Evidence Report/Technology Assessment
Number 208

1. Bundled Payment: Effects on Health Care Spending and Quality

Closing the Quality Gap: Revisiting the State of the Science

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Closing the Quality Gap: Revisiting the State of the Science

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The information in this report is intended to help health care decisionmakers—patients and clinicians, health system leaders, and policymakers, among others—make well-informed decisions and thereby improve the quality of health care services. This report is not intended to be a substitute for the application of clinical judgment. Anyone who makes decisions concerning the provision of clinical care should consider this report in the same way as any medical reference and in conjunction with all other pertinent information, i.e., in the context of available resources and circumstances presented by individual patients.

This report may be used, in whole or in part, as the basis for development of clinical practice guidelines and other quality enhancement tools, or as a basis for reimbursement and coverage policies. AHRQ or U.S. Department of Health and Human Services endorsement of such derivative products may not be stated or implied.

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Preface

The Agency for Healthcare Research and Quality (AHRQ), through its Evidence-based Practice Centers (EPCs), sponsors the development of evidence reports and technology assessments to assist public- and private-sector organizations in their efforts to improve the quality of health care in the United States. The reports and assessments provide organizations with comprehensive, science-based information on common, costly medical conditions, and new health care technologies and strategies. The EPCs systematically review the relevant scientific literature on topics assigned to them by AHRQ and conduct additional analyses when appropriate prior to developing their reports and assessments.

In 2004, AHRQ launched a collection of evidence reports, Closing the Quality Gap: A Critical Analysis of Quality Improvement Strategies, to bring data to bear on quality improvement opportunities. These reports summarized the evidence on quality improvement strategies related to chronic conditions, practice areas, and cross-cutting priorities.

This evidence report is part of a new series, Closing the Quality Gap: Revisiting the State of the Science. This series broadens the scope of settings, interventions, and clinical conditions, while continuing the focus on improving the quality of health care through critical assessment of relevant evidence. Targeting multiple audiences and uses, this series assembles evidence about strategies aimed at closing the "quality gap," the difference between what is expected to work well for patients based on known evidence and what actually happens in day-to-day clinical practice across populations of patients. All readers of these reports may expect a deeper understanding of the nature and extent of selected high-priority quality gaps, as well as the systemic changes and scientific advances necessary to close them.

AHRQ expects that the EPC evidence reports will inform consumers, health plans, other purchasers, providers, and policymakers, as well as the health care system as a whole, by providing important information to help improve health care quality.

We welcome comments on this evidence report or the series as a whole. Comments may be sent by mail to Elisabeth U. Kato, M.D., M.R.P., at: Agency for Healthcare Research and Quality, 540 Gaither Road, Rockville, MD 20850, or by email to epc@ahrq.hhs.gov.

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Bundled Payment: Effects on Health Care Spending and Quality

Closing the Quality Gap: Revisiting the State of the Science

Structured Abstract

Background. "Bundled payment" is a method in which payments to health care providers are related to the predetermined expected costs of a grouping, or "bundle," of related health care services. The intent of bundled payment systems is to decrease health care spending while improving or maintaining the quality of care.

Purpose. To systematically review studies of the effects of bundled payment on health care spending and quality, and to examine key design and contextual features of bundled payment programs and their association with program effectiveness.

Data Sources. Electronic literature search of PubMed® and the Cochrane Library for studies published between 1985 and 2011.

Study Selection. Title and abstract review followed by full-text review to identify studies that assessed the effect of bundled payment on health care spending and/or quality.

Data Extraction. Two authors independently abstracted data on study design, intervention design, context, comparisons, and findings. Reviewers rated the strength of individual studies as well as the strength and applicability of the body of evidence overall. Differences between reviewers were reconciled by consensus. Studies were categorized by bundled payment program and narratively summarized.

Data Synthesis. We reviewed 58 studies, excluding studies of the Medicare Inpatient Prospective Payment System, for which we reviewed 4 review articles. Most studies (57 of 58) were observational or descriptive; 1 study employed randomization of providers, and none employed random assignment of patients to treatment and control groups. The included studies examined 20 different bundled payment interventions, 16 of which focused on single institutional providers. The introduction of bundled payment was associated with: (1) reductions in health care spending and utilization, and (2) inconsistent and generally small effects on quality measures. These findings were consistent across different bundled payment programs and settings, but the strength of the body of evidence was rated as low, due mainly to concerns about bias and residual confounding. Insufficient evidence was available to identify the influence of key design factors and most contextual factors on bundled payment effects.

Limitations. Most of the bundled payment interventions studied in reviewed articles (16/20) were limited to payments to single institutional providers (e.g., hospitals, skilled nursing facilities) and so have limited generalizability to newer programs including multiple provider types and/or multiple providers. Exclusion criteria and the search strategy we used may have omitted some relevant studies from the results. The review is limited by the quality of the underlying studies. The interventions studied were often incompletely described in the reviewed articles.

Conclusions. There is weak but consistent evidence that bundled payment programs have been effective in cost containment without major effects on quality. Reductions in spending and utilization relative to usual payment were less than 10 percent in many cases. Bundled payment is a promising strategy for reducing health spending. However, effects may not be the same in future programs that differ from those included in this review.

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Executive Summary

Background

This review is part of the Closing the Quality Gap: Revisiting the State of the Science series, which aims to provide critical analysis of the existing literature on quality improvement strategies for a selection of diseases and practices. The review focuses on "bundled payment," a strategy for health care quality improvement and cost containment. This strategy has been the subject of increasing interest, with the Centers for Medicare & Medicaid Services announcing a large national bundled payment initiative in August 2011. Other reviews in the series will address a range of quality improvement topics arising from portfolios (areas of research) of the Agency for Healthcare Research and Quality (AHRQ).

We define "bundled payment" as a method in which payments to health care providers are related to the predetermined expected costs of a grouping, or "bundle," of related health care services. In contrast, fee-for-service payment typically involves payments for individual services, while capitation involves a single per capita prospective payment for all services over a fixed period of time, regardless of the number of services or episodes of care provided within that period. Within the bundled payment model, a variety of specific payment methods are possible. Bundles may be defined in different ways, covering varying periods of time and including single or multiple health care providers of different types. In addition, given the diversity and complexity of the U.S. health care delivery system, bundled payment programs may be implemented in a variety of contexts that may influence their effects on spending and quality.

Bundled payment should create a financial incentive for providers to reduce the number and cost of services contained in the bundle.[1] Providers are typically given discretion over the allocation of the services used to treat the patient's episode most effectively. This flexibility may encourage providers to use resources to coordinate care; often, these services are not reimbursed under fee-for-service payment. If the bundle includes services delivered by multiple providers in multiple settings, providers have to create a mechanism for managing the shared payment for a given treatment or condition, which could also foster coordination.[1]

Several types of undesired effects of bundled payment have also been postulated. The most significant potential undesired effects include underuse of effective services within the bundle, avoidance of high-risk patients, and an increase in the number of bundles reimbursed (increasing health spending). Providers under bundled payment may "game" the system by changing coding practices to maximize reimbursement for the bundle ("upcoding") or by moving services in time or location to qualify for separate reimbursement ("unbundling").

Objectives

This review was designed to address the uncertainties about the effects of bundled payment on spending and quality measures. It should help readers (1) understand what the evidence shows about the effects of bundled payment on health care spending and quality of care, and (2) understand key design and contextual features of bundled payment programs and their association with bundled payment effects.

The review addressed three Key Questions:

1. What does the evidence show on the effects of bundled payment versus usual (predominantly fee-for-service) payment on health care spending and quality measures?

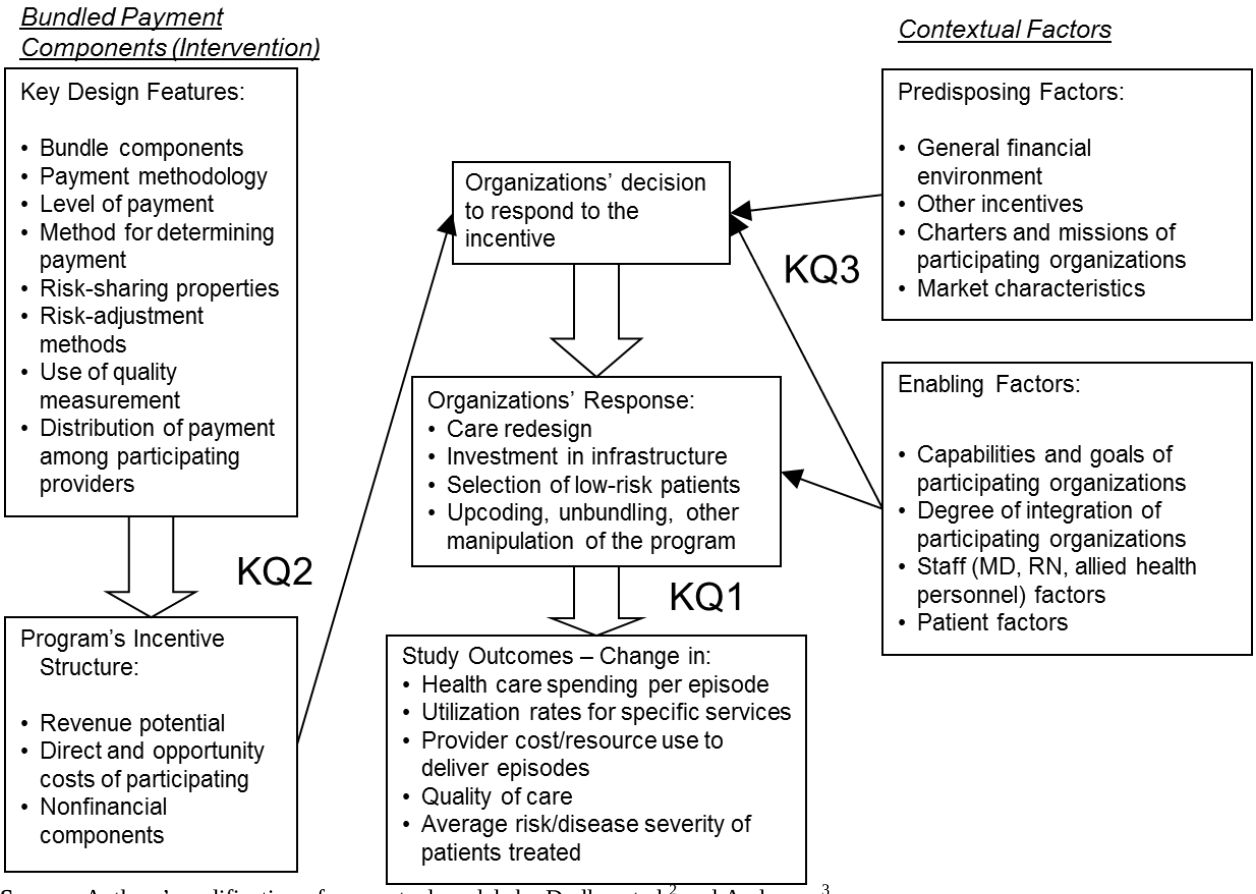
2. Does the evidence show differences in the effects of bundled payment systems by key design features?
3. Does the evidence show differences in the effects of bundled payment systems by key contextual factors?

Conceptual Framework

We use the conceptual model in Figure A to understand these Key Questions. This model is based on ones developed by Dudley et al.[2] and Andersen[3] to describe organizations' response to payment incentives in general[2] and in the context of access to health care specifically.[3]

Several key design features define a particular set of incentives and disincentives associated with any specific bundled payment strategy. The impact of these design features is addressed by Key Question 2. The financial and nonfinancial characteristics of these incentives are primary determinants of an organization's need to change practice in response to the modified payment policy. This response, however, may be mediated by key contextual factors, including both predisposing and enabling factors. Predisposing factors include the general financial environment (such as baseline levels of financial performance and efficiency), other incentives outside of the bundled payment program, market variables, and characteristics of participating provider organizations (such as charter and mission). Enabling factors include the capabilities and goals of participating organizations and the degree to which these organizations are integrated, as well as staff and patient characteristics. The impact of these contextual factors is addressed by Key Question 3. The center of the model reflects how organizations respond to the incentives created by bundled payment in both desirable and undesirable ways. Key Question 1 addresses how different potential responses affect study outcomes, including health care spending and health care quality.

Figure A. Conceptual model for review of the effects of bundled payment strategies on health care spending and quality of care



Source: Authors' modification of conceptual models by Dudley et al.[2] and Andersen.[3]
Note: KQ = Key Question.

Methods

Topics for the Closing the Quality Gap: Revisiting the State of the Science series were solicited from the portfolio leads at AHRQ. The nominations included a brief background and context, the importance of and/or rationale for the topic, the focus or population of interest, relevant outcomes, and references to recent or ongoing work. Among the topics that were nominated, the following considerations were made in selection for inclusion in the series: the ability to focus and clarify the topic area appropriately, relevance to quality improvement and a systems approach, applicability to the Evidence-based Practice Center program/amenability to systematic review, potential for duplication and/or overlap with other known or ongoing work, relevance and potential impact in improving care, and fit of the topics as a whole in reflecting the AHRQ portfolios.

A Technical Expert Panel reviewed and provided input on topic definition, Key Questions, the search strategy, and preliminary search results. A draft report was reviewed by 11 peer reviewers and posted for public comment.

Studies published between January 1, 1985, and January 17, 2011, that address the Key Questions described above were included. The following studies were excluded: (1) studies that did not report any of the outcomes of interest; (2) studies that did not report on a bundled payment intervention as defined above; (3) background articles or articles strictly limited to

describing theoretical models. Studies of interventions implemented in countries other than the United States were included if they met broad criteria for generalizability to the United States, such as implementation in a health care delivery organization comparable to one found in the United States.

A librarian performed the initial literature search. One trained reviewer, with input on questionable titles from a second trained reviewer, scanned the titles and abstracts of the list generated by the librarian and selected studies for full-text screen. For each of the selected studies, reviewers performed further reference mining by scanning titles listed in the reference section to identify additional articles to be included. Reviewers reconciled their selections and made joint decisions, following the inclusion/exclusion criteria listed above. Given the large and relatively older body of research on the Medicare Inpatient Prospective Payment System, the researchers, in consultation with AHRQ and the Technical Expert Panel, chose to consider a review of review articles for the assessment of this program.

We summarized the evidence for effectiveness and risks of bundled payment in comparison with usual payment methods. We present the results in a narrative synthesis and evidence tables (Appendix A).

We assessed the methodological quality of individual studies and reviews as good (low risk of bias), fair, or poor (high risk of bias). Studies rated "poor" or "good" were also given a brief explanation of the basis for the rating. The rating was based on criteria developed by AHRQ.[4] We also rated the overall strength of the evidence using methods adapted by AHRQ from the GRADE (Grading of Recommendations Assessment, Development and Education) Working Group and assessed the overall applicability of the studies reviewed.[4]

Results

We reviewed 58 studies, excluding studies of the Medicare Inpatient Prospective Payment System (IPPS), for which we reviewed 4 review articles. Among the reviewed studies, 48 employed observational designs, while 9 were descriptive. Only one study was randomized at the provider level,[5] and we identified no studies of bundled payment programs randomized at the patient level. The included studies examined 20 different bundled payment interventions. Most articles examined U.S. public insurance prospective payment systems or international prospective payment systems. All but three of the bundled payment interventions in the included studies included public payers only. Bundled payment interventions may aggregate costs longitudinally (i.e., over time within a single provider), aggregate costs across providers, and/or involve warranties by which the costs of complications are rolled into a single payment. All but 4 of the 20 bundled payment interventions involved bundling of services during a period of time by a single provider, such as a hospital, skilled nursing facility, or home health provider.

Our search identified other bundled payment programs in progress, including the Medicare Acute Care Episode demonstration, PROMETHEUS Payment®, and others. However, we did not identify published evaluations of these programs that met our inclusion criteria. We briefly describe several of these programs in this review.

Despite the heterogeneity of settings, interventions, study designs, and measures used, reviewers noted relatively consistent impacts of bundled payment on spending and quality measures (Key Question 1), which are summarized below. Few studies explicitly included analyses of differential effects by key contextual factors (Key Question 3), and none included analyses of differential effects by key design features (Key Question 2). We did not attempt to address Key Questions 2 and 3 through comparisons across interventions because these analyses

would be limited by the heterogeneity of the interventions and evaluation methods. Table A summarizes the studies included in the review, followed by our assessments of the evidence for each Key Question. The majority of studies were of U.S. public insurance prospective payment systems.[6-51] The remainder of the studies were of a U.S. private-sector single-setting payment system,[52,53] international bundled payment systems,[54-62] and U.S. bundled payment systems including multiple providers or sites of care.[63-66]

Table A. Bundled payment systems in included studies

Payment System	No. of Included Studies	Intervention Date	Payer	Provider Type(s)	Services Included in Bundle
U.S. Public Insurance Prospective Payment Systems					
Medicare Inpatient Prospective Payment System	4[6-9] (reviews)	October 1983[a]	Medicare	Inpatient hospitals	Per-discharge payment for hospital costs associated with each diagnosis-related group (including nursing, accommodation, etc.) and outpatient services in 3 days prior to admission.
Medicare Skilled Nursing Facility Prospective Payment System	20[10-29]	July 1998	Medicare	Skilled nursing facilities	Per diem payment for routine, ancillary, and capital-related skilled nursing services for each of 56 resource utilization groups.
Medicare Inpatient Rehabilitation Facility Prospective Payment System	11[11,19,30-38]	January 2002	Medicare	Inpatient rehabilitation facilities	Per-discharge payment for operating and capital costs for each of 92 case-mix groups.
Medicare Home Health Prospective Payment System	12[5,11,19,39-47]	October 2000	Medicare	Home health agencies	Payment per 60-day episode for all nursing care, therapy, and aide services for each of 153 Home Health Resource Groups.
Medicare Long-Term Acute Care Hospital Prospective Payment System	1[48]	October 2002	Medicare	Long-term acute care hospitals	Per-discharge payment for all operating and capital costs for each of 318 Medicare long-term care diagnosis-related groups.
Department of Veterans Affairs Resource Allocation Methodology	1[49]	1985-88	Department of Veterans Affairs	Inpatient hospitals	Per-admission payment (diagnosis-related groups) for hospital services.
Maine Medicaid Nursing Home Prospective Payment	1[50]	1982-85	Maine Medicaid	Nursing homes	Per diem payment for nursing home services (patient care, dietary care, lodging, etc.).
New Hampshire Medicaid Hospital Prospective Payment	1[51]	January 1989	New Hampshire Medicaid	Inpatient hospitals	Payment includes per-discharge prospective component based on diagnosis-related group as well as an actual costs component.
U.S. Private-Sector Single-Setting Bundled Payment System					
Case Rate for Managed Behavioral Health Care	2[52,53]	July 1995	Single U.S. managed behavioral health care organization	Psychiatrists, psychologists, social workers	All outpatient mental health services for 1 year following referral.

Table A. Bundled payment systems in included studies (continued)

Payment System	No. of Included Studies	Intervention Date	Payer	Provider Type(s)	Services Included in Bundle
International Bundled Payment Systems					
Belgium Inpatient Prospective Payment System	1[54]	1995	Belgian public health insurance	Inpatient hospitals	Per-admission payment for nonmedical hospital services (e.g., nursing staff, accommodation) for each of 604 case-mix groups.
National Health Service (England) Payment by Results	1[55]	2003	English National Health Service	Hospitals	Hospital services. (More detail not reported.)
Italy Inpatient Prospective Payment	1[56]	January 1995	Italian Ministry of Health	Inpatient hospitals	Hospital and physician services. (More detail not reported.)
Japan Outpatient Hemodialysis Bundled Payment	1[57]	April 2006	Not reported	Dialysis clinics and hospitals	Dialysis drugs. (More detail not reported.)
Netherlands Inpatient Prospective Payment	1[58]	2005	Not reported	Inpatient hospitals	Hospital and physician services. (More detail not reported.)
Sweden Inpatient Prospective Payment System	1[59]	1992	Stockholm County Council	Inpatient hospitals	Hospital services. (More detail not reported.)
Taiwan Hospital Case Payment	3[60-62]	October 1997	Taiwan National Health Insurance Bureau	Hospitals	Per-episode payment for required medical services, "optional" medical services, pharmaceuticals, and evaluations within a 2-week period for surgeries.
U.S. Bundled Payment Systems Including Multiple Providers/Sites of Care					
Geisinger ProvenCare[SM]	1[63]	February 2006	Geisinger Health Plan, PA	Three demonstration hospitals	Per-discharge payment for evaluation, hospital, and professional fees; routine postdischarge care; management of complications.
Medicare Participating Heart Bypass Demonstration	1[64]	May 1991-June 1996	Medicare	Seven demonstration hospitals	Per-discharge payment for all inpatient hospital and physician services, including related readmissions.
Medicare Cataract Surgery Alternative Payment Demonstration	1[65]	1991-April 1996	Medicare	Four demonstration sites	Preoperative diagnostics and evaluation, surgical services, postoperative exams to 120 days, management of common complications.
Michigan Arthroscopic Surgery Bundling Pilot With Warranty	1[66]	April 1987	Blue Care Network (Blue Cross Blue Shield of MI)	Single surgical practice and hospital	Single payment for all care related to surgery, including repeat surgery, repeat hospitalization, or any other related services rendered by the providers for 2 years.

[a]Implementation was delayed in 4 States.
Source: Authors' analysis of search results.

Key Question 1. Impact of Bundled Payment on Health Care Spending and Quality Measures

The published evidence suggests that transitioning from cost-based or fee-for-service payment to bundled payment resulted in declines in spending and utilization, with small changes in quality measures that were in different directions. The evidence suggests that the transition from a cost-based or fee-for-service reimbursement to bundled payment was generally associated with a decline in spending of 10 percent or less. Bundled payment was associated with a decrease in utilization of services included in the bundle, often measured as reductions in length of stay or utilization of specific services (5-percent to 15-percent reductions in many cases).

The inconsistency in findings on quality measures included both differences in the direction and magnitude of effects on different quality measures within a single study and differences in the direction and magnitude of effects for similar quality measures between studies. For a given bundled payment intervention, either some quality measures improved while others worsened or studies arrived at different conclusions about the effect of bundled payment on related quality measures. Little evidence was reported about other potential negative consequences of bundled payment, although studies of several programs noted that bundled payment programs resulted in shifts of utilization to other settings of care.

Overall, reviewers graded the strength of evidence for this Key Question as "low," indicating that there is low confidence that the evidence reflects the true effect, and that further research is likely to change our confidence in the estimate of effect and is likely to change the estimate. This rating was based primarily on reviewers' assessments that the included studies were, as a whole, at high risk of bias and residual confounding, although the expected direction of the effect of residual confounding could not be assessed. The results of included studies were consistent in the direction of the effect for spending and utilization measures but inconsistent for quality measures. Based on the consistency of findings across heterogeneous interventions and evaluations, it is likely that the direction of the observed effects on spending and utilization measures would not change in future studies, although the magnitude of the effect could change in studies employing different methods for addressing bias and confounding.

Key Question 2. Differential Effects by Key Design Features

No studies explicitly tested the effect of intervention design features, such as variations in the set of services included in a bundle, on spending or quality measures. We did not perform comparisons of design-feature impacts across studies because of the heterogeneity of the bundled payment programs studied. We do, however, provide some discussion of the potential impact of design features on study outcomes. Reviewers graded the evidence for this Key Question as insufficient to permit an estimation of effects due to the lack of evidence.

The reviewed studies included a heterogeneous set of bundled payment programs. Reviewed payment systems differed in the degree to which the bundled payment applied to multiple independent providers and/or provider types. Only the Medicare Participating Heart Bypass Demonstration, Medicare Cataract Surgery Alternative Payment Demonstration, Michigan Arthroscopic Surgery Bundling Pilot, and Geisinger ProvenCare^{SM} Program integrated physician payments with hospital payments when these payments were previously separate. Studies of these programs found evidence for reduced spending with inconsistent effects on different quality measures. However, there was limited basis for a comparison of the magnitude of these findings with the magnitude of findings from studies of bundled payment interventions that

apply to a single institutional provider. The two Medicare demonstrations reported some difficulty in administration of the bundled payment programs, in part due to challenges of distributing payment among the multiple providers participating in the bundled payment.

