adherence to filter retrieval guidelines [6,7]. That shift was further captured by an FDA advisory in 2010 recommending that filters be routinely removed at the earliest opportunity [8].

Since that time, recent work has indicated a decline in the placement of IVC filters in the inpatient setting [9], but it is not clear whether this trend is generalizable to other sites of service and various specialty provider groups or how retrieval procedures have changed over that time. To inform emerging consensus documents and guide future research, we aimed to study longitudinal trends in IVC filter placement and retrieval procedures in the Medicare population.

## METHODS

This study, which did not use private identifiable information, did not constitute human subjects research and therefore did not require approval from our institutional review boards. Annual Medicare Physician/Supplier Procedure Summary (PSPS) Public Use Files [10] were obtained from CMS from 1994 through 2015. These files include aggregate service counts by provider specialty and site of service for 100% of Part B fee-for-service Medicare claims and have been used in a variety of similar analyses [11].

Reflecting ongoing updates to the Current Procedural Terminology (CPT) code set, IVC filter placement procedures were identified with CPT code 37620 from 1994 through 2011 and with CPT code 37191 beginning in 2012. IVC filter retrieval procedures were unambiguously identified with CPT code 37197 beginning in 2012. Before that time, no dedicated IVC filter retrieval CPT code existed. Accordingly, different approaches were taken to calculate high and low estimates of retrievals from 1994 through 2011. For our upper limit estimate, all service counts for CPT code 37203 (for any foreign body retrieval) were identified and considered IVC filter retrieval procedures. For our lower limit estimate, the average number of annual non-IVC foreign body retrievals were identified beginning in 2013 (when separate dedicated CPT codes were put in place to distinguish for IVC filter retrieval procedures [37193] from non-IVC filter foreign body retrieval procedures [37197]). This average was then subtracted from the number of foreign body retrievals overall (IVC filters and other foreign bodies) from 1994 to 2013.

Based on additional service claim data in the PSPS Master Files, the number of IVC filter placements was further stratified each year by billing provider specialty

and place of service. Using previously described specialty group code mapping [1], provider specialty was stratified as radiology (including diagnostic radiology, interventional radiology, and nuclear medicine), surgery (all subspecialties), cardiology, undetermined, and other. Place of service was stratified as inpatient hospital, outpatient hospital, and other (given the very low frequency of all services outside of the hospital setting). IVC filter retrievals were similarly stratified by billing provider specialty, and the overall national rate of filter removal was estimated annually as the ratio between each specialty group's retrieval and placement service counts. Given year-to-year changes in the size of the Medicare fee-for-service population over time, all procedure rates were normalized to 100,000 Medicare fee-for-service beneficiaries based on each year's relevant Medicare enrollment [12,13].

Analysis was performed using SAS version 9.4 (SAS Institute Inc, Cary, North Carolina) and Excel for Windows (Microsoft Corporation, Redmond, Washington).

## RESULTS

The total number of claims for IVC filter placement procedures for Medicare fee-for-service beneficiaries increased from 20,984 in 1994 to a peak of 65,038 in 2008 and then declined to 43,623 in 2015. Per 100,000 Medicare fee-for-service beneficiaries, this translates to a 211.1% increase from an initial filter insertion rate of 65.0 in 1994 to a peak of 202.1 in 2008 (compound annual growth rate [CAGR] +8.4%), and a subsequent decline from that peak by 36.2% to 128.9 in 2015 (CAGR -6.2%; Fig. 1).

Similar trends were observed among all of the targeted specialty groups (Fig. 2a). Filter insertion rates per 100,000 Medicare beneficiaries by radiologists increased 293.2% from 1994 to 2007 (CAGR +11.1%), and then decreased by 29.8% to 2015 (CAGR -4.3%). Insertion rates by surgeons increased 135.0% from 1994 to 2008 (CAGR +6.3%), and then decreased by 49.4% to 2015 (CAGR -9.3%). Insertion rates by cardiologists increased 850.0% from 1994 to 2011 (CAGR +14.2%) and then decreased by 43.4% to 2015 (CAGR -13.3%). As a result, market share for all filter insertion procedures increased from 45.1% in 1994 to 62.7% in 2015 for radiologists, decreased from 46.6% in 1994 to 27.9% in 2015 for surgeons, and increased from 2.5% in 1994 to 6.7% in 2015 for cardiologists.

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