Overall, the reviewed payment systems employed a variety of bundle definitions that were tailored to the relevant care setting. Risk adjustment and separate outlier payments were common, with methods varying among programs.

Quality metrics or incentives were rarely integrated into bundled payment systems. Despite the potential for undesired effects of bundled payment on quality of care, programs generally did not include quality as an intrinsic part of the bundled payment mechanism. Among the programs reviewed, only the Geisinger ProvenCare[SM] Program integrated pay-for-performance components into a bundled payment system, and therefore no differential effects across evaluations can be reported for this design feature. It is possible that inclusion of quality-related incentives as a component of future bundled payment programs will change providers' response to the program in a way that impacts quality measures, but the effect is unknown at this time. Other programs used quality measurement in program monitoring and evaluation or as a criterion for program participation but not as a component of the payment method. Many of the bundled payment programs studied were implemented prior to the recent proliferation of pay-for-performance programs. The science of health care quality measurement and quality incentives has developed since many of the programs were implemented. In some cases, the bundled payment programs reviewed will be accompanied in the future by a separate pay-for-performance program that addresses the same providers and services. It is unclear how these pay-for-performance programs will interact with the bundled payment programs studied or the differential impact on quality of including the quality-related incentives as an integrated part of bundled payment or as a stand-alone program. Among more recent bundled payment programs that have been announced or initiated but not yet evaluated, some use quality measurement in a monitoring and evaluation role (e.g., Medicare national bundled payment initiative), while others incorporate pay-for-performance with the bundled payment (e.g., PROMETHEUS Payment).

Reviewed payment systems also differed in their approach to establishing initial bundle reimbursement rates. Historical expenditures were typically used to determine the initial bundled payment rates, but programs differed in whether the bundled payment rate was set at an amount estimated to increase, decrease, or maintain historical expenditure levels.

Several reviewed studies either directly studied the implementation process of one or more bundled payment systems or included implementation-related anecdotes. Most studies providing survey or anecdotal evidence from providers noted that new bundled payment systems faced significant initial resistance from providers.

Key Question 3. Differential Effects by Key Contextual Factors

The effects of most key contextual factors were not addressed by any reviewed studies. Several studies compared differential effects of bundled payment on spending among for-profit and not-for-profit providers. In general, for-profit providers experienced larger declines in utilization under bundled payment than their not-for-profit counterparts (including U.S. and non-U.S. hospitals, skilled nursing facilities, inpatient rehabilitation facilities, and home health agencies).[22,23,25,35,38,43,57] The four review articles on the Medicare IPPS reported that hospitals under greater financial pressure had greater reductions in utilization in response to IPPS.

Several studies reported outcomes separately for patients with relatively severe disease or injury and patients with less severe disease or injury, but the results were inconsistent between

studies. One study reported different impacts of bundled payment on spending and utilization by geographic area but did not provide an explanation of this differential impact.

For the effect of three specific contextual factors—patient severity, provider for-profit/not-for-profit status, and provider financial pressure—reviewers graded the strength of evidence on one outcome, utilization, as "low." The primary reasons for this rating were risk of bias, risk of residual confounding, inconsistency of findings, and imprecision of findings. The strength of evidence for other contextual factors and study outcomes was rated insufficient due to lack of evidence.

Several important contextual factors were described in reviewed studies, but their impact was not directly assessed. Some bundled payment interventions were implemented in the context of simultaneous but independent health care spending reduction efforts, including payment reforms other than bundled payment. For example, the Medicare Resource-Based Relative Value Scale physician fee schedule was implemented in 1992, overlapping with the time periods examined in several of the reviewed studies. Capitation and the spread of health maintenance organizations are two other examples of reforms that occurred during the time period of reviewed bundled payment programs. Due to the study designs used, studies were not able to differentiate the effects of bundled payment programs from related but independent interventions.

None of the reviewed studies provides insight into differential results by the degree of integration between health care delivery organizations and payers or between various health care delivery organizations. As noted above, most reviewed bundled payment interventions applied to a specific outpatient care setting or to inpatient environments where hospital and physician payments are not integrated. None of the reviewed studies reported on the effects of payer or provider competitive environments.

Applicability

The main intended audience for this report is policymakers, payers, and providers in the United States that are considering implementation of a bundled payment program. The findings of this review are likely to be applicable most directly to those considering a bundled payment program targeting single providers. The majority of bundled payment programs in the included studies focused on single institutional providers, such as inpatient hospitals, skilled nursing facilities, or inpatient rehabilitation facilities.

Recent interest in bundled payment has focused mostly on programs that bundle payments for multiple providers and/or provider types. The findings of this review are less applicable to these types of programs. There were several reviewed studies of bundled payment across multiple settings, but these included a small number of participating provider organizations that are not representative of the U.S. delivery system. More evidence is likely to be available in the future as evaluations of ongoing programs, such as the Medicare Acute Care Episode Demonstration, are published.

The interventions studied were typically specific to a single payer, most often Medicare or various public insurance systems outside the United States. The applicability of findings in studies involving one payer (e.g., Medicare) to other payer contexts is limited due to differences in beneficiary characteristics, provider bargaining power, and competitive pressures.

Interventions implemented in countries other than the United States may have limited applicability to the U.S. context due to differences in health system organization, financing, and delivery. Although non-U.S. studies were screened for comparability with a U.S. delivery

setting, in practice this criterion was difficult to apply and no studies were excluded on the basis of nationality.

All reviewed studies assessed the impact of bundled payment relative to either fee-for-service or cost-based payment. The magnitude and direction of effects relative to fee-for-service or cost-based payment may differ from absolute effects. For example, bundled payment might slow an increase in absolute spending relative to usual payment. Transitions to bundled payment from other payment methods (e.g., salary or capitation) may have other effects.

Finally, evidence on bundled payment applies specifically to cases in which reimbursement based on episodes of care is both reasonable and feasible. Bundled payment may be less feasible or effective when applied to health care related to conditions without clearly defined treatment regimens, conditions with multiple treatment approaches, or rare conditions.

Recommendations for Further Research

There are several ways that future evaluations could produce a stronger evidence base. Policymakers and evaluation researchers must recognize the tension between producing timely practical evidence and conducting rigorous evaluations. The most rigorous study designs are usually feasible only when policymakers plan for an evaluation experiment in the course of implementation. We focus our recommendations on improving retrospective quasi-experimental studies, which formed the bulk of research reviewed for this report.

Use stronger evaluation study designs. Most reviewed studies used a pre-post design with no comparison group and a relatively short post period. Use of stronger study designs, such as difference-in-differences analyses with randomized control and intervention groups, would reduce risk of bias. The benefits to validity from including a comparison group likely outweigh the associated increase in evaluation time and cost.

Most studies considered a brief time horizon (less than 2 years) after the implementation of bundled payment systems. Given the challenges in implementation and redesign of care processes reported in studies with qualitative components, a longer time horizon is likely necessary to observe many important impacts. However, the benefits of a longer time horizon must be balanced against the need for rapid information on program effects and the risk of attributing changes due to secular variation to the payment intervention. Future evaluations could balance these needs by reporting at several points in time after intervention.

Practical data, time, and funding constraints often dictate the choice of evaluation study design. The limitations intrinsic to retrospective observational studies prevent the reviewed studies from approaching the "gold standard" equivalent of a randomized controlled trial. However, the two studies rated good and several studies rated fair outlined natural experiments or quasi-experimental strategies to identify the effect of bundled payment on spending and quality outcomes. Future evaluations should consider these and related methods that could improve evaluation validity with little effect on the timeliness of results.

Use standardized measures of impact on costs and quality. The measures used varied across studies. While different measures are likely more relevant to different interventions and implementations, increased consistency in the use of measures could increase the comparability of future evaluations of the impact of bundled payment. Collaboratives of evaluators, such as the Patient-Centered Medical Home Evaluators' Collaborative, are one potential mechanism for identifying priority measurement areas and measurement approaches. Evaluation sponsors could

also encourage evaluators to use standard measurement approaches or to collaborate with evaluators of similar interventions to harmonize measurement approaches.

Use stratification to understand the impact of bundled payment on specific patient groups. Few studies reported results for patient subgroups, but several that did so found significant differences in effects between subgroups. Future research on the impact of payment system changes should focus on specific patient populations (e.g., relatively seriously ill patients) and types of service.

Incorporate quantitative and qualitative measures of program design and contextual factors. This type of evidence will be critical as Medicare and private payers experiment with various payment and delivery reforms, including not only bundled payment but also reforms that include global payment or shared savings for accountable care organizations, and as they seek to identify which aspects of these pilots have the potential to be scaled widely. Important design features to be addressed include the definition of the bundle (How many providers are included? What is the length of time? Which services are included and excluded from the bundle?); methods for limiting financial risk, including risk adjustment and outlier payments; use of quality measurement; and methods for distributing payment among participating providers. Important contextual factors to be addressed include whether bundled payment is more effective in more highly integrated delivery settings, the role of financial pressure and the general financial environment on responses to bundled payment, and differential effects between subgroups of patients.

Incorporate measurement of ancillary or spillover effects. Only a handful of studies explored broader consequences of bundled payment beyond the setting of care or patient group targeted by the intervention. Several reviewed studies demonstrated that bundled payment programs had effects on other settings and patient groups. Future evaluations should be designed to detect these effects.

Conclusion

In summary, the introduction of bundled payment was associated with (1) reductions in health care spending and utilization, and (2) inconsistent and generally small effects on quality measures. These findings were consistent across different bundled payment programs and settings, but the strength of the body of evidence was rated as low, due mainly to concerns about bias and residual confounding.

These findings were subject to several important limitations. Most of the bundled payment interventions studied in reviewed articles (16/20) were limited to payments to single institutional providers (e.g., hospitals, skilled nursing facilities) and so have limited generalizability to newer programs that include multiple providers and/or multiple provider types. Exclusion criteria and the search strategy we used may have omitted some relevant studies from the results. The review is limited by the quality of the underlying studies. The interventions studied were often incompletely described in the reviewed articles.

For policymakers considering implementation of bundled payment programs, this evidence provides some support that the programs are likely to be an effective strategy for reducing health care spending. While the effects on health care quality are less certain, the available evidence does not support concerns about the worst potential adverse effects of bundled payment.

Policymakers considering bundled payment programs should also consider several caveats, however. First, future bundled payment programs are likely to differ in important ways from those reviewed in this study. Most of the programs reviewed were single-setting prospective payment systems that replaced fee-for-service reimbursement systems. In contrast, recent and forthcoming bundled payment programs, such as the Medicare national bundled payment initiative, focus on bundling services provided by different providers over the course of an episode defined by a condition, diagnosis, or procedure. The few completed studies of programs involving payment for multiple providers found evidence for reduced costs and inconsistent impacts on quality, although there were some reports of implementation difficulty. These programs are likely to be more complex than most of the reviewed programs and therefore may have different effects. Nevertheless, multiple-setting programs present a logical next step building on the largely positive effects of previous single-setting bundled payment programs.

Second, although evidence of effects on quality was inconsistent, bundled payment has the potential to either adversely affect quality or be used as part of a quality improvement strategy. Future bundled payment programs should incorporate a robust quality monitoring and improvement component, potentially as an integrated part of the payment system.

Third, the strength of evidence on bundled payment effects was low, reflecting the difficulty in evaluating large-scale policy interventions that occur in a rapidly changing health care system. Better information from evaluations could improve the impact of bundled payment programs, in particular by illustrating how the programs could be adapted for adoption in the variety of health care delivery contexts found in the United States.

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Introduction

Background and Objectives for This Systematic Review

This review is part of the Closing the Quality Gap: Revisiting the State of the Science series, which aims to provide critical analysis of the existing literature on quality improvement strategies for a selection of diseases and healthcare practices. The review focuses on "bundled payment," a strategy for health care quality improvement and cost containment. Other reviews in the series will address a range of quality improvement topics arising from AHRQ portfolios.

Policymakers, payers, and providers are considering the effects of switching from currently used provider payment methods, which are predominantly fee-for-service, to bundled payment. This strategy has been the subject of increasing interest, with the Centers for Medicare and Medicaid Services announcing a large national bundled payment initiative in August 2011. The hope is that bundled payment would give providers incentives and flexibility to choose those inputs that can most efficiently achieve good health care outcomes. Specifically, bundled payment is hoped to lead to more efficient resource use than fee-for-service payment, in which each additional billable service generates revenue. Thus, part of this review will assess the evidence on whether bundled payments have resulted in lower health care spending or use of services. If one assumes, however, that under fee-for-service payment providers use all the services that could benefit the patient, then a reduction in the use of services could result in a reduction in quality. On the other hand, if fee-for-service leads to excessive use of services, or the failure to compensate for the time for appropriately coordinating care, or the failure to offer effective services that are not billable, then bundling might improve the quality of care. Thus, this review will also assess the evidence on the impact of bundled payment on health care quality.

We define "bundled payment" as a payment method in which payments to health care providers are related to the predetermined expected costs of a grouping, or "bundle," of related health care services. For the purpose of this review, the definition of "bundled payment" includes several related approaches that have been referred to as "bundling," "packaging," "episode-based payment," and "warranties." Distinctions are sometimes made between "packaging" of services provided during a single patient encounter and "bundling" of services during multiple visits. Each of these approaches establishes a method to aggregate services into a single unit of care for which a payment will be made. We distinguish the following general aggregation approaches and acknowledge specific payment models may include some or all of these approaches:

- Aggregation of services *longitudinally in time* for an episode of care. The episode is defined to encompass services related to a health care treatment or condition taking place within a defined time window. For example, a single payment could include a surgical procedure and follow-up care.
- Aggregation of services *across providers* who may be practicing in different care settings. For example, a single payment could be made for inpatient hospital facility services and physician professional services during an inpatient stay.
- *Warranties* refer to payment arrangements where payment for complications is aggregated into the unit of payment. Providers assume financial risk for the cost of care defects above a predetermined amount.

Increasingly, policymakers have been interested in bundled payment programs with greater aggregation of services longitudinally in time and across providers and including warranties. For example, the Medicare Inpatient Prospective Payment System, implemented in 1983, involved bundling during a relatively short period of time (a hospital stay) and included only hospital facility services, excluding physician professional services. In contrast, the recently initiated Medicare Bundled Payments for Care Improvement initiative will include bundles of services including the hospital stay and up to a 90-day post-discharge period, including hospital facility, physician professional, and post-acute facility services.

Bundled payment differs from other reimbursement mechanisms. Table 1 lists features of common alternatives to bundled payment. Most health care payers use mixed reimbursement systems which blend these individual mechanisms and integrate separate incentives for cost-control, quality of care, or both.[1] The distinction between bundled payment and fee-for-service reimbursement is that fee-for-service reimbursement requires separate payment for each service provided while bundled payment aggregates payment for individual services as described above. We differentiate between bundled payment and payment methods such as global payment or capitation where payment is made for management of a defined patient population. Under bundled payment, payers assume the insurance risk - that is, the financial risk related to incidence of bundles.[2] Under global payment and capitation, providers assume this risk. The incentives for quality management and quality improvement activities may also differ under these two models. Global payment and capitation create an incentive to reduce the need for services (bundled or not). Bundled payment creates an incentive to improve the services that are part of the bundle.

Table 1. Features of common comparison reimbursement methods

Payment Method	Features
Cost-based	• Aggregated payments (over patients and related services) reimburse providers for care provided over a fixed period of time. • Payment amount determined by costs incurred.
Fee-for-service	• Each service reimbursed separately. • Payment rate determined by a fee schedule negotiated between payers and providers.
Capitation	• Multiple services over a fixed period of time are reimbursed by a single, prospective, per capita payment. • Provider, not payer, bears insurance risk for the incidence of episodes within the time period.
Salary	• Providers are not reimbursed for specific services provided.

Note: Definitions adapted from CBO (2008) and Gosden, et al. (2006).[1,3]

While all bundled payment programs share the common element of payment related to the expected cost of a bundle of services, specific payment mechanisms vary. One mechanism is to make a single, prospective payment for the bundle. Other mechanisms include a blend of payment methods. A "shared savings" approach may blend retrospective fee-for-service reimbursement with periodic bonus payments equal to a share of difference between actual and expected payments for episodes if actual costs are lower than a threshold level set below expected costs. Bundled payment programs can explicitly incorporate quality measurement in several ways, including using quality measures as a pay-for-performance payment adjustment; to set eligibility thresholds for provider participation in bundled payment programs; to assess potential negative consequences of bundled payment; and to inform provider performance improvement activities.[4] Bundled payments could also be used in conjunction with (or in addition to) other new payment and delivery models such as shared savings for accountable care

organizations or medical homes.[4] The review is not limited by the types of payment methods employed; all of the above methods are included.

Bundled payment interventions that vary in aggregation of services into the bundle and payment method could differ substantially, including interventions as diverse as prospective payment systems for a single setting of care to retrospective payment adjustments for broad episodes of care. The design of bundled payment interventions may differ in other key ways including the type of conditions or procedures used as the basis for the bundle, risk adjustment, methods used to establish and update payment rates, etc.

In addition, bundled payment may be affected by the context of its implementation, such as the degree of integration of the providers delivering services included in the bundle, disease or condition severity, provider not-for-profit or for-profit status, and the presence of broader policy objectives which affect bundled payment implementation. These design and contextual factors could have important effects on the impact of bundled payment.

The intent of bundled payment systems is to decrease health care spending (i.e., spending by payers) while improving or maintaining the quality of care, relative to usual, e.g., fee-for-service, payment.[5] Bundled payment should create a financial incentive for providers to reduce the number and cost of services contained in the bundle, thereby reducing costs to providers.[6] Providers are typically given discretion under bundled payment as to the allocation of the services used to treat the patient's episode most effectively. In particular, it has been postulated that the financial risk associated with a bundled payment could motivate and enable providers to eliminate services that are low value (from the perspective of health outcomes), duplicative, or unnecessary.[2] This flexibility may encourage providers to use resources to coordinate care; often, these services are not reimbursed under fee-for-service payment. If the bundle includes services delivered by multiple providers in multiple settings, providers have to create a mechanism for managing the shared payment for a given treatment or condition, which could also foster coordination.[6]

Several types of undesired effects of bundled payment have also been postulated. To offset the financial risk associated with individual bundles, providers might increase the number of bundles provided (an incentive to increase service volume also exists under fee-for-service payment, but not other alternatives such as capitation).[2] For example, providers receiving a bundled payment for a surgical procedure may seek to increase volume by encouraging surgery for patients ambivalent between medical management and surgical treatment options. Instead of eliminating low-value services, bundled payment could lead to underuse of appropriate services, with potential adverse effects on patient outcomes.[6] In the absence of robust risk adjustment of bundled payments, providers may select low-risk patients and avoid those with higher risks (and costs).[6] Providers may "game" the system by changing coding practices to maximize reimbursement for the bundle ("upcoding") or by moving services in time or location to qualify for separate reimbursement ("unbundling"). Concerns have also been raised about the administrative feasibility of bundled payment programs, particularly in establishing accountability and a mechanism for distributing payment among otherwise independent providers who participate in providing services that are part of a bundle.[7,8]

This review was designed to address the uncertainties about the effects of bundled payment on health care delivery. This review should help readers to (1) understand what the evidence shows on the effects of bundled payment on health care spending and quality of care relative to usual, e.g., fee-for-service, payment, and (2) understand key design and contextual features of bundled payment programs and their association with bundled payment effects.

Key Questions

The review addressed three Key Questions:

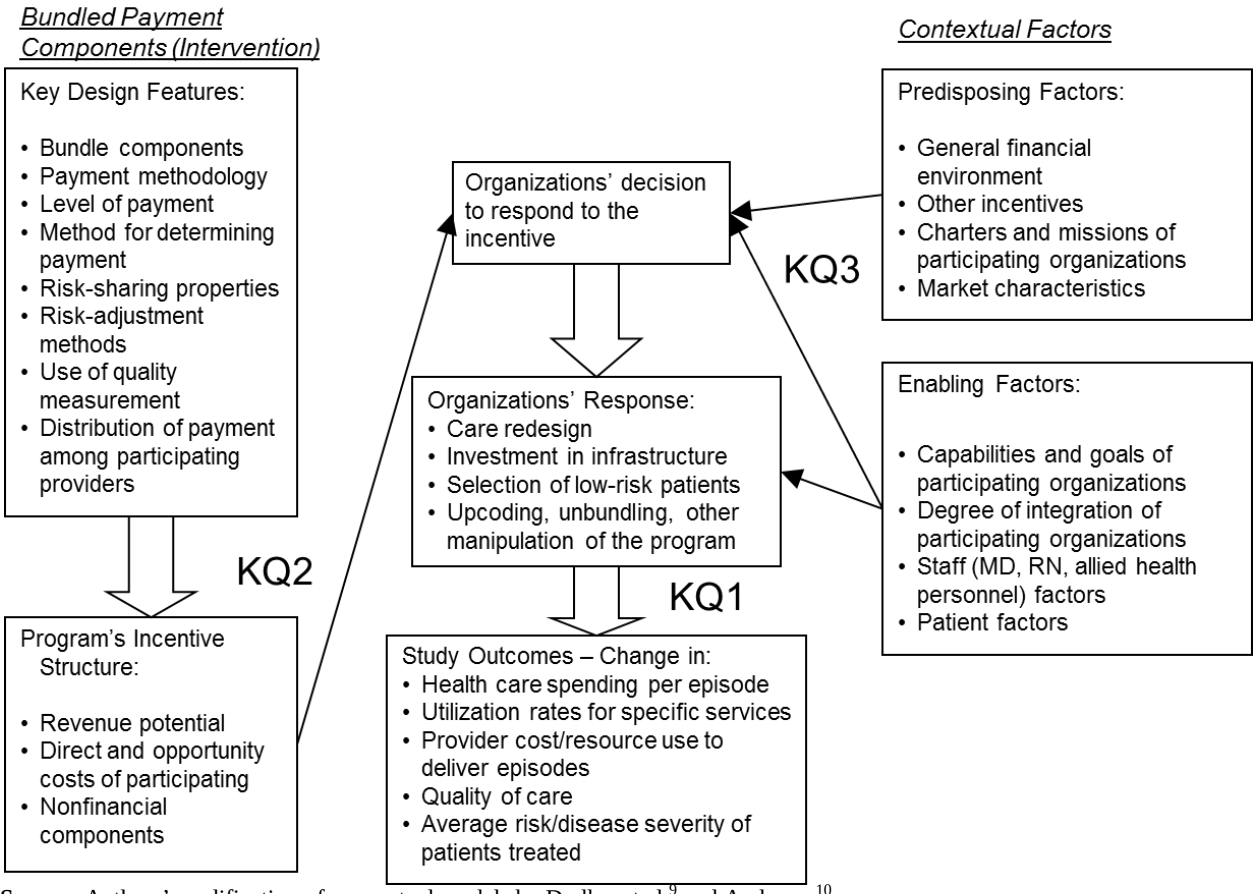
1. What does the evidence show on the effects of bundled payment versus usual (predominantly fee-for-service) payment on health care spending and quality measures?
2. Does the evidence show differences in the effects of bundled payment systems by key design features?
3. Does the evidence show differences in the effects of bundled payment systems by key contextual factors?

We use the conceptual model in Figure 1 to understand these key questions. This model is based on one developed by Dudley, et al.[9] to describe organizations' response to payment incentives in general. The Dudley et al. model draws from the health services research literature and incorporates more general economic concepts, such as opportunity costs, that often are not addressed in research about specific incentives. It is also grounded in Andersen's Behavioral Model of Health Services Use.[10] The Andersen model was modified to apply to organizations rather than individuals seeking access to care.

In Figure 1, several key design features define a particular set of incentives (and disincentives) associated with any specific bundled payment strategy. The impacts of these design features are addressed by Key Question 2. The financial and nonfinancial characteristics of these incentives are primary determinants of an organization's "need" to change practice in response to the modified payment policy. This response, however, may be mediated by key contextual factors, including both predisposing and enabling factors. Predisposing factors include the general financial environment (including baseline levels of financial performance and efficiency), other incentives outside of the bundled payment program, market variables, and characteristics of participating provider organizations such as charter and mission. Enabling factors include the capabilities and goals of participating organizations and the degree to which these organizations are integrated, as well staff and patient characteristics. The impacts of these contextual factors are addressed by Key Question 3. The center of the model reflects how organizations respond to the incentives created by bundled payment through care redesign. Key Question 1 addresses how different potential responses affect study outcomes including health care spending, health care quality measures, and others.

We distinguish between the impact of bundled payment on spending by payers and cost to providers. By spending we refer to the amount paid to providers in exchange for health care services, i.e., payments to providers. By costs we refer to the value of resources used to provide health care services by providers, e.g., hospitals. The difference between payments (spending) and costs is the provider's margin. The hope is that bundled payment will decrease spending by payers and costs to providers relative to usual, typically fee-for-service, reimbursement. Under this scenario, provider profits may either increase or decrease depending on the relative magnitude of changes in spending and costs. We also note the distinction between aggregate spending and costs and per-episode spending and costs. If the introduction of bundled payment increases the number of episodes provided, aggregate spending may increase even if per-episode spending decreases. In this review, we consider a wide range of related study outcomes including spending, costs, margins, and others.

Figure 1. Conceptual model for review of the effects of bundled payment strategies on health care spending and quality of care



Source: Authors' modification of conceptual models by Dudley et al.[9] and Andersen[10]
Note: KQ = Key Question

Methods

The methods for this comparative effectiveness review follow the methods suggested in the Agency for Healthcare Research and Quality (AHRQ) Methods Guide for Effectiveness and Comparative Effectiveness Reviews (available at www.effectivehealthcare.ahrq.gov/methodsguide.cfm). Below, we describe methods used for topic selection, input from stakeholders, inclusion and exclusion criteria, literature search strategies, data abstraction and management, assessment of methodological quality of individual studies, data synthesis, grading the evidence for each Key Question, and rating applicability of reviewed studies.

Topic Selection

Topics for the Closing the Quality Gap: Revisiting the State of the Science series were solicited from the portfolio leads at AHRQ. The nominations included a brief background and context; the importance and/or rationale for the topic; the focus or population of interest; relevant outcomes; and references to recent or ongoing work. Among the topics that were nominated, the following considerations were made in selection for inclusion in the series: the ability to focus and clarify the topic area appropriately; relevance to quality improvement and a systems approach; applicability to the EPC program/amenable to systematic review; the potential for duplication and/or overlap with other known or ongoing work; relevance and potential impact in improving care; and fit of the topics as a whole in reflecting the AHRQ portfolios.

Input From Stakeholders

A Technical Expert Panel (named in the front matter of this report) reviewed and provided input on topic definition, Key Questions, the search strategy, and preliminary search results. The review protocol was then posted on the Effective Health Care program page of the AHRQ Web site for transparency. Eleven experts in health care payment policy and individuals representing stakeholder and user communities provided external peer review of this report. AHRQ staff and an associate editor also provided comments. A draft report was posted on the AHRQ Web site for four weeks to elicit public comment. We addressed all reviewer comments, revising the text as appropriate, and documented revisions in a disposition of comments report that was made available three months after the final report was posted on the AHRQ website.

Criteria for Inclusion/Exclusion of Studies in This Review

Studies were included that address the Key Questions described above. All study designs were included, including experimental, observational, and descriptive studies. Relevant grey literature, including government and third-party evaluation reports, were included as well. These were identified through ad hoc searches of research sponsors' Web sites, reference mining, and recommendations from the Technical Expert Panel, as these are generally not included in literature databases. Publication date was limited to January 1, 1985 because health care financing has changed over time, potentially limiting the generalizability of earlier findings to the current health care system. The review includes studies published through January 17, 2012.

The following studies were excluded: (1) studies that did not report any of the outcomes of interest; (2) studies that did not report on a bundled payment intervention as defined above; (3) background articles or articles strictly limited to describing theoretical models.

Studies of interventions implemented in countries other than the United States were included only if they met broad criteria for generalizability to the United States. These criteria included:

- The country's delivery system provides similar types of services to the U.S. system (i.e., not low-income countries that provide a much different mix of services);
- The comparison payment method is predominantly fee-for-service as in the United States;
- The delivery context in which the intervention was implemented is similar to one that exists somewhere in the United States;
- The bundled payment intervention meets other inclusion criteria and the study addresses the key study outcomes of interest.

The search strategy did not use language restrictions, however no studies were identified that fit all other inclusion criteria and were not published in English.

Searching for the Evidence: Literature Search Strategies for Identification of Relevant Studies To Answer the Key Questions

The objective of the search strategy was to identify all published bundled payment evaluations. A Technical Expert Panel reviewed and provided input on the search strategy and preliminary search results.

A librarian performed the initial literature search. One trained reviewer (CS), with input from a second trained reviewer (PH) on questionable titles, scanned the titles/abstracts of the list run by the librarian and selected studies for full-text screening. For each of the selected studies, reviewers performed further reference mining by scanning titles listed in the reference section to identify additional articles to be included. Reviewers reconciled their selections and made joint decisions, following all the inclusion/exclusion criteria listed in previous sections.

The initial search consisted of three separate queries, including one using PubMed and two using the Cochrane Library. The search terms utilized for these searches are provided below.

PubMed Search Terms:
(bundl*[tiab] OR episode[tiab] OR "prospective payment"[tiab] OR warranty[tiab] OR warranti*[tiab] OR global[tiab]) AND (payment[tiab] OR finance*[tiab] OR reimburse*[tiab] OR incentive*[tiab] OR fees[tiab]) AND (trial[tiab] OR compare*[tiab] OR effect*[tiab] OR impact[tiab] OR outcome*[tiab] OR result*[tiab])

First Cochrane Library Search Terms:
(bundl*:ti,ab OR episode:ti,ab OR "prospective payment":ti,ab OR warranty:ti,ab OR warranti*:ti,ab OR global:ti,ab) AND (payment*:ti,ab OR finance*:ti,ab OR reimburse*:ti,ab OR incentive*:ti,ab OR fees:ti,ab) AND (trial:ti,ab OR compare*:ti,ab OR effect*:ti,ab OR impact:ti,ab OR outcome*:ti,ab OR result*:ti,ab)

Second Cochrane Library Search Terms:
(bundl*:ti OR episode:ti OR prospective:ti OR warranty:ti OR warranti*:ti OR global:ti) AND (payment*:ti OR finance*:ti OR reimburse*:ti OR incentive*:ti OR fees:ti) AND (trial:ti OR compare*:ti OR effect*:ti OR impact:ti OR outcome*:ti OR result*:ti)

Systematic Reviews for the Medicare Inpatient Prospective Payment System

The Medicare Inpatient Prospective Payment System was implemented in 1983, and represented the first nationwide implementation of bundled payment in the United States. This program was studied heavily in the years after implementation, and these studies have been the subject of previous reviews. Given the large and relatively older body of research on this program and the availability of several published reviews, the researchers, in consultation with the Technical Expert Panel and following AHRQ guidance for using previously published reviews in systematic reviews, chose to consider a review of the review articles for the assessment this program, rather than reviewing individual studies.

The search and review process used for the identifying review articles was the same as those described above, with the exception of the search parameters. The terms utilized for this search are described below.

PubMed Search Terms:
("prospective payment system" OR (PPS AND Medicare)) AND (Review) AND (impact* OR implicat* OR effect)

Cochrane Library Search Terms:
("prospective payment system" OR (PPS AND Medicare)) AND (Review) AND (impact* OR implicat* OR effect)

Data Abstraction and Data Management

Data were independently abstracted by two reviewers per study. The reviewers included three researchers (AM, CS, and PH) trained in the critical assessment of evidence. The following data were abstracted from included studies:

- Trial name;
- Setting and context (including but not limited to number of payers involved, market share, payer relationship with participating providers);
- Provider population characteristics (including but not limited to provider organization type(s), provider organization staffing, profit status);
- Patient population characteristics (including but not limited to sex, age, ethnicity, diagnosis and/or disease severity, baseline health care utilization);
- Eligibility and exclusion criteria;
- Interventions (including "anchor" procedure or diagnosis, services included in the bundle, payment methodology used, risk-adjustment methods, use of quality measurement);
- Any co-interventions;
- Comparisons;
- Results for each outcome;
- Funding source.

We abstracted all information relevant to the above points from reviewed studies. Many individual studies included incomplete descriptions of intervention design and context. The aggregate detail abstracted on some interventions, especially those described in one or a handful

of studies, was often incomplete. The accuracy and completeness of descriptions of interventions in the Results section are limited by the availability of information in source studies.

We also abstracted the statistical significance of outcomes when directly reported in the reviewed studies. Studies did not always report test statistics or p-values for individual results or for pair-wise differences or comparisons across groups. We note p-values for individual outcomes when this information was available in the source study.

Assessment of Methodological Quality of Individual Studies

We assessed the methodological quality of individual studies following methodology outlined in the EPC Methods Guide.[11] Each individual study was given a summary rating of good (low risk of bias), fair, or poor (high risk of bias). Studies rated "poor" or "good" were also given a brief explanation of the basis for the rating. The focus of the rating system is to gauge absolute rather than relative strength of evidence presented in each study. Limitations imposed by the design or implementation of the intervention may limit the feasibility of some methodological approaches to evaluation. The rating for each study therefore reflects both study design and intervention characteristics. For example, a study utilizing the most appropriate methodology in a given intervention context may still be rated "fair" or "poor" due to limitations imposed by the intervention. The rating was based on the following list of specific criteria:

Several core elements apply to trials as well as observational studies:

- Similarity of groups at baseline in terms of baseline characteristics and prognostic factors,
- Extent to which valid primary outcomes were described,
- Blinding of subjects and providers,
- Blinded assessment of the outcome,
- Intention-to-treat analysis,
- Differential loss to follow-up between the compared groups or overall high loss to follow-up, and
- Conflict of interest.

For trials two additional elements are important:

- Methods used for randomization,
- Allocation concealment.

For observational studies, yet other additional elements were considered:

- Sample size;
- Methods for selecting participants (inception cohort, methods to avoid selection bias);
- Methods for measuring exposure variables;
- Methods to deal with any design-specific issues such as recall bias, interviewer bias, etc.; and
- Analytical methods to control confounding.

The quality of systematic reviews of the Medicare IPPS were assessed following methodology outlined in the EPC Methods Guide.[11] Two independent reviewers (CS and PH) assessed relevant systematic reviews for quality with differences resolved by consensus. The quality of individual reviews was assessed using the Assessment of Multiple Systematic Reviews

(AMSTAR) tool, which examines factors including the methods used to identify and select studies, data extraction, and data synthesis. The quality of data abstraction and synthesis was further assessed through review of a sample of primary source studies. The included reviews were checked for consistency in the studies included and the conclusions drawn regarding the Key Questions of this review.

Data Synthesis

We summarized the evidence for the effects of bundled payment in comparison with usual payment methods. We did not conduct any quantitative synthesis of results because we found there was relatively low similarity between studies along key dimensions such as study outcomes. We synthesized the results by bundled payment program, and then summarized these findings by Key Question. The results are presented below in narrative form, with summary tables provided as Appendix A.

Grading the Evidence for Each Key Question

We assessed the overall strength of evidence for intervention effectiveness using guidance outlined in the EPC Methods Guide.[11] This method was developed for use in a variety of comparative effectiveness reports, many of which study clinical interventions with evidence from randomized trials, as opposed to the health services delivery intervention reviewed here. The rating method is based loosely on one developed by the GRADE Working Group, and classifies the grade of evidence according to the following criteria:

High = High confidence that the evidence reflects the true effect. Further research is very unlikely to change our confidence on the estimate of effect.

Moderate = Moderate confidence that the evidence reflects the true effect. Further research may change our confidence in the estimate of effect and may change the estimate.

Low = Low confidence that the evidence reflects the true effect. Further research is likely to change our confidence in the estimate of effect and is likely to change the estimate.

Insufficient = Evidence is either unavailable or does not permit estimation of an effect.

The evidence grade is based on four primary domains (required) and three optional domains. The required domains are risk of bias, consistency, directness, and precision; the additional domains are coherence, residual confounding, and strength of association. One other optional domain, dose-response association, was not used in this review. Publication bias was also considered; while not considered a separate domain of strength of evidence, it is related to strength of evidence, particularly consistency and precision. We used both an explicit scoring scheme, completed by three reviewers independently with differences resolved by consensus, and a global implicit judgment about "confidence" in the result. If the explicit scoring and global judgment disagreed, we used the lower classification.

Applicability

We assessed the overall applicability of the studies reviewed for U.S. policymakers, payers, and providers considering implementation of bundled payment programs. These decisions will be made in widely varying contexts reflecting the diversity of health care markets and delivery settings across the United States. The assessment method was based on the AHRQ Methods Guide for Comparative Effectiveness Reviews.[12] We provide a summary of the most important characteristics of the body of reviewed studies that affect applicability and a description of their expected effects on applicability. We considered interventions that have consistent findings in multiple environments as having greater likelihood of greater generalizability.

Results

In this chapter, we first summarize the results of the search and characteristics of studies and bundled payment systems reviewed. We then narratively summarize the evidence from studies on each of the payment systems, which are listed in Table 2 below. We categorize these systems into three groups based on two key dimensions: whether they were implemented domestically or abroad (a key contextual factor), and whether they were implemented in a single setting or include multiple settings of care (a key design factor). The first category is prospective payment systems implemented in the United States including a single care delivery setting. All of these programs except for one were implemented in public insurance systems, the one exception was implemented by a private managed behavioral healthcare organization. The second category is bundled payment systems implemented in international settings and including a single setting. The third category includes bundled payment programs that involve providers across multiple care delivery settings. These programs include two implemented by public payers and two by private payers, all located in the United States. There were no systems in the fourth category (i.e., systems implemented abroad in multiple settings of care).

We provide a narrative synthesis of evidence for each bundled payment program in these three categories. For each bundled payment program, we summarize the evidence using the following format:

- Description of the payment system
  - Description of the payment system's implementation
  - Details of the payment method
- Summary of the findings of reviewed studies of the payment system
  - Description of the payment methods used for comparison by reviewed studies
  - Overview of the design of reviewed studies relevant to the payment program
  - Summary of findings of effects on study outcomes of interest (Key Question 1):
    - Health care spending (i.e., payments from payers to providers) or costs (i.e., the costs to providers of providing goods or services)
    - Utilization of health care services
    - Health care quality
    - Other study outcomes of interest
  - Summary of findings of differential effects by key design features of the intervention (Key Question 2)
  - Summary of differential effects by key contextual factors (Key Question 3).

Articles Identified

The initial search identified 1,310 articles, including 1,198 identified through the PubMed search, 102 additional articles identified through the first Cochrane Library search, and ten others identified through the second Cochrane search. Of these articles, 74 were included following title and abstract review. Twenty-three were eliminated during full text review, and seven were added from other sources including ad hoc searches, reference mining and expert recommendations. This resulted in a total of 58 articles included for review, including peer-reviewed journal articles as well as evaluation reports identified in the grey literature (Figure 2). This total excluded studies of the Medicare IPPS, for which we searched for review articles separately. The initial search for these review articles identified 160 articles, including 150 identified through the

PubMed search, and 10 additional articles identified through the Cochrane Library search. Eleven of these review articles were retained following title and abstract review (Figure 3). A list of studies excluded after full-text review, with reasons for exclusion, is included in Appendix C. Three articles remained following the full-text screen, and an additional article was identified by an ad hoc search, resulting in the inclusion of four review articles on the Medicare IPPS.

Figure 2. Search tree for primary sources

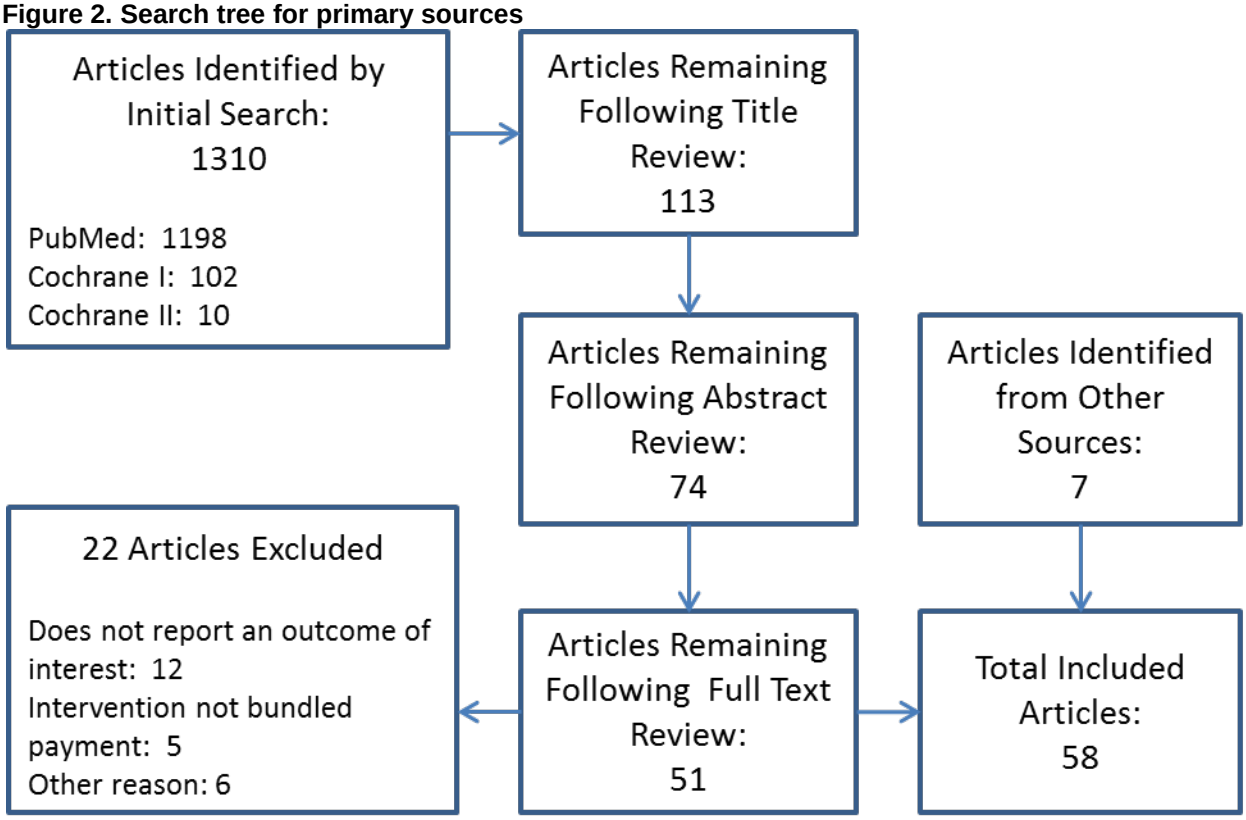
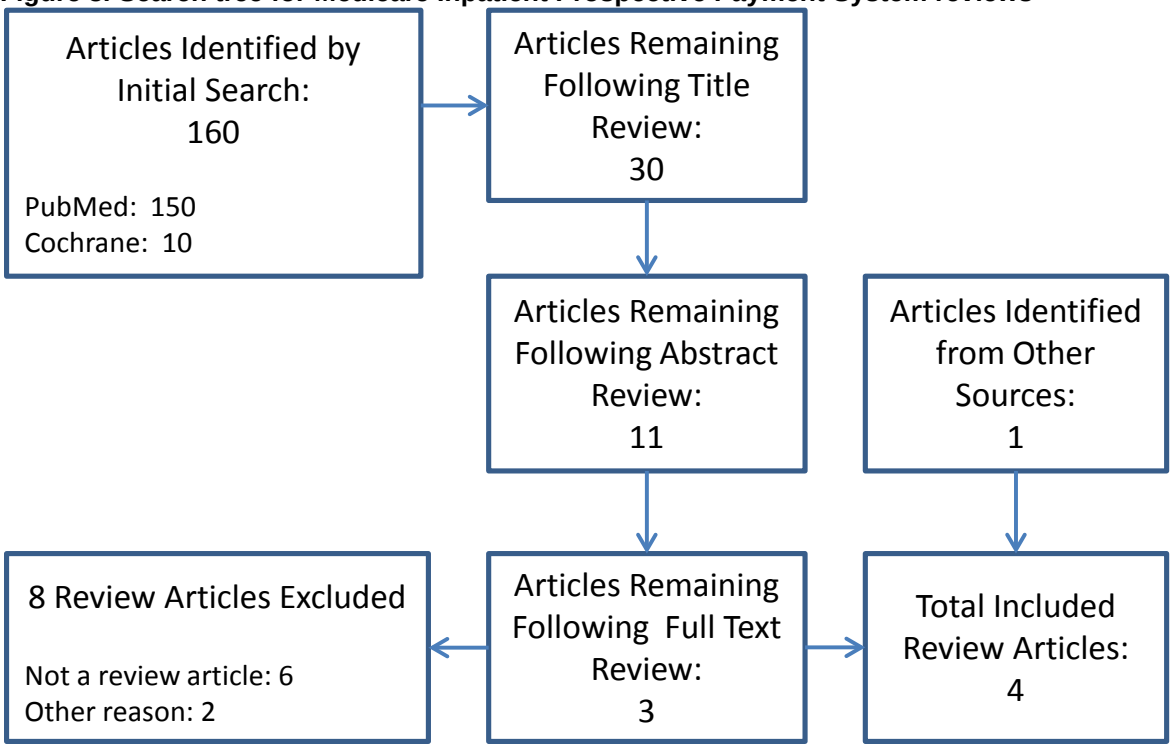


Figure 3. Search tree for Medicare Inpatient Prospective Payment System reviews



The included articles examined 20 different bundled payment interventions (Table 2). Most articles examined U.S. public insurance prospective payment systems or international prospective payment systems. Among the 58 reviewed studies, 48 employed observational designs, while 9 were descriptive. There was only one study randomized at the provider level,[13] and we identified no studies of bundled payment programs randomized at the patient level. All but four of the 20 bundled payment interventions involved bundling of services during a period of time by a single provider such as a hospital, skilled nursing facility, or home health provider. Two studies jointly examined multiple Prospective Payment Systems implemented in Medicare through the Balanced Budget Refinement Act of 1999, including systems for skilled nursing facilities, inpatient rehabilitation facilities, and home health care. All but three of the bundled payment interventions in the included sources included public payers only.

Our search identified other bundled payment programs in progress, including the Medicare Acute Care Episode demonstration, PROMETHEUS Payment, and others. However, we did not identify published evaluations of these programs that met our inclusion criteria. Compared with the majority of the bundled payment interventions in reviewed studies, the programs in progress use bundles with greater aggregation of services over time and across provider types and/or providers. Below, we briefly describe selected ongoing programs.

Medicare Acute Care Episode (ACE) Demonstration.[14] Medicare is conducting a demonstration that provides bundled payments for acute care episodes for orthopedic and cardiovascular inpatient procedures. The bundles include both Medicare Part A and Part B services, including physician services, provided during a hospital stay. Prices for the bundled payment were established through competitive bidding. Five organizations—entities including an affiliation between at least one physician group and at least one hospital—initiated the

demonstration in 2009-2010. CMS is conducting an evaluation, but it has not yet been completed and published.

Medicare Bundled Payments for Care Improvement.[15] Medicare is currently accepting applications for a national initiative that will make bundled payments for episodes of care. The initiative includes four "models," or bundled payment methods. Model 1 is a retrospective payment for hospital and physician services provided during a hospital stay; Model 4 is a prospective payment for these services. Model 2 is similar to Model 1 but also includes 30-90 days of post-discharge care. Model 3 is a retrospective payment for post-discharge services only. Prices for the bundled payment will be negotiated between providers in CMS during the application, with reference to historical utilization and payment amounts for services included in the bundle.

Integrated Healthcare Association (IHA) Bundled Episode Payment and Gainsharing Demonstration. This demonstration is testing bundled payment for episodes related to inpatient surgical procedures in California. The demonstration is funded by AHRQ. IHA serves as a convener of participating hospitals, physician groups, and health plans. The bundles include hospital and physician services during the hospitalization as well as selected services provided during a 90-day post-discharge period (routine followup care, treatment of complications, related readmissions, and optionally therapy). The prices for bundles are negotiated between each participating provider organization and health plan. An evaluation is being conducted by RAND and researchers from the University of California at Berkeley and San Francisco but is not yet complete.

PROMETHEUS Payment. PROMETHEUS is a bundled payment model managed and implemented by the Health Care Incentives Improvement Institute. It is being implemented in several sites where provider organizations and commercial payers have volunteered to participate. The bundles include episodes of care related to chronic conditions, inpatient acute conditions, and inpatient surgical procedures. An evaluation of the implementation of three sites showed that the pilots have faced sizable implementation challenges, with none of the three pilot sites having executed contracts or made bundled payments three years after the pilot initiation.[16] Therefore, no information is currently available on the impact of the bundled payment intervention on spending, quality, or other study outcomes of interest for this report.

Table 2. Bundled payment systems in included studies

Payment System	No. of Included Studies	Intervention Date	Payer	Provider Type(s)	Services Included in Bundle
U.S. Public Insurance Prospective Payment Systems					
Medicare Inpatient Prospective Payment System	4[6-9] (Reviews)	October 1983[a]	Medicare	Inpatient hospitals	Per-discharge payment for hospital costs associated with each diagnosis-related group, including nursing, accommodation, etc., and outpatient services in three days prior to admission.
Medicare Skilled Nursing Facility Prospective Payment System	20[10-29]	July 1998	Medicare	Skilled nursing facilities	Per diem payment for routine, ancillary, and capital-related skilled nursing services for each of 56 Resource Utilization Groups.
Medicare Inpatient Rehabilitation Facility Prospective Payment System	11[11,19,30-38]	January 2002	Medicare	Inpatient rehabilitation facilities	Per-discharge payment for operating and capital costs for each of 92 Case-Mix Groups.
Medicare Home Health Prospective Payment System	12[5,11,19,39-47]	October 2000	Medicare	Home health agencies	Per 60-day episode payment for all nursing care, therapy, and aide services for each of 153 Home Health Resource Groups.
Medicare Long Term Acute Care Hospital Prospective Payment System	1[48]	October 2002	Medicare	Long term acute care hospitals	Per discharge payment for all operating and capital costs for each of 318 Medicare long-term care diagnosis-related groups.
Department of Veterans Affairs Resource Allocation Methodology	1[49]	1985–1988	Department of Veterans Affairs	Inpatient hospitals	Per admission payment (diagnosis-related groups) for hospital services.
Maine Medicaid Nursing Home Prospective Payment	1[50]	1982–1985	Maine Medicaid	Nursing homes	Per diem payment for nursing home services (including patient care, dietary care, lodging, etc.).
New Hampshire Medicaid Hospital Prospective Payment	1[51]	January 1989	New Hampshire Medicaid	Inpatient hospitals	Payment includes per discharge prospective component based on Diagnosis Related Group, as well as an actual costs component.
U.S. Private Sector Single-Setting Bundled Payment Systems					
Case Rate for Managed Behavioral Health Care	2[52,53]	July 1995	Single U.S. Managed Behavioral Healthcare Organization	Psychiatrists, psychologists, social workers	All outpatient mental health services for one year following referral.

Table 2. Bundled payment systems in included studies (continued)

Payment System	No. of Included Studies	Intervention Date	Payer	Provider Type(s)	Services Included in Bundle
International Bundled Payment Systems					
Belgium Inpatient Prospective Payment System	1[54]	1995	Belgium public health insurance	Inpatient hospitals	Per-admission payment for non-medical hospital services (e.g., nursing staff, accommodation) for each of 604 case mix groups.
National Health Service (England) Payment by Results	1[55]	2003	England NHS	Hospitals	Hospital services (more detail not reported).
Italy Inpatient Prospective Payment	1[56]	January 1995	Italian Ministry of Health	Inpatient hospitals	Hospital and physician services (more detail not reported).
Japan Outpatient Hemodialysis Bundled Payment	1[57]	April 2006	Not reported	Dialysis clinics and hospitals	Dialysis drugs (more detail not reported).
Netherlands Inpatient Prospective Payment	1[58]	2005	Not reported	Inpatient hospitals	Hospital and physician services (more detail not reported).
Sweden Inpatient Prospective Payment System	1[59]	1992	Stockholm County Council	Inpatient hospitals	Hospital services (more detail not reported).
Taiwan Hospital Case Payment	3[60-62]	October 1997	Taiwan National Health Insurance Bureau	Hospitals	Per episode payment for required medical services, "optional" medical services, pharmaceuticals, and evaluations within a two-week period for surgeries.
Bundled Payment Systems Including Multiple Providers/Sites of Care					
Geisinger ProvenCare(SM)	1[63]	February 2006	Geisinger Health Plan, PA	Three demonstration hospitals	Per-discharge payment for evaluation, hospital and professional fees, routine post-discharge care, management of complications.
Medicare Participating Heart Bypass Demonstration	1[64]	May 1991–June 1996	Medicare	Seven demonstration hospitals	Per-discharge payment for all inpatient hospital and physician services, including related readmissions.
Medicare Cataract Surgery Alternative Payment Demonstration	1[65]	1991–April 1996	Medicare	Four demonstration sites	Pre-operative diagnostics and evaluation, surgical services, post-operative exams to 120-days, management of common complications.
Michigan Arthroscopic Surgery Bundling Pilot with Warranty	1 [66]	April 1987	Blue Care Network (Blue Cross Blue Shield of MI)	Single surgical practice and hospital	Single payment for all care related to surgery, including repeat surgery, repeat hospitalization, or any other related subsequent services rendered by the providers for 2 years.

Source: Authors' analysis of search results
[a]Implementation was delayed in four states.

U.S. Public Insurance Prospective Payment Systems

We identified studies of eight U.S. public insurance prospective payments systems. We first summarize findings of studies on five Medicare programs, then one Department of Veterans Affairs program and two state Medicaid programs.

Medicare Inpatient Prospective Payment System

Description of the Payment Model

Implementation

Prior to 1983, hospitals were reimbursed retrospectively based on costs incurred. In October 1983, Medicare implemented the Medicare IPPS for payments to participating hospitals (implementation was delayed in four states). Payment rates were transitioned over a four-year period, moving from a blend of hospital-specific and regional average payment rates to a relatively generous (4 percent higher) national payment rate.[19] Similar payment policies were adopted by other payers. Medicare IPPS was applied to all short-term community hospitals, but excluded sole community hospitals.

The implementation of Medicare IPPS occurred at a time when a number of other trends were shaping hospital costs and utilization. These include technological advances that shifted care from inpatient to outpatient settings; changes in private insurance payment, notably the rapid adoption of managed care; and shifts towards more favorable reimbursement for care nursing home, home health and hospice benefits under Medicare.[18]

Payment Method

Under Medicare IPPS, a single prospective per-discharge payment was made for hospital operating costs associated with a hospital admission, including room and board, nursing, and costs associated with specialized care and ancillary services. The bundle did not include physician professional services provided during the hospital admission. Payments were made to the hospital, which employed staff whose services were included in the payment (nurses, technicians, etc.). Related outpatient department services provided in the three days prior to admission were also included.

Payments were adjusted for the patient's diagnosis, through the classification of discharges into Diagnosis-Related Groups (DRGs). Payment adjustments were also made based on each hospital's local market characteristics and teaching status. Outlier payments were added for the most-costly cases. There was no explicit role of performance measurement built into the payment methodology.

Summary of Findings

Comparison Payment Methods

The effects of the Medicare IPPS were generally assessed through comparisons with the retrospective reasonable cost-based system of reimbursement that preceded it in the Medicare program.

Overview of Design of Relevant Studies

Reviews

As noted above, we searched for review articles summarizing prior research on the Medicare IPPS. We identified four articles that reviewed studies of the impact of the Medicare IPPS and were relevant to the Key Questions of this review.[17-20] The reviews were published in 1989-1991 and therefore do not include more recent studies. However, the intervention studied was implemented in 1983 and therefore we expect that most relevant studies were published prior to 1991.

None of the four reviews reported detailed information on methods for study selection, data abstraction, and data synthesis, precluding assessment of the quality of the individual reviews against AMSTAR criteria. The reviews did not include lists of included studies, which precluded assessment of the degree of consistency in study inclusion. The findings of the four reviews on the Key Questions were compared and had a high degree of consistency between reviews. Data abstraction and synthesis accuracy were assessed through review of a small sample (4-6 primary source articles per review) of primary source studies; this review confirmed a high degree of accuracy.

Based on these assessments of the quality of the review articles, we concluded that although the lack of transparency in methods indicates that each individual review is at risk of bias, the consistency in findings and the checks against primary source articles indicate a lower risk of bias for the body of evidence from the four reviews considered together.

Primary Source Studies

The majority of studies reviewed in the four included review articles relied on a small number of common national data sources and used observational pre/post designs. A handful of studies referenced in the reviews leveraged a delay in implementation of the Medicare IPPS in four states initially exempted from the program under a waiver, allowing contemporaneous comparison between the new system and cost-based reimbursement.

The focus of the analyses was driven largely by the available data, with the primary emphasis on care utilization and Medicare program costs, which could be extracted from available administrative data. There was a secondary focus on the impact of the Medicare IPPS on hospital finances. Analysis of quality and outcomes was largely focused mortality rates, with the acknowledgement that this measure is unlikely to be highly sensitive to Medicare IPPS implementation.

All four reviews noted the inherent difficulty in analyzing the effects of the Medicare IPPS or drawing meaningful conclusions, given the myriad external trends and related policy developments during the years before and after Medicare IPPS implementation. Feinglass in particular noted that rapid increases in the prevalence of outpatient surgery and utilization of home health services, as well as increasing severity of inpatient cases, were influenced by numerous external factors in addition to Medicare IPPS implementation.[19] However, given these limitations, there was notable consistency among the included studies and the reported findings across the four reviews.

Effects on Health Care Spending and Quality

Effect on Health Care Spending and Provider Costs

The Medicare IPPS was found to substantially reduce the rate of increase in Medicare inpatient hospital expenditures. Medicare payments per discharge increased post-implementation, driven largely by increases in reported case-mix and relatively generous per-discharge payment rates in the early implementation period. However, discharge volumes decreased, leading to an overall decrease in Medicare inpatient spending growth.[17] The reductions in growth of total hospital expenditures attenuated following the first two years of the Medicare IPPS, returning to double-digit annual growth in the fourth year of the program.[18]

Based on comparisons of inflation-adjusted Medicare expenditure growth before and after Medicare IPPS implementation, the reduced rate of spending growth translated into a reduction of $17 billion to $18 billion in Medicare spending on inpatient care in the payment system's first five years.[17] These decreases in inpatient spending were offset to some degree by increases in spending for care in other settings.[20] Medicare payments for physician services (including inpatient and ambulatory) grew at a slower rate under the Medicare IPPS, while outpatient hospital and post-acute care payments grew slightly faster under the new system. The real rate of growth of total Medicare spending decreased following the Medicare IPPS, from roughly seven percent annually in the four years prior to implementation to roughly four percent annually in the subsequent three years.[18,20] These findings suggest that the Medicare IPPS resulted in care shifting from inpatient to outpatient settings, and had a modest impact on overall Medicare spending.[17]

Effect on Health Care Utilization

The reviews found that the Medicare IPPS resulted in a decrease in hospital utilization, particularly in the early years of the program. Feinglass noted that the average length of stay for Medicare patients was 25 percent lower in 1985 than in 1980, while it was five percent lower over that interval for non-Medicare patient under 65. Total hospital days per 1,000 Medicare enrollees per year decreased by 21.8 percent over the initial two years of the Medicare IPPS.[19] Chulis reported similar findings, including reductions in length of stay that were large in the initial years of the Medicare IPPS (as high as 1.6 fewer days per stay in the first year), but stabilized thereafter. Due to data limitations, however, this effect may have been overstated, specifically in light of questions about the inclusion or exclusion of long-stay hospitalizations that continued to be reimbursed on a reasonable cost-basis following the Medicare IPPS.[17] Limited evidence suggests that the Medicare IPPS resulted in a reduction in the intensity of care (i.e. the volume of tests, procedures and services utilized per patient).

There was strong evidence linking the Medicare IPPS to significant shifts in the delivery of services from inpatient to outpatient settings. The reviews suggested that there was a shift in treatment from hospitals to other post-acute settings, although the results are somewhat mixed.[18] Lave reported an increase in Medicare discharges to skilled nursing facilities, and an increase in home health services for discharges to home in the initial years of the Medicare IPPS, but noted that these shifts do not necessarily reflect inappropriate changes in treatment setting.[20]

Contrary to conventional wisdom at the time of implementation that hospital admissions rates might increase in response to the new payment system, hospital admission rates actually fell during the first several years of the Medicare IPPS, with the decline estimated to be as much as 10 percent in the first year when adjusted for other factors.[18] Chulis reported similar decreases in admission rates, totaling 14 percent over the first five years of the Medicare IPPS.[17] However,

the causes of this reduction in admissions have not been definitively explained. A number of potential causes external to the Medicare IPPS have been theorized, and the four reviews included significant speculation about other factors that contributed to this outcome. In particular, other factors at the time may have encouraged shifting certain types of care from inpatient to outpatient settings, such as surgical procedures that could be performed in an ambulatory setting.[17-20]

Effect on Health Care Quality

There is no evidence of systematic deterioration in quality of care under the Medicare IPPS, as had been predicted by some observers before implementation. On the contrary, the evidence shows that most quality measures improved post-implementation, although the changes can't be attributed to the Medicare IPPS. However, researchers cautioned the length of follow-up might have been insufficient to detect long-term effects on outcomes.[18,20]

The reviews reported that studies demonstrated either no change or a decline in mortality rates following the Medicare IPPS. This result was consistent across in-hospital mortality rates and long-term mortality rates (up to one year post-discharge). During this time period, the overall population mortality rate among Medicare beneficiaries also decreased.[17]

There was less evidence available on non-mortality health outcomes or other quality measures. Some studies examined potential adverse quality effects of incentives to discharge patients quickly. The available evidence did not suggest that the Medicare IPPS led to increases in hospital readmissions. Inter-hospital transfer rates did not appear to change in the first two years of the Medicare IPPS. There was insufficient evidence to assess the long-term effect on transfers or any impact on emergency room admissions.[18] Lave noted one study that found a higher proportion of previously hospitalized patients residing in nursing homes at six months post-discharge after the implementation of the Medicare IPPS.[20] One study also found an increase in the level of instability of patients at the time of discharge after the Medicare IPPS.[18]

Other Effects

The case-mix index of patients treated increased under the Medicare IPPS, with the largest increase in the first year, but it is unclear to what degree this resulted from changes in the actual condition of patients treated, as opposed to changes in coding and DRG assignment.[17,18,20]

The literature indicated that the Medicare IPPS did not drive hospital closure, but did impact hospital financial performance. The Medicare IPPS led to a sharp short-term increase in hospital margins, followed by reductions over the subsequent years; however, this effect varied across hospitals based on market conditions. The initial payment rates under the Medicare IPPS, particularly in the first year, were widely recognized as overly generous. While these rates were later adjusted, they may have distorted the intended effects in the initial years of the Medicare IPPS, both by dampening the cost-containment incentive in the first year, and by providing revenue to hospitals that could be used to compensate for the changes in later years.[18]

Some evidence suggested that productivity increased in hospitals under the Medicare IPPS, in terms of the amount of care provided relative to the resource used.[18] Chulis reported government estimates of hospital profits exceeding 14 percent on Medicare IPPS business in each of the first two years of the program, decreasing to 2.6 percent by 1988. The impact among hospitals differed substantially, with urban hospitals performing much better than rural hospitals in terms of profitability under the Medicare IPPS, and teaching hospitals performing the best. These differences were mitigated by targeted changes in differential payments among hospital types in the years following the initial implementation of the Medicare IPPS.[17]

Differential Effects by Key Design Feature

None reported.

Differential Effects by Key Contextual Factor

When measures of financial pressure on hospitals were applied to the data, the impacts of the Medicare IPPS appear much larger among hospitals identified as experiencing significant pressure. Feinglass defined financial pressure as a measure of the "gap between (hospitals') actual costs and their anticipated or actual PPS revenues."[19] Reductions in utilization were more pronounced among hospitals under a high degree of financial pressure, while reductions are muted among hospitals under lower or negligible pressure. This suggests that local market conditions played a significant mediating role in hospital response to the Medicare IPPS.[17-19]

Medicare Skilled Nursing Facility Prospective Payment System

Description of the Payment Model

Implementation

The Medicare Skilled Nursing Facility (SNF) Prospective Payment System (PPS) replaced a retrospective cost-based payment system on July 1, 1998. The SNF PPS was one of several new Medicare post-acute care payment systems introduced in the 1997 Balanced Budget Act. Unlike the other new payment systems in the Balanced Budget Act which were for the most part budget neutral, the SNF PPS was predicted to reduce Medicare SNF spending by $9.5 billion from 1998-2003.[78] After implementation, aggregate Medicare SNF spending declined 15 percent from $11.3 billion in 1998 to $9.5 billion in 1999, roughly in line with CBO projections.[78,79]

The SNF PPS applied to both freestanding and hospital-based SNFs. A three-year mandatory phase-in period blended facility-specific payment rates based on historical allowable costs with the new prospective rates. Several changes were made to the PPS payment rates after implementation. The 1999 Balanced Budget Act included a 20 percent increase for 15 "complex care" case mix groups and a four percent increase for all other case mix groups. The 2000 Benefits Improvement and Protection Act included an additional 6.7 percent increase for all case mix groups and a 16.6 percent increase in each rate's nursing component.

Payment Method

The SNF PPS bundled routine, ancillary, and capital-related services provided under Medicare Part A into one per diem payment for each of 56 Resource Utilization Group III (RUG) case-mix groups.[a] Services provided at SNFs included nursing care, rehabilitation therapy, laboratory services, and drugs. Payment rates were updated each federal fiscal year by CMS using an SNF market basket index. Rates were also adjusted for geographic variation in wages using the hospital wage index.

The RUG system tied the per diem payment amounts to patient clinical and functional characteristics as well as to services provided. Specifically, assignment to one of the 56 RUGs was determined by the amount of rehabilitation therapy provided (in minutes per week), the need for extensive or skilled services, and patient condition.

[a] See Federal Register (2005), "FY 2006 SNF PPS Final Rule," 70(149): 45025-45127.

Summary of Findings

Comparison Payment Methods

All reviewed studies (n=18) compared the SNF PPS to the previous retrospective cost-based reimbursement system. One study also analyzed the impact of Medicaid SNF case mix reimbursement, and one study assessed the impact of each Balanced Budget Act PPS intervention, including the SNF PPS, on utilization of SNF and other types of post-acute care. Five studies utilized data on non-Medicare patients in a differencing strategy or to report separate pre/post results for Medicare and non-Medicare beneficiaries.

Overview of Design of Relevant Studies

Most studies specifically assessing the Medicare SNF PPS (n=14) reported changes in patient outcomes (eight studies), SNF utilization (nine studies), and/or Medicare SNF spending (three studies) attributed to SNF PPS implementation. Five additional studies assessed SNF-level effects associated with the SNF PPS, including staffing levels,[29,35,40] efficiency,[23,39] and regulatory deficiencies.[29] Of the 14 studies focusing on patient-level effects, one considered total knee replacement patients only,[24] three considered rehabilitation services only,[34,36,38] one considered Medicare patients hospitalized for stroke only,[21] one considered long-stay patients only,[27] one considered the pharmacologic treatment of depression only, and one considered pharmacologic second ischemic stroke prevention only.[32]

One study considered a range of utilization, reimbursement category and level, and length of stay measures and was rated "good" by reviewers.[25] This study included a SNF profit maximization model supported by a supply response theoretical framework and employed difference-in-differences and difference-in-difference-in-differences identification strategies to estimate the impact of the SNF PPS. Of the remaining 16 studies, 12 were rated "fair" and four were rated "poor". The poor studies reported only univariate analyses without considering potential confounders (three of the four), and/or lacked generalizability due to the small number of SNFs studied (the remaining one of the four). Reviewed studies provided limited information on the long-term impact of the SNF PPS: Eleven of the seventeen studies used "post" data from 2001 or earlier (compared to the PPS implementation date of July 1998).

Effects on Health Care Spending and Quality

Effect on Health Care Spending and Provider Costs

Few of the reviewed studies provided direct estimates of the impact of the SNF PPS on Medicare SNF spending. The study which most directly addressed this question (rated fair) modeled the change in SNF spending from 1997 to 1999 for elderly patients hospitalized with stroke controlling for a range of individual and hospital-level covariates and the degree of integration between hospitals and SNFs.[21] The authors found a statistically insignificant 8.2 percent decline in spending. Another study (rated poor) focused on SNF rehabilitation services and found that average SNF rehabilitation charges per Medicare hospital stay decreased from $421 in 1997 to $233 in 2000 (a 44.6 percent decline) with the largest decreases for for-profit, freestanding SNFs.[34] The author suggested that lower rehabilitation charges per SNF day (rather than lower length of stay or probability of discharge to a SNF) were responsible for this decline.

Three studies assessed changes in SNF use of nursing labor in response to the SNF PPS. Changes in nurse staffing are related SNF facility costs. Collectively, these studies suggested SNF staffing decreased post-PPS except for an increase in administrative nurse hours. The first study (rated fair) found SNFs with the average Medicare patient fraction had 13 fewer minutes of nurse staffing per day post-PPS ($p<0.001$), with a smaller effect for non-profit SNFs.[35] The second (rated fair) found a 17 to 33 percent reduction in professional staffing in hours per patient day post-PPS after controlling for time trends, facility characteristics, and demographic factors.[29] Finally, a fair study assessing nurse administrative activities found administrative nurse hours per patient day increased by four percent on average post-PPS ($p<0.01$) but could not identify a dose-response relationship, i.e., a further increase in administrative nursing hours for SNFs with larger Medicare patient populations.[40]

One fair study directly assessed changes in SNF efficiency over the SNF PPS implementation period using a data envelopment analysis approach. This study found the average SNF efficiency score (measured as the output of resident days divided by operation expense inputs, after controlling for quality and case mix) gradually declined after the 1998 implementation of the PPS, from a mean of 0.198 in 1997 to 0.131 in 2003. However, SNFs with larger proportions of Medicare beneficiaries faced smaller declines in efficiency than those with smaller proportions of Medicare beneficiaries ($p<0.0001$).[39]

Effect on Health Care Utilization

Reviewed studies considered a wide range of SNF utilization outcomes. In general, studies including robust controls for potential confounders and sophisticated approaches to control for time trends found the SNF PPS had at most a modest impact on utilization. Still, taken as a whole, the evidence suggests the SNF PPS catalyzed small decreases in average length of stay, rehabilitation utilization during SNF stays, and SNF admissions.

One good study assessed whether the SNF PPS affected Medicare enrollment (i.e., the number of Medicare patients at an SNF) and Medicare share (i.e., the proportion of Medicare patients in a total SNF population).[25] The SNF PPS was associated with a decrease of one to two Medicare patients per SNF and a decline of the proportion of patients covered by Medicare of about 10 percent to 22 percent (results presented from two models with different approaches to controlling for underlying secular trends).

Three studies assessed changes in SNF average length of stay. One good study found no significant effect on average length of stay within 20 or 90 days post-PPS.[25] Two other studies found decreases in average length of stay, with one poor study reporting large but statistically insignificant decrease (from 17.4 to 8.6 days) without controlling for potential confounders,[24] and a fair study reporting a decrease from 23.8 days in 1997 to 22.9 days in 2000 without controlling for covariates.[35]

Several studies measured rehabilitation therapy time during SNF stays. One previously mentioned good study reported PPS implementation was associated with an 8.7 percent increase in therapy minutes per stay ($p<0.01$).[25] A fair study found the number of rehabilitation therapy hours per week decreased from 7.1 to 6.2 post-PPS after controlling for a range of demographic, insurance, and patient-level factors ($p<0.001$).[33] A third study (rated fair) found the number of rehabilitation therapy minutes decreased from 552 pre-PPS to 379 post-PPS (31 percent decline) after controlling for resident and facility observable factors, and reported a larger decline for Medicare beneficiaries than for those with private health insurance (21 percent decline) or Medicaid (2 percent decline).[36]

Other studies measured rehabilitation utilization during SNF stays using visit counts. One poor study found physical therapy visits per stay decreased from 10.43 pre-PPS to 7.23 post-PPS without controlling for potential confounders ($p=0.041$).[24] In a sample of three SNFs, another poor study reported post-PPS patients had five fewer physical therapy days than pre-PPS patients (down from 18.5 to 13.1 days), and that post-PPS patients received 47 percent and 54 percent of physical and occupational therapy, respectively, than pre-PPS patients.[38] A third study (rated fair) found the number of physical and occupational visits per stay for the highest-functioning patients increased at SNFs participating in the SNF PPS demonstration program (19.3 to 26.5 visits per stay) but not in nonparticipating SNFs (decrease from 23.3 to 18.2 days, not statistically significant).[26] Overall, there was mixed evidence on the direction of the PPS's impact on rehabilitation therapy utilization, although more studies reported a decrease than an increase.

Four studies reported increases in the patient-level probability of using any SNF or specifically rehabilitation services at all post-PPS. The first (rated fair) predicted a large increase in the probability of SNF resident use of rehabilitation services from 68 percent to 90 percent based on a model including a range of demographic, insurance, and patient-level factors and calibrated with pre-PPS data ($p<0.001$).[33] The second (rated fair) reported an observed but smaller increase in the use of any rehabilitation services amongst SNF residents from 89 percent pre-PPS to 91 percent post-PPS controlling for resident and facility observables.[36] The third study (rated poor) reported a decrease in the probability of hospital discharge to a SNF (from 16.3 percent pre-PPS to 14.7 percent post-PPS) without controlling for covariates.[34] The fourth study reported a 4.2% decline from 1997 to 1999 ($p<0.01$) in the use of any SNF services by elderly stroke patients.[21]

Finally, one fair study assessed the impact of the SNF PPS on utilization of SNF, Inpatient Rehabilitation Facility (IRF), home health, or no Medicare post-acute care after controlling for patient and SNF characteristics.[22] Substitution between sources of care in response to payment system change introduces important implications for payers (in this case Medicare) in terms of total expenditure and possibly quality outcomes. This study found the SNF PPS decreased the probability of SNF utilization for hip fracture patients by 0.6 percent ($p<0.05$) and for joint replacement patients by one percent while utilization for stroke patients was unchanged. The study also attributed the SNF PPS with a small decline in the probability of receiving any Medicare post-acute care and a small increase in the probability of receiving home health services for hip fracture and joint replacement patients (all $p<0.05$).

Effect on Health Care Quality

While several studies considered quality using metrics such as SNF deficiencies reported to CMS and the proportion of patients discharged to the community, very few reported consistent effects of the SNF PPS across multiple quality metrics. On the whole it appears the SNF PPS did not consistently affect quality. One study assessed the change in all-cause mortality and rehospitalizations due to a variety of causes from 1997 to 1999.[21] All-cause mortality increased by a marginally statistically significant 1.6% ($p<0.1$) while differences in readmission rates were not statistically significant.

Four fair studies measured changes in care "deficiencies" reported on regulatory forms, e.g., pressure sores or use of restraints. One study reported a significant increase in SNF-level deficiencies of about 12 percent over the pre-PPS mean of 5.4 deficiencies per report, although this study did not find a significant dose-response relationship between a SNF's Medicare beneficiary share and deficiencies.[29] Three other studies found a nil[35] or very small effect of PPS

on deficiencies reported (less than 0.25 percent greater risk of urinary tract infection or pressure sores post-PPS).[27,28]

Two fair studies measured changes in discharge patterns. The first did not find a change in discharge to community for the highest-functioning patients, or in residence in community at 30, 60 or 90 days post discharge attributed to participation in the SNF PPS demonstration.[26] The second reported the relative risk of discharge to home increased post-PPS ($p<0.01$) but noted that the increase was smaller for Medicare beneficiaries than for non-Medicare beneficiaries ($p<0.001$).[37] The same study reported Medicare beneficiaries faced lower relative risk of death in a SNF post-PPS ($p<0.01$) but noted this effect was greater for Medicare beneficiaries than for non-Medicare beneficiaries ($p<0.001$).[37] The authors conclude the SNF PPS was "associated with neither uniformly declining standards of care nor a large improvement in effectiveness".[37]

Other studies focusing on specific patient groups considered various clinically-based quality metrics. A poor study of orthopedic patients found one health outcome improved (ambulation distance feet increased by 40 percent post-PPS, $p=0.003$), one health outcome declined (extension range of motion decreased by 40 percent post-PPS, $p=0.035$), and one remained the same (knee flexion range of motion) post-PPS, all without controlling for potential confounders.[24] A poor study of stroke patients found antiplatelet use was between 21 percent and 37 percent higher post-PPS, and found no change in anticoagulant use post-PPS (odds ratio 95% confidence interval (0.88, 10.8).[32] Finally, a fair study of depressed patients found no change in the likelihood of antidepressant medication use pre/post-PPS (odds ratio 95% confidence interval (0.93, 1.18).[31]

Other Effects

Patient condition and categorization. Several studies suggested patient condition, disease severity, and comorbidities on admission worsened over time. This may have been a secular trend, in which case unobserved or otherwise omitted variables may mistakenly attribute declines in health status or outcomes to the SNF PPS. It is also conceivable that incentives in the SNF PPS induced SNFs to admit sicker patients (e.g., high rehabilitation RUGs may provide a greater margin than non-rehabilitation RUGs) or to more thoroughly document diagnoses to qualify for higher payments. In one fair study, patients had lower cognitive and motor scores, probability of planned home discharge, probability of family/friend contact, vision abilities, and ability to make needs understood post-PPS compared to pre-PPS. In the same study, post-PPS patients experienced higher rates of depression, psychiatric medication, diabetes, congestive heart failure, pulmonary disease, and other comorbidities compared to pre-PPS patients (all reported with $p<0.001$).[33] In a poor study (with patients from only three SNFs), post-PPS patients had significantly lower admission physical functioning scores (down from 20.10 to 10.52) and physical summary scores.[38] A good study analyzed shifts in RUG classification utilization pre/post-PPS and found a 6.4 percent increase in the assignment of patients to rehabilitation RUGs (from 75 percent to 79 percent; $p<0.05$) and a 30 percent increase in assignment to "high rehabilitation" RUGs (from 13 percent to 17 percent; $p<0.01$).[25]

One fair study analyzed the response of SNFs to a design feature of the SNF PPS, namely defining rehabilitation therapy RUGs on specific cutoffs in the number of minutes of therapy provided.[36] This study found the distribution of therapy minutes transitioned from a relatively even distribution pre-PPS to a distribution with some clustering at "nodal points" defining the boundaries of rehabilitation therapy RUG classifications (45, 150, 325, 500, and 720 minutes of therapy). Overall, there was a 12 percent increase in the probability of receiving rehabilitation therapy at a nodal point post-PPS.[36]

Differential Effects by Key Design Feature

As described above, one fair study focused on a specific design feature of the SNF PPS, the definition of rehabilitation therapy RUGs on the basis of therapy minutes provided. However, this study did not report on the effects of this design feature on health spending or quality. No other studies reported differential effects by key design feature.

Differential Effects by Key Contextual Factor

Facility ownership status and hospital affiliation. One poor study decomposed rehabilitation spending changes by SNF ownership status and found that a significant decline in rehabilitation charges per stay for for-profit, freestanding SNFs was offset by smaller decline for not-for-profit SNFs and a small increase in charges for hospital-based SNFs.[34] The same study found that for-profit, freestanding SNFs decreased the proportion of patients with greater than $200 in charges from 19 percent in 1997 to just 1.6 percent in 2000.[34]

Zinn et al. tested several hypotheses linking the administrative burden of the SNF PPS (as proxied by administrative nurse staffing) to for-profit status, chain affiliation, and size.[40] The study (rated fair) reported that "medium" SNFs (between 100 and 199 beds) and "large" SNFs (200 or more beds) had about 5 percent higher administrative nurse staffing post-PPS compared to "small" SNFs with fewer than 100 beds ($p<0.01$). The study reported no differences in administrative nursing levels between chain and non-chain SNFs and for-profit vs. not-for-profit SNFs.

Konetzka examined differential effects on staffing and regulatory deficiencies among different types of facilities and found no strong pattern of differential effects between for-profits and nonprofits or between chain and independent facilities (study rated fair). While the authors stressed that the results were not conclusive, they noted somewhat stronger evidence that hospital-based facilities responded to PPS (and subsequent rate adjustments) more strongly than freestanding facilities.[29] Similarly, the same researchers examined differences in incidence of urinary tract infections and pressure sores by facility type (for-profit/non-profit) and market characteristics (high-occupancy area/low-occupancy area). The study (rated fair) reported no consistent, statistically significant differences in overall effect based on these variables.[27]

Patient characteristics. One fair study reported differential utilization outcomes for relatively high-functioning and low-functioning patients.[26] This study found that use of physical therapy and occupational therapy increased for the highest functioning patients in PPS facilities, while there was no significant difference among patients at lower functional levels at admission. The same study reported that despite increased therapy provision, community residence 60 days after admission did not change for the highest functioning patients.[26]

SNF characteristics. Afendulis et al. (2011) tested whether the Medicare SNF PPS had a differential impact on hospitalized stroke patients in areas with higher integration between hospitals and SNFs (i.e., in areas with less competition).[21] They found the SNF PPS led to larger declines in the use of any SNF services in more integrated areas. They also found spending declined in more integrated areas (by 5.3% from 1997-1999, $p<0.05$) but not in less integrated areas. There were no differential effects in quality measures across more and less-integrated areas. This result may be due to effective self-referral in integrated hospital-SNFs prior to PPS.

Medicare Inpatient Rehabilitation Facility Prospective Payment System

Description of the Payment Model

Implementation

The Medicare Inpatient Rehabilitation Facility Prospective Payment System (IRF PPS) replaced a retrospective, average cost per discharge payment system with facility-level annual total reimbursement caps on January 1, 2002. The IRF PPS was one of several new Medicare post-acute care payment systems introduced in the 1997 Balanced Budget Act. IRFs were defined by CMS as inpatient facilities which admit more than 60 percent of cases from a list of 13 qualifying medical conditions.

IRFs with fiscal years starting between 1/1/2002 and 9/30/2002 could choose to blend the previous payment system (one-third) with the new PPS (two-thirds) for that year only. IRF PPS reimbursement rates were usually increased annually to reflect changes in a market basket index, but the Medicare, Medicaid, and SCHIP Extension Act of 2007 held payments constant for the second half of 2008 and all of 2009 (following increases of about 3 percent in 2006 and 2007).

Payment Method

The IRF PPS bundled all operating and capital costs into one per-discharge payment for each of 92 Case Mix Groups (CMGs). The CMG system tied payment amount to patient diagnosis, functional status, cognitive status, age, and comorbidities using 92 separate codes. The IRF PPS included separate payment for short-stay outliers, for patients who die prior to discharge, for patients transferred out of the IRF setting, and for high-cost outliers.

Payment rates were updated each federal fiscal year by CMS using an IRF market basket index (including capital). Rates were also adjusted for geographic variation in wages using the hospital wage index, for facility-level proportion of low-income patients, and for teaching status.

The IRF PPS included some patient cost sharing. Beneficiaries admitted from the community (rather than an acute care hospital) pay a deductible (about $1,000) at admission and a copayment (about $250) per day for the 61st through 90th days. Total IRF days are subject to beneficiary-specific caps (90 days for all hospital care per illness).

Summary of Findings

Comparison Payment Methods

All reviewed studies (n=10) compared the IRF PPS to the previous Tax Equity and Fiscal Responsibility Act (TEFRA) retrospective cost-based system. Four studies reported differential pre/post results for Medicare and non-Medicare beneficiaries. One study assessed the impact of each Balanced Budget Act PPS intervention, including the IRF PPS, on utilization of IRF care and of other types of post-acute care.

Overview of Design of Relevant Studies

Most studies (n=8) specifically studying the Medicare IRF PPS assessed changes in patient outcomes (all eight studies), IRF utilization (all eight studies), or Medicare IRF spending or costs (three studies) before and after IRF PPS implementation. One additional study compared IRF financial outcomes before and after the PPS.[45] Of the eight studies focusing on patient-level

effects, two considered stroke patients only,[43,44] one considered spinal injury patients only,[47] and one specifically analyzed the impact of IRF PPS on speech and language services.[42] One study considering a range of cost, length of stay, and clinical quality measures was rated "good" by reviewers.[49] This study included a hospital-level choice model and employed a sophisticated (instrumental variables) identification strategy to measure the impact of the IRF PPS free from the effect of any confounders. Of the other eight studies, five were rated "fair" and three were rated "poor" by reviewers. The poor studies generally reported only univariate analyses without considering potential confounders (all three), and/or lacked generalizability due to the small number of IRFs studied (two of the three). Reviewed studies provided limited information on the long-term impact of the IRF PPS: Six studies used "post" data from 2003 or earlier, one used 2004 data, and two used 2006 data (compared to the PPS implementation date of January 2002).

Effects on Health Care Spending and Quality

Effect on Health Care Spending and Provider Costs

Three studies assessed the impact of the IRF PPS on Medicare spending or resource use by IRFs. Overall, these studies suggested the IRF PPS slowed but did not reverse Medicare IRF spending growth. One good study concluded that the elimination of marginal reimbursement (i.e., payment for additional ancillary or other services) under PPS led to a 7-11 percent reduction in provider costs per IRF patient ($p<0.01$).[49] This reduction was offset by an increase in average reimbursement per IRF patient over the PPS implementation period: The net change was a 5-7 percent increase in provider costs per IRF patient. The key insight from this study is that provider costs did not increase proportionally with increases in reimbursement. Instead, the study found each one percent increase in reimbursement resulted in a 0.3 percent increase in provider expenditure on patients, implying IRF patients received proportionally less care per reimbursement dollar paid to IRFs.[49] A second study (rated fair) found a larger than expected decline in patients assigned to "high resource use" cases after controlling for CMG groups and other observables suggesting IRFs admitted fewer relatively high cost patients within CMG groups post-PPS.[46] Finally, a poor study found Medicare spending per discharge increased post-PPS but at a slower rate for IRFs transitioning to PPS in 2002 (2.6 percent) compared to IRFs with blended PPS/TEFRA reimbursement in 2002 (12.8 percent) without controlling for observable differences between IRFs, suggesting PPS slowed the rate of IRF spending growth (difference $p<0.01$).[45] The same study reported that the operating costs per discharge declined for IRFs transitioning to PPS in 2002 (-5.8%) compared to IRFs with blended PPS/TERFA reimbursement in 2002 (0.4% increase; difference $p<0.01$).

Effect on Health Care Utilization

Many studies assessed the impact of the IRF PPS on average length of stay. These studies consistently attributed a decrease in average length of stay to the IRF PPS. Five studies (one poor, three fair, one good) reported reduced length of stay with effects ranging from three to 11 percent after adjusting for covariates.[41,44,46,47,49] Another study, rated poor, found that the post-PPS decrease in average length of stay was smaller for IRFs transitioning to PPS (an eight percent decrease from 16.7 to 15.4 days) compared to IRFs with blended PPS/TEFRA reimbursement in 2002 (a 14 percent decrease from 16.2 to 13.9 days) without controlling for observable differences between IRFs.[45] A fair study focused on language-related services and reported a 25 percent reduction (from 23 days pre-PPS to 17 days post-PPS) in language-related length of stay post-PPS without controlling for potential confounders. This dramatic reduction in

length of stay was offset by an increase in sessions per week: For example, the proportion of language rehabilitation patients receiving five or more sessions per week increased from 11 percent pre-PPS to 77 percent post-PPS (difference $p<0.001$).[42] One fair study of three IRFs found no aggregate change in length of stay post-PPS, without adjusting for covariates.[43]

A previously mentioned fair study assessed the impact of each PPS introduced in the 1997 Balanced Budget Act on substitution between IRF, SNF, home health, or no Medicare post-acute care after controlling for patient and facility characteristics.[22] Substitution between provider types is an important outcome as it affects Medicare's overall expenditure on post-acute care. This study found the IRF PPS was not immediately associated with an increase in the probability of IRF utilization for hip fracture, stroke, or joint replacement patients, but was associated with a decrease in the probability of receiving no Medicare post-acute care for all three patient groups, a decrease in the probability of receiving home health care, and an increase in the probability of receiving SNF care (all $p<0.05$). The IRF PPS was also, over time, associated with a higher probability of IRF use and a lower probability of SNF use for hip fracture patients (both $p<0.05$).[22]

Effect on Health Care Quality

Several studies measured changes in functional improvement (using the FIM, or Functional Independence Measure) and other clinical quality measures. These studies found that the effects of the IRF PPS on quality were generally small in magnitude and mixed, with some measures improving post-PPS and some declining post-PPS.

The difference in FIM scores between IRF admission and discharge ("FIM score improvement") was the most commonly used quality measure in studies of the IRF PPS. Two studies (one fair, one good) reported no or minimal change in FIM scores post-PPS.[47,49] Four studies reported a decrease in FIM score improvement post-PPS. The magnitude of the effect ranged from a 15 percent decline in FIM improvement for severe CMGs ($p=0.049$) and a 10 percent decline in FIM improvement for all CMGs ($p=0.034$),[43] eight percent ($p<0.05$) in a fair study of motor FIM at three IRFs, [48] and 21 percent ($p<0.001$) in an unadjusted estimate in a single IRF in a study rated poor.[44] In contrast, FIM improvement increased by 35 percent (unadjusted) post-PPS in a study of mild CMGs in three IRFs, and by 51 percent in a poor-rated study of cognitive FIM only in four IRFs.[48]

One additional fair study used the condition-specific Spoken Language Comprehension functional communication measures and found that, while more patients improved on this utility post-PPS (unadjusted estimate of 80 percent versus 67 percent, $p=0.004$), fewer patients achieved multiple levels of functional improvement post-PPS ($p<0.001$).[42] Treatment-related progress in communication and swallowing did not differ pre/post-PPS.

Two studies assessed discharge outcomes. The first (rated poor) found discharge to the community was less likely post-PPS at a single IRF ($p<0.001$).[44] The second (rated fair) reported no significant change in discharge to the community post-PPS.[43]

Two studies assessed mortality outcomes, with the first (rated good) reporting no significant impact of PPS on 60-day mortality among patients discharged to the community post-PPS[49] and the second (rated fair) reporting a slight (0.5 percent) decrease in predicted 150-day mortality post-PPS ($p<0.001$).[46]

Finally, one poor study assessed patient satisfaction and found patient-reported satisfaction increased slightly (from 60.3 percent to 63.4 percent, $p<0.01$) post-PPS at four affiliated IRFs.[48]

Other Effects

Patient health status. One fair study noted the shifting of patients from more severe CMGs to less severe CMGs, at least for occupational and physical therapy services. This study reported a 20 percent decrease in patients in severe CMGs and a 20 percent increase in patients in moderate CMGs without controlling for potential covariates.[43]

IRF operations. One poor study specifically evaluated the effect of the IRF PPS on IRFs rather than patients. This study found that IRFs transitioning to PPS in 2002 experienced larger increases in operating margin and total profit margin (12.3 percent and 12.6 percent, respectively) compared to IRFs with blended PPS/TEFRA reimbursement in 2002 (6.5 percent and 4.7 percent, respectively) without controlling for observable differences between IRFs.[45]

Spillover effects for non-Medicare beneficiaries. Several studies compared the impact of the IRF PPS on Medicare beneficiaries and patients with other payers, e.g., Medicaid or simply all non-Medicare patients aggregated together. In general, differences between these patient populations make comparisons across payers untenable. The addition of Medicare per-beneficiary, per-admission hospital care caps introduces an additional complication. Still, some studies reported interesting "spillover" outcomes of the IRF PPS on non-Medicare patients. One fair study found length of stay for non-Medicare patients decreased by an additional 1.3 days a year post-PPS ($p=0.031$) after controlling for an existing downward trend in length of stay.[47]

Dobrez et al. also report differential results for Medicare and non-Medicare beneficiaries (study rated fair). These authors found the decline in average length of stay post-PPS was similar for Medicare and non-Medicare patients, although Medicare patients had lower discharge motor function and cognitive FIM scores ($p<0.05$) and were less likely to be discharged to the community post-PPS ($p<0.01$) compared to no significant change for non-Medicare patients on both of these outcomes.[41] These differential results are taken from separate regressions on the Medicare and non-Medicare populations with dissimilar sample sizes and underlying characteristics.

Differential Effects by Key Design Feature

None reported.

Differential Effects by Key Contextual Factor

Patient characteristics. Several studies reported differential effects of bundled payment by patient characteristics. The reviewed studies often presented separate subgroup analyses without testing for statistically significant differences in outcomes across groups.

In one fair study comparing predicted to observed post-PPS average length of stay and spending per case between patients with different health conditions, post-PPS average length of stay was lower for hip fracture patients (12 percent below predicted average length of stay) than for lower extremity joint replacement or stroke patients (about 11 percent and 9.5 percent below predicted average length of stay, respectively).[46] A post-PPS reduction in spending per case was larger for hip fracture patients (about 6 percent below predicted spending) than for joint replacement or stroke patients (about 4 percent and 5.5 percent below predicted spending, respectively). While individual results were significant with $p<0.01$ except for the joint replacement spending result, the study does not report whether the comparisons across groups are statistically significant.

Another fair study reported differential outcomes for patient condition-payer categories and found the IRF PPS was associated with significantly longer length of stay for only Medicare incomplete tetraplegia patients ($p<0.05$), and not for incomplete paraplegia, complete paraplegia, or incomplete tetraplegia.[47]

In another fair study limited to three IRFs, FIM score improvement declined 15 percent post-PPS for severe CMGs (from 33.3 to 28.2, $p=0.049$) but dramatically increased for mild CMGs (41 percent, from 14.0 to 19.8, $p=0.015$).[43]

Medicare Home Health Prospective Payment System

Description of the Payment Model

Implementation

The Medicare Home Health (HH) Prospective Payment System (PPS) replaced a cost-based payment system on October 1, 2000. The HH PPS was one of several new Medicare post-acute care payment systems introduced in the 1997 Balanced Budget Act. Between the 1997 announcement and 2000 implementation of the HH PPS, the Balanced Budget Act outlined an Interim Payment System which began in October 1997 and imposed additional controls on the previous cost-based reimbursement system, including controls on per-visit costs and per-patient caps. A revised Interim Payment System began in October 1998 and relaxed but did not eliminate per-visit and per-patient caps. Medicare home health spending declined from $18.3 billion in 1997 to $9.5 billion in 1999 before the HH PPS began in October 2000.

Payment Method

The HH PPS bundled all skilled nursing care, physical, occupational, and speech therapy, medical social work, and home health aide services received at home during a 60-day episode into a single payment for each of 153 Home Health Resource Groups (HHRGs). No beneficiary cost sharing was required. HH PPS rates were updated annually based on a home health market basket index. Rates were also adjusted for geographic variation in labor and non-labor input prices. The HH PPS did not impose a cap on the number of 60-day episodes a single beneficiary can use.

The HHRG system tied payment amount to patient clinical characteristics, functional score, and service utilization using 153 separate codes. The HH PPS excluded patients with fewer than five stays in a 60-day episode (these visits are reimbursed at a per-visit rate) and included a high-cost outlier payment. Home Health Agencies (HHAs) received half of the reimbursement rate when the Medicare fiscal intermediary received the initial claim, and the balance at the end of the 60-day episode.

Summary of Findings

Comparison Payment Methods

All reviewed studies (n=9) compared the HH PPS to previous retrospective cost-based systems (including the Interim Payment System and revised Interim Payment System). One study assessed the impact of each Balanced Budget Act PPS intervention, including the HH PPS, on utilization of home health care and other types of post-acute care.

Overview of Design of Relevant Studies

Most reviewed studies (n=6) were retrospective observational studies tracking pre and post patient cohorts. Three additional studies were retrospective observational studies tracking home health agencies pre/post PPS implementation. Only one study considered a robust set of controls for potential confounders (FitzGerald et al 2006). The same study also focused specifically on Interim Payment System/PPS differences. Other papers examined changes attributed to both the Interim Payment System and PPS (and sometimes the revised Interim Payment System) over the initial cost-based system. Reviewed studies provided limited information on the long-term impact of the HH PPS: Five studies used "post" data from 2001, three from 2002, and only one from 2003 (compared to the PPS implementation date of October 2000). Reviewers ranked three of the six patient-level studies as "poor," primarily because they were descriptive, pre/post studies with little or no mention or assessment of potential confounders. Two of the three home health agency-level studies were ranked "poor" for essentially the same reasons.

One additional study rated fair evaluated the Medicare National Home Health Prospective Payment Demonstration.[13] The demonstration enrolled 48 treatment HHAs and 43 control HHAs in five states (CA, FL, IL, MA, and TX). All Medicare patients at treatment HHAs were transitioned to a 120-day home health episode-based prospective payment system. The bundled payment included aide services, skilled nursing services, physical and occupational therapy, medical social services, and speech therapy. Reimbursement rates were case-mix adjusted for each HHA based on patient preadmission characteristics and the hospital care history. The demonstration included outlier payments and special treatment of "phase-in" and "phase-out" visits at the beginning and end of the demonstration. The demonstration included significant loss-sharing between HCFA and participating HHAs (between 97 and 99 percent of losses covered by HCFA). Control HHAs were reimbursed actual costs up to 112 percent of the average case-mix adjusted costs across all agencies in the same geographic area.

Effects on Health Care Spending and Quality

Effect on Health Care Spending and Provider Costs

One poor study evaluated the effect of the HH PPS on Medicare spending and suggested home health spending increased at the same time the HH PPS was implemented. The study found Medicare mean annual payments per home health user increased in aggregate 11 percent post-PPS with wide variation across patient diagnoses, from a 41 percent increase in mean payments per users with orthopedic diagnoses to an 18 percent decrease for those with diabetes diagnoses (test statistics or p-values not reported for pre/post comparisons).[57] The same study reported spending per home health visit (rather than per episode) increased by 38 percent in the first year of PPS after adjusting for inflation and home health discipline. Beneficiaries received fewer total visits (25 percent) but more skilled (10 percent) visits post-PPS, suggesting growth in per visit spending is driven by patients shifted to HHRGs with higher reimbursement rates. No studies evaluated the impact of the HH PPS on the cost of providing an episode of home health care.

The National Home Health Prospective Payment Demonstration evaluation found the average Medicare spending on participating HHAs was 20 percent less than the average Medicare spending on control HHAs.[13] The reduction in Medicare spending was primarily due to lower spending after the 120-day episode cutoff. Participating HHAs earned larger profits over time, from no profit in year one to 2.6 percent of Medicare revenues in year two to 7.8 percent in year three. Reductions in HHA costs per episode were larger (approximately 14 percent, $p<0.01$)

but were offset by higher costs per visit (approximately 14 and 10 percent increases in costs per skilled nursing visit and per home health aide visit, respectively (both $p<0.01$). While profits as a percent of Medicare revenues increased over time, total HHA Medicare revenues declined by 20 percent on average (from $4.4 million, $p<0.01$).

Effect on Health Care Utilization

Studies assessing the impact of the HH PPS on utilization generally found a negative and significant effect of PPS on the number of visits per episode. Four studies (three fair, one poor) reported reductions of between 10 and 25 percent in aggregate visits per episode depending on patient diagnosis.[53,54,57,58] A fifth study (rated poor) decomposed the aggregate reduction in visits by visit type and reported a larger decline in aide visits per user (rather than per episode; 34 percent) than for nurse visits per user (23 percent; test statistic or p-value not reported).[51] One fair study reported an 8 percent increase in therapy visits per episode contrary to the overall consensus on a decline in all-type visits, perhaps because the number of therapy visits is one criterion used to assign patients to HHRGs.[58] Studies (two fair, one poor) assessing the probability of any home health utilization found no[54] or small[55,57] declines over the HH PPS implementation period.

A previously mentioned study assessed the impact of each PPS introduced in the 1997 Balanced Budget Act on substitution between IRF, SNF, home health, or no Medicare post-acute care after controlling for patient and facility characteristics.[22] Substitution between provider types is an important outcome as it affects Medicare's overall expenditure on post-acute care. This study found the HH PPS was immediately associated with a decrease in the probability of receiving home health care for hip fracture, stroke, and joint replacement patients (between 0.5 percent and 1.5 percent, all $p<0.05$), an increase in the probability of receiving no Medicare post-acute care for all three patient groups (between 0.2 percent and 0.8 percent, all $p<0.05$), and an increase in the probability of receiving SNF care for stroke and joint replacement patients (1.0 percent and 1.1 percent, respectively, both $p<0.05$).

The National Home Health Prospective Payment Demonstration evaluation found participating HHAs provided 17 percent fewer visits than control HHAs (37 versus 45 visits on average).[13] Participating HHAs provided 33 percent fewer visits in the eight months after an episode (20 versus 30 visits) and 24 percent fewer visits over a one-year period starting at the beginning of an episode (57 versus 75 episodes). Participating HHAs had significantly shorter episode length.

Effect on Health Care Quality

Only two studies (rated fair) examined the impact of the HH PPS on quality. Effects on quality measures were generally small and inconsistent, with some improving post-PPS and some declining post-PPS. One study noted most stabilization measures (i.e., outcome measures capturing the fraction of patients whose conditions do not decline while receiving home health services) improved.[58] Another study based on responses to a small (n=68) survey suggested the HH PPS contributed to an increase in hospital readmissions.[56]

The National Home Health Prospective Payment Demonstration evaluation found quality measures differed slightly between participating and control HHAs, with about as many measures improving in participating HHAs as in control HHAs.[13] Twelve improvement in clinical symptom measures, three emergency care measures, two improvements in activities of daily living measures, and two other measures were significantly higher for participating HHAs, and three stabilization in activities of daily living measures, two improvement in instrumental

activities of daily living measures, three stabilization in instrumental activities of daily living measures, three patient satisfaction measures, and two other measures were significantly higher for control HHAs.

Other Effects

Patient health status. One study noted a shift towards higher-reimbursement HHRGs post-PPS. It is unclear if this was caused by changes in patient characteristics or upcoding by providers.[58]

Implementation challenges. Two studies based on survey data collected from administrators in rural home health agencies provided insight into HH PPS implementation challenges. These studies suggested the PPS led to increased staffing, changes in staffing activities, demands on existing staff, and job-related stress driven by the administrative burden imposed by PPS (study rated poor),[56] and that 40 percent of home health agencies reported financial vulnerability and 24 percent reported financial uncertainties post-PPS, but more home health agencies reported their financial situation improved rather than worsened from Interim Payment System to PPS (64 percent versus 22 percent, test statistic or p-value not reported; study rated fair).[55]

Differential Effects by Key Design Feature

None reported.

Differential Effects by Key Contextual Factor

Provider profit status. One fair study reporting reductions in visits per episode[54] found larger (approximately two times as large, $p<0.0001$) declines for for-profit home health agencies (for hip fracture and elective joint replacement patients).

Patient characteristics. The same study found larger declines in visits per episode for dual eligibles (for elective joint replacement patients only) and for women (for elective joint replacement patients only). This study and another fair study by the same lead author[53] found slight differences in the impact of bundled payment across various patient diagnoses. Briefly, hip fracture patients experienced a slightly larger post-PPS decline in the probability of receiving home health care (five percent) than elective joint replacement patients (two percent) after adjusting for patient, institutional, and regional covariates. However, hip fracture home health users experienced a larger 16 percent decline in mean home health visits during a 120-day episode compared to a 10 percent decline for elective joint replacement surgery patients (statistical significance not reported for pre/post differences). These authors do not report the net implications on overall Medicare home health spending.[53,54]

The impact of bundled payment on probability of home health use and the number of visits also varied by CMS regional office geography (study rated fair).[53] The pre-PPS probability of using home health ranged from 31 percent for hip fracture patients in the Kansas City region to 70 percent for elective joint replacement patients in the Boston region. The impact of bundled payment on the probability of utilization ranged from zero (Kansas City and Chicago joint replacement patients and Boston hip fracture patients) to 11 percent for Denver hip fracture patients. Similarly, the pre-PPS number of visits per 120-day episode ranged from 10.1 for Seattle region elective joint replacement patients to 44.4 for Dallas region hip fracture patients, and impact of bundled payment on the mean number of visits ranged from a decline of 0.5 percent for hip fracture patients in the Seattle region to a decline of 24 percent for hip fracture

patients in the Atlanta region.[53] The authors do not posit explanations for these differences. Most individual regional outcomes differed from national outcomes with p<0.0001.

One fair study reported the impact of the HH PPS on individual quality measures for different levels of patient baseline severity (specific measures include improvement in transferring, stabilization in transferring, stabilization in housekeeping, improvement in dyspnea, improvement in urinary incontinence, and improvement in confusion frequency).[58] While results in the stratified analyses were generally similar to the pooled analysis noted above, there were some differential effects, e.g., the measure "stabilization in transferring" was likely to worsen post-PPS for the least dependent patients (odds ratio 0.883, p=0.002) while more dependent patients were more likely to improve post-PPS (odds ratio = 1.631, p<0.001). The result for more dependent patients drove the pooled result of an improvement on this measure post-PPS (odds ratio 1.134, p<0.001). For improvement in dyspnea, the least severe patients were likely to worsen post-PPS (odds ratio =1.100, p=.001) while the expected impact of PPS on more severe patients was not statistically significant. The authors do not suggest a rationale for these results. Differential effects of bundled payment interventions on quality measures may suggest health care providers (in this case home health agencies) alter services provided or standards of care for some patient subgroups as a response to bundled payment which leads to differential change in quality measures.

One poor study reported the mean number of home health visits and mean payments by patient diagnosis in 2000 and 2001 (the PPS began in October 2000, test statistics or p-values not reported for pre/post comparisons). [57] Decreases in visits were similar across diagnoses ranging from a 19 percent decrease in orthopedic diagnoses to a 26 percent decrease for diabetes diagnoses. Payments increased in real terms for some diagnosis categories (by 41 percent for orthopedic diagnoses and 21 percent for neurological diagnoses) and decreased for others (by 18 percent for diabetes diagnoses and 7 percent for burn or trauma diagnoses). These analyses did not control for potential covariates over time or across patients.

Medicare Long-Term Acute-Care Hospital Prospective Payment System

Description of the Payment Model

Implementation

The Medicare Long-term Acute Care Hospital (LTACH) Prospective Payment System (PPS) replaced the TEFRA cost-based payment system in October 2002. CMS defined LTACHs as acute care hospitals with average lengths of stay greater than 25 days. Medicare coverage of hospital stays (including post-acute care hospital stays in LTACHs and IRFs) was limited to 90 days per illness. The LTACH PPS was one of several new Medicare post-acute care payment systems introduced in the 1997 Balanced Budget Act and was designed to be budget neutral.

Individual LTACHs could choose to shift to the new PPS in fiscal year 2003 or to adopt a five-year phase-in program blending TEFRA cost-based reimbursement with the new PPS rates. Several restrictions on self-referral/transfer were implemented after the initial implementation of the LTACH PPS. The "25 percent rule" was phased in between 2006 and 2008 and limited the transfer of patients from an acute care hospital to an LTACH located in the same hospital. The 2007 Medicare, Medicaid, and SCHIP Extension Act of 2007 introduced a three-year moratorium or new or expanded LTACHs.

Payment Method

The LTACH PPS bundled the cost of care received in the LTACH setting, including operating and capital costs, into a single payment for each of 318 "Medicare severity long-term care DRGs." While payment rates were not systematically updated, CMS has made changes over time, and the labor component of each DRG payment (76 percent of the total DRG rate) is adjusted for market area wages and cost of living adjustment for Hawaii and Alaska. Medicare beneficiaries admitted to LTACHs are subject to cost sharing unless they are transferred from an acute care hospital.

The Medicare severity long-term care DRG system tied payment amount to age, sex, discharge status (from acute care hospital), principal and secondary diagnoses, and procedures performed. The LTACH PPS included separate payments for high-cost outliers, short-stay outliers, and "interrupted-stay" patients transferred to another acute-care setting or readmitted to an inpatient hospital.

Summary of Findings

Comparison Payment Methods

The one reviewed study in this category compared LTACH staffing post-PPS to staffing under the pre-PPS cost-based payment system.[59]

Overview of Design of Relevant Studies

The one reviewed study in this category assessed the impact of Medicare's LTACH PPS on facility-level staffing intensity.[59] This study included all LTACHs operating continuously from 2001 to 2004 (n=212). Reviewers rated this study as "fair."

Effects on Health Care Spending and Quality

Effect on Health Care Spending and Provider Costs

The one reviewed study in this category reported LTACHs increased staffing under PPS (by about one FTE per 1,000 inpatient days, or about a 12.5 percent increase from 2001 to 2004) compared to staffing under the previous cost-based payment system (test statistic or p-value not reported for pre/post comparison). While this result is contrary to the author's hypotheses, it might be explained by the self-selection of LTACHs into 100 percent PPS reimbursement or the five year PPS phase-in program in FY 2003. It may also be explained by the need for additional administrative staffing post-PPS.

Effect on Health Care Utilization

None reported.

Effect on Health Care Quality

None reported.

Differential Effects by Key Design Feature

None reported.

Differential Effects by Key Contextual Factor

None reported.

Department of Veterans Affairs Resource Allocation Methodology

Description of the Payment Model

Implementation

The Resource Allocation Methodology (RAM) was implemented by the United States Department of Veterans Affairs (VA) in 1985 as the system for financing hospital care within the VA health system. RAM replaced a system of global budgeting at the hospital level that was based on historical utilization and costs. The RAM was utilized for three years, and then replaced in 1988 by a system of case-mix-adjusted capitation.

RAM differed from other prospective payment systems in several ways. First, the VA operated under global budgeting at the system level, and increases in workload did not necessarily result in an increase in total VA funding. An increase in the total number of cases treated resulted in a decline in the payment per case with RAM. Second, the VA's budgetary process imposed a 2-year delay between changes in a hospital's volume and case-mix and the resulting changes in funding. This lag reduced the tie between efficiency and financial rewards. Third, to prevent unreasonable shifts in funds among hospitals and regions of the country, the VA capped the annual change in a hospital's budget. No hospital could gain or lose more than three percent of its previous year's budget.[60]

Payment Method

Under RAM, the unit of payment was the hospital admission. Institutions were paid a single prospective bundled payment, the level of which was based on the VA system-wide global budget and the total number of cases treated. Patients were assigned to diagnostic groups based on clinical characteristics that determined the actual level of payment. There was little additional information provided in the reviewed study about how payments were distributed, or whether quality measurement was incorporated into the RAM payment system.[60]

Summary of Findings

Comparison Payment Methods

The RAM was introduced by the VA to replace a global budgeting system in 1985. RAM was replaced by case-mix adjusted capitation in 1998. A single retrospective, observational study compared RAM to both of these alternate payment systems.[60]

Overview of Design of Relevant Studies

The reviewed study utilized data from all 172 VA hospitals, during a period spanning federal fiscal year 1982 through 1990. A multivariate analysis was performed using data for all discharges over that period among 22 medical and surgical diagnostic groups. These were selected based on volume, collective representation of conditions, inclusion of both discretionary and non-discretionary admissions, and diagnostic groups unaffected by technologic innovations.[60] Reviewers rated the quality of this study as fair.

Effects on Health Care Spending and Quality

Effect on Health Care Spending and Provider Costs

None reported.

Effect on Health Care Utilization

While length of stay generally declined over the entire study period, these declines were steepest during the RAM years for 17 of 22 diagnostic groups. Relative to the preceding and subsequent time periods, annual declines in length of stay associated with RAM were less than five percentage points greater for medical diagnosis groups (treatment of chronic disease such as diabetes), four to 6.5 percentage point greater decline for surgical diagnosis groups, and larger for psychiatric patients (nine percent per year according to descriptive analyses). Similar effects were found on inpatient days per patient. The study found negligible associations between RAM and the number of discharges per patient, with slight increases in the growth rate in discharges under RAM for most diagnosis groups.[60]

Effect on Health Care Quality

None reported.

Differential Effects by Key Design Feature

None reported.

Differential Effects by Key Contextual Factor

Reductions in length of stay and total inpatient days varied based on patient diagnosis. As noted above, RAM reduced length of stay relative to comparison payment methods for 17 of 22 diagnoses examined, and the most significant changes were seen among psychiatric diagnoses.

Maine Medicaid Nursing Home Prospective Payment

Description of the Payment Model

Implementation

The Maine Medicaid Agency implemented a PPS for nursing home care in July, 1982. The Medicaid Agency accounted for 80 percent of nursing home payment days and nursing home revenue in Maine. The nursing home market in Maine was characterized by a high number of intermediate care beds, relatively high nursing home bed supply, and high baseline reimbursement rates for nursing home care.[61]

Payment Method

Under PPS, each facility in the state was assigned a prospectively determined per diem rate for nursing home care based on its historical costs. The nursing home PPS replaced cost-based reimbursement in the Maine Medicaid program. The single reviewed study did not provide additional details about the payment methodology.[61]

Summary of Findings

Comparison Payment Methods

The nursing home prospective per diem payment replaced cost-based reimbursement in the Maine Medicaid program.

Overview of Design of Relevant Studies

A single retrospective observational study examined admissions in all Maine nursing home between July, 1979 and June, 1985, bracketing the implementation of nursing home PPS in July, 1982.[61] Reviewers rated the quality of this study as fair.

Effects on Health Care Spending and Quality

Effect on Health Care Spending and Provider Costs

Multivariate analysis indicated that total variable provider costs decreased over the three years following PPS implementation, by between $3.31 to $3.69 per patient day, off of a base of $33.17 in the final year before PPS. Patient care costs decreased in the range of $1.60 to $1.94 per patient day by the end of the study (off of a base of $17.61), and room and board costs decreased between $2.41 and $2.55 per patient day over in the initial three years after PPS (off of a base of $12.21). Results indicated a slight decrease in administrative costs after three years, although these costs initially appeared to increase (p-values on the prospective payment indicator variable positive and significant at $p<0.01$ for all results described above).[61]

Effect on Health Care Utilization

The analysis indicated no significant trend over the six-year period in the distribution of costs among patient care, room and board, and administrative costs as a percentage of total variable costs resulting from the change in payment system.[61]

Effect on Health Care Quality

None reported.

Other Effects

Results weakly indicated a relationship between PPS implementation and a decreasing Medicaid market share for nursing home care.[61]

Differential Effects by Key Design Feature

None reported.

Differential Effects by Key Contextual Factor

None reported.

New Hampshire Medicaid Inpatient Prospective Payment

Description of the Payment Model

Implementation

The New Hampshire Medicaid Agency replaced cost-based reimbursement with a PPS for inpatient care in January, 1989.

Payment Method

The New Hampshire payment system that was examined in this study was actually a mixed system that paid hospitals partially prospectively, and partially retrospectively based on costs. For psychiatric DRGs in particular, the Medicaid agency distinguished between three types of hospitals, and based reimbursement rates in part on hospital type. The three hospital types were known as Designated Receiving Facilities (DRFs), Distinct Part Unit hospitals (DPUs) and "scatterbed" hospitals. There were a total of 28 hospitals in New Hampshire at the time of the study: 3 DRFs, 8 DPUs, and 17 scatterbed facilities. New Hampshire also operated a state hospital, financed outside of the Medicaid reimbursement system, which accounted for a large share of psychiatric discharges prior to the payment change. The payment rates under PPS were based on historical costs, and were initially intended to be budget neutral.[62]

Summary of Findings

Comparison Payment Methods

PPS was compared with the previous system of cost-based reimbursement.[62]

Overview of Design of Relevant Studies

A single retrospective, observational study examined all psychiatric admissions to New Hampshire hospitals between July 1, 1987 and June 30, 1992. Patients over 65 years of age or under 21 years of age were excluded from the analysis. A number of control variables were included for multivariate analyses: gender, age group (four categories), race (white/nonwhite), a community proxy for the patient's average income, provider variables, and time dependent variables. Reviewers rated the quality of this study as fair.[62]

Effects on Health Care Spending and Quality

Effect on Health Care Spending and Provider Costs

None reported.

Effect on Health Care Utilization

Multivariate analysis indicated that overall, a 14 percent reduction in length of stay (4.5 days per episode) among the study population could be attributable to payment system reform. The analysis utilized a complex theoretical model to separate this result into component effects, and determined that 1.8 days of the reduction resulted from "moral hazard effects," 3.0 days were attributable to "practice style effects," and "selection effects" added 0.3 days back to the total length of stay.[62]

Effect on Health Care Quality

None reported.

Differential Effects by Key Design Feature

None reported.

Differential Effects by Key Contextual Factor

Changes in length of stay, and the portions of those changes that can be attributed to different effects (moral hazard, selection, and practice style) all varied according to hospital type. In addition, length of stay increased for short-stay patients, and decreased for long-stay patients. Virtually all of the total change in average length of stay was accounted for by changes in treatment for the longest stay patients.[62]

U.S. Private Sector Single-Setting Bundled Payment Systems

We identified two studies of one bundled payment system implemented in a single private-sector health care setting in the United States.

Case Rate for Managed Behavioral Health Care

Description of the Payment Model

Implementation

A single Managed Behavioral Healthcare Organization (MBHO) implemented a "case rate," or bundled payment, for mental health services provided by 26 independent practice associations (IPAs) and group practice behavioral health providers. The payment system was phased in among participating providers between July, 1995 and January 1996, and was accompanied by assistance from the MBHO to providers with developing utilization and quality management capabilities.[63,64]

Payment Method

The MBHO case rate involved a single payment to providers for all outpatient mental health services over a period of one year, beginning with referral of the patient for treatment by the MBHO. The case rate payment included services provided by psychiatrists, psychologists and social workers, but excluded substance abuse treatment and inpatient services, which were paid separately. The payment rate was set based on historical utilization by all enrollees of the MBHO, and was not adjusted based on any individual patient characteristics.[63,64]

Summary of Findings

Comparison Payment Methods

In both studies, the case-rate system was compared to fee-for-service payment, which was still used by the MBHO to reimburse solo practitioners and small group practices.[63,64]

Overview of Design of Relevant Studies

The case rate for managed behavioral health care was examined in two observational retrospective studies of the same program by a single author. The studies tracked mental health

providers over a period of 28 months (updated to 30 months in the second study) following the implementation of the case rate payment. The studies examined the impact of the new payment method on utilization of services, measured as the average number of encounters per episode of care. For the purposes of the studies, an episode of care was defined as a series of outpatient mental health visits with no more than eight weeks between any two of them. It is important to note that while this definition of episode was used for the analysis, it was not used within the payment system, where the episode (or "case") was defined as a one-year period following initial referral for treatment by the MBHO.[63,64] The first study reported that data was analyzed for a total of 21,673 individuals, including 10,488 who received care from case rate providers.[63] The second study reported that it was based on analysis of data from 49,463 episodes of care.[64] Both studies employed multivariate analyses to estimate the impact of case rate payment, and controlled for patient and provider characteristics. Reviewers rated the quality of both studies as fair.[63,64]

Effects on Health Care Spending and Quality

Effect on Health Care Spending and Provider Costs

One of the two studies reported that patients under case rate payment were more likely to receive medication, be referred for self-help, or be referred to a community mental health center. This finding indicated that other treatment modalities were being substituted for therapy, which may or may not be appropriate, depending on the circumstances.[63]

Effect on Health Care Utilization

Both studies examined the impact of case rate payment on the number of mental health visits per episode, and found reductions of 20 to 25 percent ($p<.05$) depending on the model specifications.[63,64]

Effect on Health Care Quality

One study examined the probability that an individual treatment episode would consist of a single visit. The author hypothesized that a high proportion of single visit episodes would offer evidence of patient selection by providers, as they may attempt to divert high-cost patients after the first visit. However, the study found no difference in the proportion of single-visit episodes between the two payment groups.[63]

The same study examined MBHO quality assurance data to determine if there were differences between the two groups in the reported change in patients' Global Assessment of Functioning scores. No differences were detected, however the author points out that these data are reported by providers, so they may be biased.[63]

Differential Effects by Key Design Feature

None reported.

Differential Effects by Key Contextual Factor

Provider characteristics. The studies noted that some case rate providers employed more intensive utilization review procedures. Among these providers, there was an additional reduction in visits of 22.3 percent ($p<.01$). Case rate providers also generally received some of their revenue through other contracts that continued to pay on a FFS basis during the study. The studies found that the effect on visits under the case rate was mediated by the percentage of total

revenue to a provider that was paid by FFS. A case rate provider that received 50 percent of total revenue through FFS contracts was found to provide 34 percent more visits than a case rate provider who received no FFS revenue ($p<.05$). The author interpreted this as an indication that providers tend to respond to their dominant financial incentives in their treatment of all patients, and do not necessarily respond to payment changes for patients on an individual basis.[63,64]

International Bundled Payment Systems

We identified studies of seven international bundled payment systems. All of the reviewed payment systems were implemented in the predominant public insurance program in each country. Six were inpatient prospective payment systems, and the seventh was a bundled payment system for outpatient hemodialysis. We discuss the payment systems in alphabetical order by country.

Belgium Inpatient Prospective Payment System

Description of the Payment Model

Implementation

The public health insurance system in Belgium implemented an inpatient hospital PPS in 1995, replacing cost-based per diem payment. The primary source of revenue for Belgian hospitals was public insurance.[65]

Payment Method

The Belgian PPS covered hospital costs associated with an inpatient stay such as accommodation and nursing care, but excluding physician services. Hospitals received a single prospective bundled payment for each hospital admission. The payment was based on the assignment of the patient at admission to one of 604 condition groups. The single reviewed study provided little additional information about the payment methodology, including whether quality measurement is explicitly incorporated into the system.[65]

Summary of Findings

Comparison Payment Methods

The inpatient PPS was compared to the cost-based per diem payment system that preceded it in Belgium.

Overview of Design of Relevant Studies

The Belgian inpatient PPS was examined in one observational retrospective study. The study tracked hospitals over a period of eight years, spanning roughly equal periods before and after implementation, and included all inpatient stays in Belgium over that period.[65] Reviewers rated the quality of this study as fair.

Effects on Health Care Spending and Quality

Effect on Health Care Spending and Provider Costs

The study found increases in spending on physician services (0.8 percent for surgical services and 0.5 percent for other medical services) after the implementation of the PPS (both $p<0.05$).[65] The authors suggested this is due to negotiations between physicians and hospitals to distribute fees paid by the government to physicians for procedures performed in hospitals. The authors hypothesized the PPS induced hospitals to demand a larger share of these fees, which in turn induced physicians to increase the number of procedures performed to reach a target income.[65] This phenomenon highlights the importance of considering indirect or downstream effects of bundled payment on the spending or utilization of services outside the scope of the bundled payment intervention.

Effect on Health Care Utilization

The study found a decrease of 1.49 percent in hospital length of stay attributable to the intervention (after controlling for cost sharing, death and transfer outcomes, and facility fixed effects, $p<0.05$).[65]

Effect on Health Care Quality

None reported.

Differential Effects by Key Design Feature

None reported.

Differential Effects by Key Contextual Factor

Patient socioeconomic status. The study notes hospitals serving relatively few or many patients with low socioeconomic status (SES) responded to the IPPS differently in the year of the reform and afterwards. Specifically, in the year of the reform average length of stay decreased in high-SES hospitals and increased in low-SES hospitals. In later years, average length of stay decreased in low-SES hospitals and did not change in high-SES hospitals. The underlying secular decrease in average length of stay was similar in both groups. While the authors do not conjecture on the source of this difference, it is possible that high-SES hospitals responded to the bundled payment system by "cream skimming" relatively healthy patients or by shifting relatively sick patients to low-SES hospitals in the year of implementation.[65]

National Health Service (England) Payment by Results

Description of the Payment Model

Implementation

England's National Health Service (NHS) instituted "Payment by Results" (PBR) in 2003 to pay hospitals for inpatient services. The NHS is the predominant payer for hospital services in England. The Payment-by-Results (PBR) system was phased in between 2003 and 2006 as part of a larger strategy to increase NHS efficiency.[66]

Payment Method

The PBR system implemented inpatient hospital payment, but the single study reviewed provided few details about how the payment system works and does not define the specific services included in the payment bundles. The study refers to PBR as a "case-mix-based, fixed-tariff" payment system, and it appears to have operated much like other inpatient prospective payment systems. Payment rates were adjusted for individual patient clinical characteristics, through the assignment of patients to Healthcare Resource Groups (HRGs).[66]

Summary of Findings

Comparison Payment Methods

The NHS PBR system was compared to a suite of payment arrangements that preceded it, known as block contracts, sophisticated block contracts, cost and volume contracts, and cost per case contracts.

Overview of Design of Relevant Studies

The NHS PBR was examined in one observational retrospective study.[66] The study tracked hospitals over a period of four years, using statistics from the year spanning 2002-2003 through the year spanning 2005-2006. The study included 258 hospitals in England that were tracked before and after case-payment implementation, and 49 Scottish hospitals that were never subjected to case payment as additional controls. The English hospitals included two different types, known as foundation and non-foundation trusts. Foundation trusts were created in order to give high performing trusts more autonomy from central government control. They have more independence, and implemented the program more quickly, than non-foundation trusts. Foundation trusts implemented PBR for all elective and non-elective admissions in 2004/5, and non-foundation trusts implemented PBR for all elective admissions in 2005/6. The study included four separate difference-in-difference analyses based on pre-post and treatment-control comparisons:[66]

- Analysis 1: Changes in foundation trusts (treatment) were compared to non-foundation trusts (control) over the period from 2003/4 to 2004/5
- Analysis 2: Changes in foundation trusts (treatment) were compared to Scotland (control) over the period from 2003/4 to 2004/5.
- Analysis 3: Changes in non-foundation trusts (treatment) were compared to Scotland (control) over the period from 2004/5 to 2005/6.
- Analysis 4: Changes in foundation trusts (treatment) were compared to Scotland (control) over the period from 2003/4 to 2005/6, the only comparison that included two years of treatment data.

Reviewers rated the quality of this study as fair.

Effects on Health Care Spending and Quality

Effect on Health Care Spending and Provider Costs

None reported.

Effect on Health Care Utilization

In three of the four analyses (see above), length of stay fell more quickly where PBR was implemented, resulting in eight days (analysis 2), three days (analysis 3), and 18 days (analysis 4) saved per 100 admissions; in the remaining analysis (analysis 1), PBR resulted in two additional inpatient days per 100 admissions. All four comparisons showed that the proportion of elective care provided through day treatment increased more quickly where PBR was implemented, by (in order of analysis) 0.4, 0.4, 0.8 and 1.5 percentage points. Both foundation trusts and non-foundation trusts experienced a growth in volume associated with payment by results.[66]

Effect on Health Care Quality

The study examined several outcome variables, including in-hospital mortality, 30-day postsurgical mortality, and emergency readmission after treatment for hip fracture. Little evidence was found demonstrating an association between the introduction of payment by results and clinical outcomes. However, the fourth comparison did show a statistically significant reduction in in-hospital mortality over the first two years of PBR.[66]

Differential Effects by Key Design Feature

None reported.

Differential Effects by Key Contextual Factor

While the reviewed study presented separate analyses for different types of hospitals, the authors did not directly compare or test for differential effects in outcomes across hospital types.

Italy Inpatient Prospective Payment

Description of the Payment Model

Implementation

The Italian Ministry of Health implemented an inpatient prospective payment system on January 1, 1995. The Ministry of Health was the dominant payer for hospital services in Italy.[67]

Payment Method

Under the PPS, the Ministry of Health paid for all hospital costs associated with an admission, including physician costs, as a single prospective bundled payment. Payments were adjusted based on individual clinical characteristics, and varied by geographic region. The single reviewed study provided few additional details about the payment methodology.[67]

Summary of Findings

Comparison Payment Methods

The inpatient prospective payment system replaced cost-based reimbursement of hospitals in Italy.

Overview of Design of Relevant Studies

One descriptive study was reviewed which examined the impact of the inpatient PPS in Italy. It examined all cases of congestive heart failure in four hospitals selected because of perceived highly reliable diagnosis coding procedures, in the Marche region of Italy.[67] Reviewers rated the quality of this study as poor, due to the small number of sites and a lack of control for confounding variables.

Effects on Health Care Spending and Quality

Effect on Health Care Spending/Costs

The average cost per discharge declined by 14 percent following the introduction of the PPS ($p<.05$).[67]

Effect on Health Care Utilization

Average length of stay decreased from 13.6 days to 11.7 days per case, for a reduction of 13.9 percent ($p<.05$). Total discharges increased by 10.3 percent, while congestive heart failure discharges increased by 13.4 percent and grew as a proportion of all discharges by 2.8 percent. There were no significant changes in the rate of hospital readmissions after three months.[67]

Effect on Health Care Quality

None reported.

Differential Effects by Key Design Feature

None reported.

Differential Effects by Key Contextual Factor

Patient age. While reductions in length of stay and cost per case were relatively consistent across age groups, there was an increase in readmissions detected among patient 70 years of age and older of approximately 17 percent ($p<.05$). Statistically significant effects on readmissions were not detected in younger patients or in the study population as a whole.[67]

Japan Outpatient Hemodialysis Bundled Payment

Description of the Payment Model

Implementation

Japan implemented a bundled payment for outpatient dialysis services on April 1, 2006. The Japanese government plays a central role in health care cost control through fee schedules and regulation. The outpatient dialysis services bundled payment system was designed to reduce spending on these services by four percent.[68]

Payment Method

The bundled payment included outpatient hemodialysis services (including for example, recombinant human erythropoetin [rHuEPO] and intravenous iron [iron]) provided at hospitals and clinics offering outpatient dialysis services. Little other information on risk-adjustment,

distribution, or quality measurement was reported in the one reviewed study on this payment system.[68]

Summary of Findings

Comparison Payment Methods

One study examined the impact of replacing fee-for-service reimbursement with a bundled payment system for outpatient hemodialysis in Japan.

Overview of Design of Relevant Studies

One descriptive study examined this intervention, comparing prescription and dosing of rHuEPO and iron in a sample of 3,206 patients from 53 geographically representative outpatient dialysis sites. The study included a pre/post comparison of patients seen in a narrow, one-year period which spanned the bundled payment implementation date.[68] Reviewers rated the quality of this study as fair.

Effects on Health Care Spending and Quality

Effect on Health Care Spending and Provider Costs

None reported.

Effect on Health Care Utilization

The study examined the number of patients receiving rHuEPO and iron, as well as the average dosages. While the study reported no significant change in the proportion of patients that received rHuEPO, it did report an 11.8 percent decrease in average rHuEPO dosage, suggesting that providers became more judicious in their use of this drug as a result of the policy. The prescription of intravenous iron was more likely after implementation of bundling, undergoing a 9.6 percent increase ($p<0.001$), while average dosage was not affected ($p=0.15$).[68] Given that iron was relatively inexpensive compared to rHuEPO and similar drugs, providers may have been substituting iron among some patients as they reduced dosages of more expensive treatments.

Effect on Health Care Quality

No change in hemoglobin levels among dialysis patients was detected as a result of payment bundling,[68] indicating that patients' conditions did not deteriorate due to the intervention.

Differential Effects by Key Design Feature

None reported.

Differential Effects by Key Contextual Factor

Provider characteristics. The study identified differential effects by ownership and facility type, e.g., private hospitals were more likely to prescribe rHuEPO after bundled payment (by 5.2 percent, $p<0.01$, compared to no change in the aggregate sample and a negative but insignificant change in private clinics and public hospitals). Private clinics and hospitals showed a larger decline in rHuEPO dosage (12.1 percent and 13.7 percent, respectively) than public hospitals (8.8 percent), but this difference was not statistically significant. The net effect including

changes in the probability of prescription and dosage was difficult to compare across provider types.[68]

Patient severity. The study also identified differential effects of bundled payment on relatively sicker patients (i.e., patients with lower hemoglobin levels). The authors found rHuEPO dosage decreased by 13.9 percent for relatively sicker patients ($p<0.001$) but only by 7.4 percent for relatively healthier patients ($p=0.01$). The percent of relatively sicker and relatively healthier patients receiving iron increased by 6.5 percent and 11.3 percent, respectively. The authors did not report a statistic testing whether differences for either outcome were significant. While relatively sicker patients experienced a larger decline in rHuEPO dosage and a smaller increase in intravenous iron use, it is unclear whether these patients were receiving appropriate prescriptions prior to the bundled payment intervention.[68]

Netherlands Inpatient Prospective Payment

Description of the Payment Model

Implementation

An inpatient PPS was introduced in the Netherlands in 2005, and gradually replaced fee-for-service reimbursement of hospital care.[69]

Payment Method

Under the Netherlands inpatient PPS, hospital budgets were determined based on the number of Diagnosis Treatment Combinations (DTCs) they deliver. A single DTC consisted of all diagnosis and treatment related costs incurred by hospitals and clinicians over the course of an episode, from the initial consultation to the final follow-up visit. Unlike other similar systems in the United States and elsewhere, hospital budgets under PPS in the Netherlands were not open-ended. Hospitals negotiated with health insurers to determine the number of DTCs they may deliver each year. The single reviewed article that examined the Netherlands system did not provide any additional details regarding the PPS.[69]

Summary of Findings

Comparison Payment Methods

The inpatient PPS in the Netherlands was compared with the pre-existing fee-for-service reimbursement of hospital care.

Overview of Design of Relevant Studies

The Netherlands PPS was the subject of a single study employing a retrospective, observational design. The study was based on a survey of hospital Chief Executive Officers which was sent to all 96 hospitals in the Netherlands. The survey was intended to assess whether hospitals were more likely to establish care programs for patients as a step towards becoming more "process-oriented" under the PPS. The statistical analysis was oriented towards demonstrating relationships between management processes linked to payment incentives in a logic model, rather than showing an explicit link between payment bundling and the outcomes of

interest.[69] The reviewers classified the study as poor, as it relied on cross-sectional, self-reported survey data, with no adjustment for confounding variables.

Effects on Health Care Spending and Quality

Effect on Health Care Spending and Provider Costs

None reported.

Effect on Health Care Utilization

None reported.

Effect on Health Care Quality

None reported.

Other Effects

At the time of the survey, two years after the introduction of the PPS, 81 percent of hospitals reported that they undertook projects to establish care programs; 33 percent of care delivery was organized in care programs; 75.4 percent of hospitals appointed process owners for care processes; 93.5 percent of hospitals reported having clinical protocols for specific diseases; and 75 percent maintained organizational protocols for routing patients.[69]

Differential Effects by Key Design Feature

None reported.

Differential Effects by Key Contextual Factor

None reported.

Sweden Inpatient Prospective Payment System

Description of the Payment Model

Implementation and Payment Method

The Stockholm County Council implemented a PPS in 1992 to pay hospitals for inpatient admissions. Implementation coincided with a change in the authority in charge of nursing homes and long-term care. Local municipal welfare authorities took over the responsibility for about 80 percent of geriatric beds, which were previously administered by hospitals. The single reviewed study of the Swedish PPS included very few details about the methodology or parameters of the bundled payments.[70]

Summary of Findings

Comparison Payment Methods

The inpatient prospective payment system replaced fee-for-service reimbursement in Sweden.

Overview of Design of Relevant Studies

A single descriptive study examined the inpatient PPS in Sweden. The study examined patients in five Stockholm hospitals admitted for hip fracture before and after the implementation of PPS. The sample included 2,331 consecutive patients in the five hospitals, with 1,271 admitted after the initiation of the new payment method. Reviewers rated the quality of this study as poor due to its pre-post design and lack of control for confounding variables.[70]

Effects on Health Care Spending and Quality

Effect on Health Care Spending and Provider Costs

Total costs per discharge increased by 12 percent, despite a decrease in orthopedic department costs (including surgery costs). The overall cost increase was due to an increase in post-acute care utilization. Home help costs did not change.[70]

Effect on Health Care Utilization

Average orthopedic department length of stay decreased by 42 percent after implementation of PPS ($p<0.05$), from 20 to 12 days. Total inpatient hospital days post-fracture decreased but were replaced by nursing home days. Total combined hospital and nursing home days increased by eight percent ($p<.05$), from 73 to 79 days.[70]

Effect on Health Care Quality

The percentage of patients discharged from the hospital to home decreased from 56 to 43 percent following PPS implementation with a corresponding increase in the percentage discharged to an institutional setting from 36 to 54 percent. At one year post-fracture, residence at home was 68 percent before PPS and 64 percent after PPS and residence in an institution increased from 11 percent to 14 percent; these changes were not statistically significant. Mortality at one year post-fracture remained constant at 21 percent. [70]

Differential Effects by Key Design Feature

None reported.

Differential Effects by Key Contextual Factor

As noted above, total costs per discharge increased by 12 percent for all Stockholm hospitals, however a single hospital operating a dedicated hip fracture unit actually decreased total costs by 12 percent under PPS. Taking into account only hospitalizations directly related to hip fractures, bed-days and total costs increased by 18 percent and 15 percent respectively for Stockholm hospitals in general, but decreased by 23 percent and 15 percent in the hospital with a dedicated hip fracture unit.[70]

Taiwan Hospital Case Payment

Description of the Payment Model

Implementation

The Taiwan National Health Insurance Bureau implemented a PPS, referred to as "case payment," for reimbursing hospital care on October 1, 1997. The PPS was implemented two and

a half years after the introduction of National Health Insurance in Taiwan, which paid for about 95 percent of hospital services. Physicians and hospitals were generally highly integrated in Taiwan, and hospitals typically employed physicians.

Payment Method

Under the PPS, hospitals received a single prospective bundled payment for most costs related to an episode of care. The inpatient case payment included pre-defined "basic" and "optional" care elements, including tests, examinations, and medical treatments. Surgery-related examinations within a 2-week interval around a patient hospital episode were included as well. All other related outpatient care was excluded, as well as outlier costs above condition-specific thresholds. Cases were assigned to tiers based on individual patient factors, with higher rates for more complicated cases.

Summary of Findings

Comparison Payment Methods

The PPS was compared with pre-existing fee-for-service reimbursement for inpatient hospital services in Taiwan.

Overview of Design of Relevant Studies

Three studies examined the impact of the introduction of the PPS in Taiwan, including two retrospective observational studies[72,73] and one descriptive study.[71] One study examined all cases of five surgical procedures (n = 22,327) at three related teaching hospitals for one year before the change to the PPS and nearly two years following the change.[73] A second study examined all hemorrhoidectomies performed in Taiwan (n = 23,638) for a period of nine months prior to implementation and nine months following the change in payment.[72] The descriptive study looked at 199 appendectomies performed at a single hospital, half performed in the six months prior to the PPS, and the other half performed in the six months following the shift.[71] Subjects in the two large studies averaged 45 to 47 years of age, and 35 to 40 percent were women.[72,73] Subjects in the descriptive study were slightly younger, averaging 31 years of age.[71] All three studies excluded patients with high costs that were classified as outliers.[71-73] The reviewers rated the two observational studies as fair, and the descriptive study as poor due to its small sample size and inadequately controlled pre-post design.

Effects on Health Care Spending and Quality

Effect on Health Care Spending and Provider Costs

One fair study showed that inpatient claims were two percent lower in the first year and six percent lower in the second year of the PPS, compared to the final year of fee-for-service. Claims associated with x-ray imaging decreased by seven percent in the first year, and were 15 percent lower in the second year. Laboratory test claims increased by four percent in the first year of the PPS, but were four percent lower in the second year under the PPS compared to the final year under fee-for-service.[73]

The poor study found that total hospital costs were lower by 19 percent under the PPS compared to fee-for-service, including component decreases associated with room costs (35.1

percent), treatment costs (33.5 percent), pharmacy utilization (34.3 percent), examinations (25.3 percent) and anesthesia (9.2 percent) (all $p < 0.01$, except for anesthesia $p < 0.05$).[71]

Effect on Health Care Utilization

The two fair studies both found a decrease in length of stay post-PPS, with a decrease of 0.6 days per case in the first year of PPS and an additional 0.26 day decrease in the second year in one study,[73] and a decrease of 0.6 days during the nine month follow-up period in the second study.[72]

Both fair studies also found that the PPS reduced some other types of utilization but also observed increased utilization of certain types of services. Wen found a decrease of 0.15 outpatient visits per case after two years of the PPS. Pre-surgery outpatient claims were 79 percent higher after 2 years of case payment, post-surgery outpatient claims were eight percent higher after one year but 117 percent lower two years after the change from fee-for-service, and overall outpatient claims were six percent higher after the first year of case payment but 61 percent lower after two years under the new system.[73]

The second fair study found that the number of minimally required services that were delivered increased (between 2.19 and 4.24 more items, $p < 0.0001$), the number of optional service items provided was lower (by 0.32 items, $p < 0.0001$), and medication prescriptions decreased slightly (between fewer 0.58 and 0.99 items, $p < 0.0001$) per hospitalization. Descriptive statistics showed a 24 percent increase in the number of surgeries performed under the PPS.[72]

In the poor study, the PPS did not have an effect on length of stay, and mean operating time and use of general anesthesia decreased ($p<.01$).[71]

Effect on Health Care Quality

The poor study found no significant differences in frequencies of painful incision sites, clear incision wounds on the day of discharge, and the removal of stitches at the hospital ($p > 0.05$ for all comparisons).[71] The two fair studies did not examine quality outcomes.

Other Effects

One fair study showed that the number of comorbidities per case at intake increased, indicating more unhealthy patients were receiving surgery ($p<.01$).[73]

Differential Effects by Key Design Feature

None reported.

Differential Effects by Key Contextual Factor

One fair study reported average length of stay reductions by type of facility.[72] Average length of stay decreased by 0.59 days, 0.67 days, and 0.83 days at medical centers, district hospitals, and regional hospitals, respectively. The authors did not report baseline average length of stay, did not report tests for significant differences between these changes, and did not discuss the implications of these differences.

Bundled Payment Systems Including Multiple Providers/Sites of Care

The reviewed studies included three bundled payment systems that included multiple providers and sites of care in the bundle, all implemented in the United States. We first discuss two Medicare demonstrations, then one private-sector program implemented by Geisinger Health System.

Medicare Participating Heart Bypass Demonstration

Description of the Payment Model

Implementation

The Medicare Participating Heart Bypass Demonstration was intended to evaluate the feasibility and impact on spending and outcomes of a negotiated bundled payment system for coronary artery bypass graft surgery. Participating hospitals aimed to increase their market share by advertising themselves as Medicare Participating Heart Bypass Centers.

The Health Care Financing Administration (HCFA; now CMS) selected hospitals to participate in the demonstration program based on breadth of service coverage, performance on quality measures, financial incentives for patients and physicians, health information systems quality, heart bypass service volume, geographic diversity, and discount offered to Medicare for providing heart bypass services. Over 200 of the 734 hospitals invited to participate in the demonstration submitted initial applications. Of these, HCFA invited 42 to submit more extensive applications and to propose a bundled payment rate for two DRG codes (106 and 107, bypass with or without catheterization). Ten of the 27 responding hospitals were selected by HCFA as finalists, and of these four were selected to participate in the demonstration which began in 1991 (St. Joseph's Hospital in Atlanta, St. Joseph Mercy Hospital in Ann Arbor, The Ohio State Univ. Hospitals in Columbus, and University Hospital in Boston). Three additional hospitals were added to the demonstration in 1993 (St. Luke's Episcopal Hospital in Houston, Texas, St. Vincent's Hospital in Portland, Oregon, and Methodist Hospital in Indianapolis, Indiana). All but one of the demonstration hospitals were major teaching hospitals, all but one were not-for-profit (the remaining hospital was public), and the demonstration hospitals' beds accounted for seven to 28 percent of their respective markets.

While the demonstration was initially scheduled to end in June 1994, this date was pushed back to the second quarter of 1996 at the same time the three expansion hospitals joined. Participating hospitals were specifically excluded from changes to Medicare physician fee schedule rules which occurred during the demonstration. National cardiac bypass surgery trends changed dramatically during the evaluation period with a 40 percent growth in volume, 175 percent increase in post-acute care costs, and 33 percent decrease in length of stay. To control for these secular trends the demonstration hospitals were compared to nonparticipating hospitals in each market.

Payment Method

The bundle included all inpatient hospital and physician services for DRGs 106 and 107 and readmissions, including pro-rated pass-throughs for capital and medical education. Physician

services before admission and after discharge were not included beyond those included in the surgical global period.

Participating hospitals were reimbursed a single per-discharge rate negotiated between HCFA and providers for DRGs 106 and 107 (when DRG 108 was reclassified into 106 and 107 in 1992, these patients joined the demonstration). These rates were updated annually based on Medicare IPPS and physician fee schedule rules in place at the start of the demonstration. There were no separate payments for high cost or low cost outliers, although negotiation did allow for an expected outlier payment included in the global rate based on each hospital's prior experience.

Hospital discharge abstract and physician bills were submitted by the hospital to Medicare for payment. The claims for physician services that were included in the bundle were not paid by Medicare but were tracked for evaluation purposes. Patients were subject to the usual Part B deductibles plus 20 percent coinsurance which, as the negotiated rate included all bundled services, resulted in a single coinsurance amount for each hospital/DRG.

HCFA did not specify how payments should be divided between the hospitals that received the payments and the participating physicians. All demonstration hospitals provided a capitated amount to specialists (i.e., the surgeon, anesthesiologist, cardiologist, and radiologist) while reserving some funds to compensate consulting physicians on an ad hoc basis.

Quality measurement was not intrinsic to the payment method. However, quality was assessed at participating hospitals as part of the demonstration evaluation. While demonstration hospitals provided clinical data on each patient as part of the demonstration, researchers used surveys to collect analogous data from patients at comparison hospitals. Panels of clinical experts reviewed the appropriateness of bypass surgery at demonstration hospitals.

Summary of Findings

Comparison Payment Methods

For some analyses, the evaluation report for this demonstration compared participating hospitals to control hospitals over time. Control hospitals were from the same markets as the participating hospitals and were reimbursed on a per-case basis for Coronary Artery Bypass Grafts (CABGs) while physicians at control hospitals were reimbursed fee-for-service. For other analyses, demonstration hospitals alone were tracked over time.

Overview of Design of Relevant Studies

The one reviewed report in this category is the Final Report submitted to HCFA (now CMS) by Health Economics Research, Inc. in July 1998.[75] In addition to the direct evaluation of the bundled payment on spending, utilization, and quality, the demonstration included provisions for HCFA review of promotional materials and case study-based analysis of changes to the organization and practice of care. Reviewers rated the report as "fair" due to the small number of participating hospitals and the risk of bias from self-selected participants.

Effects on Health Care Spending and Quality

Effect on Health Care Spending and Provider Costs

Medicare spending on demonstration bypass patients (including spending on bundled and non-bundled services within 90 days post-discharge) decreased by 10 percent in aggregate

between May 1991 and June 1996, with 86 percent of this decrease due to savings from negotiated bundled payment rates, five percent from decreases in post-discharge care expense (which were excluded from the bundled), and nine percent from net shifts in market share towards lower-cost hospitals.[75] The hospitals' cost per bundle decreased between 18 percent and 40 percent in real terms for both DRGs at three of the original four demonstration hospitals. The fourth hospital (Ohio State University Hospital) experienced cost increases of 10 percent and 24 percent for the two DRGs (in nominal terms; cost increases were not reported in real terms).

Effect on Health Care Utilization

Length of stay declined between 0.5 and one day per year in all seven demonstration hospitals, but these changes differed between demonstration and comparison hospitals in only one hospital.[75]

Effect on Health Care Quality

The inpatient mortality rate declined at all demonstration hospitals, although this decline was significantly different than trends at comparison hospitals in only one case. Complication rates increased slightly at demonstration hospitals. Self-reported outcomes were not systematically different between patients at demonstration and comparison hospitals. Patients at demonstration hospitals reported higher levels of satisfaction with the overall skill of nurses, length of stay, and billing than patients at comparison hospitals.[75]

Other Effects

Two of the originally participating hospitals realized statistically significant gains in Medicare bypass market share while a third realized a statistically significant decline in share. All three hospitals added later in the demonstration realized statistically significant declines in Medicare bypass market share. Two of the four original demonstration hospitals realized significantly increased margins while the other two faced declines in margins (although margins remained positive for all demonstration hospitals). Feedback from demonstration hospitals suggests the administrative burden of implementing the bundled payment system was considerable and greater than anticipated. One particular challenge involved coordination and revenue sharing between hospitals and physicians.[75]

Differential Effects by Key Design Feature

None reported.

Differential Effects by Key Contextual Factor

None reported.

Medicare Cataract Surgery Alternative Payment Demonstration

Description of the Payment Model

Implementation

The Medicare Cataract Surgery Alternative Payment Demonstration was implemented from April, 1993 through April, 1996. The demonstration was carried out in four practice sites in three metropolitan areas (Dallas/Ft. Worth, Phoenix, and Cleveland), which were selected based on geographic, demographic and market characteristics. Selection criteria for the individual sites

included the proposed bundle price, commitments for high participation among surgeons and ophthalmologists, demonstrated access to quality care for beneficiaries, historical practice patterns and utilization rates, and the presence of quality safeguards. Among the demonstration sites, participants included hospitals, hospital units, physician groups, and ambulatory surgical centers.[76]

Cataract surgery was selected as the focus of the demonstration following a 1988 report to Congress from the Physician Payment Review Commission. The report identified cataract surgery as the surgical procedure most frequently performed on Medicare beneficiaries and the single most costly procedure in the Part B program. In the years that followed, several regulations reduced the amount that Medicare reimbursed for outpatient cataract procedures. As a result, average allowed Medicare charges for surgeons performing cataract surgery dropped by 25 percent from 1986 to 1991. The demonstration also followed the introduction of the Resource-Based Relative Value Scale introduced in 1992, which set payment rates based on the relative value of medical services, fundamentally changing how Medicare physician payment rates were determined.[76]

The evaluation report noted several challenges in recruiting demonstration sites. Among the three geographic areas chosen for the demonstration, one had to be replaced due to insufficient response to the request for applications, and demonstration participation overall was low. In addition, a lawsuit brought by the American Academy of Ophthalmology sought to cease the demonstration before the sites could be recruited. The Academy criticized the demonstration design on the grounds that it lacked patient protections, violated federal and state anti-trust laws and several state medical practice laws, and did not substantially increase the amount of bundling relative to status quo Medicare payments for cataract surgery. The government ultimately prevailed in court and the demonstration went forward.[76]

Payment Method

Under the demonstration, participating provider sites received a single prospective bundled payment for providing cataract surgery. The provider sites negotiated the payment rates as part of their recruitment into the demonstration, and the rates were not risk adjusted once they were set. The bundle of care was defined as surgery for cataract removal and the insertion of an interocular lens (IOL) implant. In addition to facility costs, specific services that made up the bundle included pre-operative diagnostic tests (e.g. A-scan ultrasound, specular microscopy, flourescien angiogram), the pre-operative surgical evaluation (including keratometry), all surgical services (including pathology of the extracted lens, in applicable), all post-operative exams up to 120 days after surgery and final refraction, and treatment of all common complications. All professional services were part of the bundle, including those provided by surgeons, anesthesiologists, certified registered nurse anesthetists, surgical nurses, technicians, allied professionals, and clinical administrative personnel such as those involved in quality assurance, utilization review, discharge planning, project direction. Services provided prior to the ophthalmological tests and exams required for surgery were excluded, such as ophthalmological exams that determine the presence of cataracts and establish the need for surgery, and the general physical exam and medical release required for surgery. All services provided after 120 days from date of surgery were also excluded, as well as eyeglasses and drugs prescribed at discharge for self-administration.[76]

Summary of Findings

Comparison Payment Methods

Bundled payment for cataract surgery was compared with pre-existing Medicare fee-for-service reimbursement at the demonstration sites.

Overview of Design of Relevant Studies

A single prospective, observational study evaluated the Medicare cataract demonstration. This study compared all patients that received cataract surgery under the demonstration (n=4,565) with a randomly selected set of patients that received the surgery prior to the demonstration (n=5,343) in 1991 and 1992. The study excluded inpatient surgeries, surgeries that did not involve the insertion of an IOL implant, surgeries that qualified for an assistant surgeon, or surgeries that were aborted without the removal or the cataract.[76] Reviewers rated this study as poor, due to the small number of non-representative, self-selected intervention sites, the contrived comparison group, and overall weak control for confounding variables.

Effects on Health Care Spending and Quality

Effect on Health Care Spending and Provider Costs

Medicare negotiated modest discounts of two to five percent relative to prior fee-for-service rates with the demonstration providers. Three of the four sites reported anecdotally that their costs had been reduced during the demonstration.[76]

Effect on Health Care Utilization

The evaluation found that no provider curtailed the use of specific services in the bundle such diagnostic tests, post-operative visits, total visits, or neodymium-doped yttrium aluminium garnet (nd:YAG) capsulotomy. Providers did not experience an increase in surgical volume that could be attributed to the intervention. All providers decreased the rate of nd:YAG capsulotomies delivered within 120 days of surgery, but this finding may have been caused by delaying this procedure in order to receive additional reimbursement.[76]

Effect on Health Care Quality

No change in clinical outcomes could be attributed to the intervention. The outcomes examined included visual acuity, complication rates, and changes in Snellan lines.[76]

Other Effects

One provider's patients exhibited more favorable pre-operative characteristics during the demonstration, but this could not be attributed to the intervention. The remaining sites exhibited roughly the same pre-operative patient characteristics.[76]

Differential Effects by Key Design Feature

None reported.

Differential Effects by Key Contextual Factor

The report noted that a number of previous policies had reduced the price that Medicare paid for cataract surgery prior to the initiation of the demonstration project. Significant price reductions had already been achieved in the facility fee paid to the hospital or ambulatory

surgery center for the procedure; in the charge for the IOL implant; and in the physician fee. Despite these recent price reductions, the authors noted that there was still potential to realize significant additional savings, however the demonstration did not impose sufficient price competition to do so.[76]

Geisinger "Proven Care(SM)"

Description of the Payment Model

Implementation

Geisinger Health Plan ("Geisinger") implemented the ProvenCare(SM) program on February 2, 2006. Geisinger was a large, non-profit integrated delivery system in central and northeast Pennsylvania, with approximately 210,000 members and a total service area population of roughly 2.6 million at the time of ProvenCare(SM) implementation. ProvenCare(SM) was initially implemented in three practice locations for elective CABG surgeries only. The bundled payment system was introduced together with an effort to re-engineer care processes, which included the introduction of 40 specific elements of care based on 20 clinical practice guidelines to be implemented and documented in each CABG episode.[74]

Payment Method

The ProvenCare(SM) CABG bundle was all-inclusive, spanning the preoperative evaluation and work-up; all hospital and professional fees; all routine post-discharge care, such as smoking cessation counseling and cardiac rehabilitation; and management of all related complications. Hospitals received a single prospective bundled payment with pay-for-performance incentives for delivering all 40 care elements, and provided a warranty for preventable follow-up care. The one reviewed study did not provide additional details regarding the payment methodology, and did not describe the payment system that preceded prospective bundled payment under ProvenCare(SM).[74]

Summary of Findings

Comparison Payment Methods

Not reported.

Overview of Design of Relevant Studies

A single observational retrospective study of ProvenCare(SM) was reviewed.[74] The study included all 254 elective CABG cases performed at three Geisinger hospitals over approximately two years, with 137 in the year before the implementation of ProvenCare(SM) and 117 in the year after its introduction. Patients on average were 66 years of age, about three quarters were men, and nearly all were white.[74] Reviewers rated the quality of this study as fair.

Effects on Health Care Spending and Quality

Effect on Health Care Spending and Provider Costs

The study reported a reduction in hospital charges of five percent for ProvenCare(SM) patients compared to patients under previous payment methods.

Effect on Health Care Utilization

The study found no change in post-operative length of stay, a 16 percent reduction in total length of stay (from 6.3 to 5.3 days), and a 15.5 percent reduction in the rate of hospital readmissions at 30 days (from 7.1 percent to 6 percent).[74]

Effect on Health Care Quality

ProvenCare(SM) resulted in an increase from 59 percent to 100 percent in adherence to the full set of 40 care elements. There was no statistically significant change apparent across 19 health outcome measures including complications, operative mortality, and readmissions following the implementation of the program; the sample size (n=117 bundled payment patients and n=137 comparison patients) may have been too small to provide adequate statistical power for analyses of these health outcomes.[74]

Other Effects

The percentage of patients discharged to their home increased from 81.0 percent to 90.6 percent ($p<0.05$).[74]

Differential Effects by Key Design Feature

None reported.

Differential Effects by Key Contextual Factor

The authors noted the organizational culture present within the Geisinger environment was essential to successfully implementing the intervention. They cautioned that applying the ProvenCare(SM) model outside of an electronic health record-enabled integrated delivery system may not achieve the same success.[74]

Michigan Arthroscopic Surgery Bundling Pilot

Description of the Payment Model

Implementation

In 1987, a surgeon in Michigan partnered with a hospital to function as a single provider, and developed a bundled payment program for a set of well-defined surgical services for shoulder and knee problems. This episode based payment included a two-year warranty, meaning that in addition to the surgery and related services, the surgeon and hospital agreed to provide all associated follow-up care for two years after the surgery, including re-operation, if necessary. They contracted with an HMO to accept referrals of patients with shoulder or knee problems that HMO staff physicians determined to be surgical candidates. At the time, the providers believed that less invasive arthroscopic surgery technology that was not widely used yet in Michigan offered a potential profit opportunity, by minimizing the hospitalization expense for treatment of these conditions. The providers offered the bundled payment package between April 1, 1987 and December 31, 1989. [77]

Payment Method

Under the bundled payment contract, the surgeon and hospital charged the HMO a single flat fee for all referred patients who went on to receive surgery. The surgeon and hospital calculated

the fee based on their knowledge of typical costs and charges for the included procedures. The flat fee was split evenly between the surgeon and hospital. The surgeon took responsibility for office visits, radiographs, surgery, additional consultations for complications, follow-up care with video documentation, utilization review (through the electronic medical record), and program administration. The surgeon also agreed to perform any necessary repeat surgery under the single bundled payment. The hospital was responsible for expenses associated with hospitalization, laboratory tests, radiographs performed in the hospital, preoperative electrocardiograms (EKGs), consultation with a cardiologist (if necessary), anesthesiologist, physical therapy and occupational therapy on the day of operation, and any necessary repeat hospitalization. The warranty covered all subsequent related services provided by the surgeon and hospital for two years. The providers paid only for defined services under their control.[77]

Summary of Findings

Comparison Payment Methods

The bundled payment price was compared to expected fee-for-service charges for the same patients receiving the same care.[77]

Overview of Design of Relevant Studies

A single descriptive study of the Michigan arthroscopic surgery pilot was studied. The study included 111 patients referred by the participating HMO for surgical consultations. Of these, 49 patients ultimately received surgery under the bundled payment option. The patients averaged 40 years of age, ranging from 8 years to 84 years, and 26 percent were female. The study tracked these patients beginning with their referral through the end of the two-year warranty, for those who received surgery. Reviewers rated the study as poor, as it was descriptive in nature, with a small, selected sample of patients and providers, and had no external comparison group.[77]

Effects on Health Care Spending and Quality

Effect on Health Care Spending and Provider Costs

The study reported that health plan spending was reduced by 39 percent, based on the difference between the actual bundled payments made and the authors' calculations of the expected payments under fee-for-service. This calculation did not include reductions in spending associated with the 63 patients who did not receive surgery.

Using similar calculations, the authors reported that hospital revenue was increased by 14 percent for the patients participating in the pilot. The participating surgeon's revenue was 82 percent higher during the pilot than it would have been under standard fee-for-service contracts.[77]

Effect on Health Care Utilization

None reported.

Effect on Health Care Quality

None reported.

Other Effects

None reported.

Differential Effects by Key Design Feature

None reported.

Differential Effects by Key Contextual Factor

None reported.

Summary and Discussion

We reviewed 58 studies that evaluated the effects of 19 bundled payment programs on spending and quality of care. We also analyzed four reviews of the Medicare Inpatient Prospective Payment System. Despite the fairly broad inclusion criteria used to identify studies for this review, the majority of published studies we retrieved focused on Medicare post-acute care prospective payment systems (40 studies) and various international programs of bundled payment (9 studies). Most of the bundled payment interventions included in these studies applied to single institutional providers such as inpatient hospitals, skilled nursing facilities, and home health care agencies. The bundle definitions and payment methods varied substantially. Despite the heterogeneity of settings, interventions, study designs, and measures used, reviewers noted highly consistent evidence of impacts of bundled payment on spending and utilization relative to usual, predominantly fee-for-service payment (Key Question 1) but inconsistent evidence of impacts on quality measures. No studies explicitly included analyses of differential impacts by key design feature (Key Question 2). Some studies reported on differential impacts by key contextual factors, but this evidence was limited to a small number of key contextual factors (Key Question 3). We did not attempt to address Key Questions 2 and 3 by collating the evidence across studies interventions because these analyses would be limited by the heterogeneity of the interventions and evaluation methods.

In this chapter, we first summarize the evidence for each Key Question across payment systems and assess the strength of the evidence. These summaries are supplemented by a table summarizing the strength of evidence for each Key Question and study outcome (Appendix D) and evidence tables summarizing data abstracted from each study (Appendix A). We then conclude with a discussion of the applicability of the reviewed studies for policymakers, payers, and providers considering implementation of a bundled payment system, recommendations for further research, and key points for policymakers.

Key Question 1. Impact of Bundled Payment on Health Care Spending and Quality Measures

Summary of Findings Across Payment Systems

The published evidence suggests that transitioning from cost-based or fee-for-service to bundled payment reimbursement resulted in declines in spending and utilization with small and inconsistently signed changes in individual quality metrics. The transition from a cost-based or fee-for-service reimbursement to bundled payment was generally associated with a decline in spending of 10 percent or less. This result was generally observed for varying interventions and settings. However, the magnitude of the decline was dependent on how payment rates were determined in bundled payment systems. Some programs were designed to be budget neutral. Others, such as the Medicare Participating Heart Bypass Demonstration, were designed to include a discount over previous payment rates.

Across the programs, the published evidence suggests that bundled payment was associated with a decrease in utilization and costs of services included in the bundle, often measured as reductions in length of stay or utilization of specific services (between five percent and 15 percent reductions in many cases). For example, the Medicare IPPS was associated with a 20 to 25 percent decline in length of stay and a similar decline in hospital days per beneficiary in the first few years after its implementation.[19] The Department of Veterans Affairs Resource

Allocation Methodology was associated with smaller but consistent length of stay reductions across various types of hospital stays (about five percent reductions for medical, surgical, and psychiatric patients).[60]

Finally, the body of published evidence provides little evidence that bundled payment (and the associated cost reductions) had major effects on quality. Studies found inconsistent effects; the inconsistency in findings on quality measures included both differences in the direction and magnitude of effects on different quality measures within a single study and differences in the direction and magnitude of effects for similar quality measures between studies. For a given bundled payment intervention, either some quality measures improved while others worsened, or studies of the same intervention arrived at different conclusions about the effect of bundled payment on related quality measures. For example, the Medicare IPPS did not have a negative effect on mortality, but was found to adversely affect selected quality measures, such as patient stability at discharge. For Medicare post-acute care in IRFs, functional improvement declined slightly post-PPS in four studies, improved slightly in two studies, and was not found to significantly differ from pre-PPS levels in two studies. Two studies reported very small increases in SNF deficiencies reported to CMS post-PPS. While two Medicare post-acute care studies found that patients were less likely to be discharged to the community post-PPS, three other studies found no significant difference in discharge before and after PPS implementation. The availability of quality measures has increased over the time period of the reviewed studies. However, given the number and variety of quality measures used in reviewed studies, it is unlikely that the overall quality effect is mainly a result of limitations of available measures.

There was limited evidence available on other types of potential negative effects of bundled payment programs such as unbundling and upcoding. There was consistent evidence from multiple studies of different programs that bundled payment programs focusing on single provider types resulted in shifts of services to other provider types (e.g., shift from inpatient to outpatient care following the Medicare IPPS). Some studies reported that measures of patient risk increased following bundled payment, although no studies tested whether this was a result of changes in coding practices (upcoding) or actual changes in patient risk.

Strength of Evidence

Overall reviewers graded the evidence for this Key Question as "low," indicating a low level confidence that the evidence reflects the true effect, and that further research is likely to change our confidence in the estimate of effect and is likely to change the estimate. The ratings and specific criteria that form the basis for this assessment of strength of evidence are shown in Appendix D and discussed below.

All included studies were observational or descriptive. Only two of the 58 reviewed studies were rated as "good" methodologically, and 19 were rated "poor." We did not exclude any studies based on their quality rating. However, we determined that our conclusions are not sensitive to the inclusion of "poor" studies.

Many studies used a pre-post design and may have been subject to bias from secular trends. Other studies employed small, often non-random samples and may have been subject to selection bias. Residual confounding may have affected the results of most or all of the included studies, but due to the large number of potential confounders, it is impossible to estimate whether confounding would be expected to reduce or increase the magnitude of observed effects. Most reported magnitudes were large enough to be economically or clinically important but small enough to raise the possibility that they were caused by confounders.

The results of included studies were consistent in the direction of the effect for cost and utilization measures, but inconsistent for quality measures. Based on the consistency of findings across heterogeneous interventions and evaluations, it is likely that the direction of the observed effects on cost and utilization measures would not change in future studies, although the magnitude of the effect could change. It is possible that the studied interventions may have been designed cautiously in order to encourage participation and avoid adverse effects.

The directness of the link between the bundled payment interventions and study outcomes was also stronger for spending and utilization measures than for quality measures. Many of the quality measures used were process or intermediate health outcome measures and therefore the effects were indirectly related to health outcomes. The reviewed studies used a limited number of quality measures that in general were selected based on availability rather than because they represented the aspects of quality most likely to be impacted by bundled payment.

Key Question 2. Differential Effects by Key Design Features

Summary of Findings Across Payment Systems

No studies explicitly tested the differential effect of key intervention design features on spending or quality measures. We did not perform comparisons of design feature impacts across studies because of the heterogeneity of the bundled payment programs studied and evaluation designs.

Strength of Evidence

Reviewers graded the evidence for this Key Question as insufficient to permit an estimation of effects due to the lack of evidence.

Description of Key Design Features

Below, we describe the key design features of the bundled payment programs reviewed and how these design features varied across programs. We provide some discussion of the potential impact of design features on study outcomes, but as previously stated we do not perform direct comparisons across studies.

Reviewed payment systems differed in the degree to which the bundled payment applied to multiple providers and/or providers of different types. In several of the international bundled payment applications this information either was not provided or was implicit as payments to providers (e.g., physicians and hospitals) were integrated prior to bundled payment. In the United States, however, physicians and hospitals are reimbursed separately by Medicare and other payers. Only the two reviewed Medicare demonstrations, the Geisinger ProvenCare(SM) program, and the Michigan Arthroscopic Surgery Bundling pilot integrated physician payments with hospital payments where these payments were previously separate. Studies of these programs found evidence for reduced costs with inconsistent effects on different quality measures. However, there was limited basis for a comparison of the magnitude of these findings to those of studies of bundled payment interventions that apply to a single setting.

The reviewed bundled payment interventions employed a variety of bundle definitions that were tailored to the relevant care setting. Most bundled payment systems defined the services included in bundles as those related to treatment for specific diagnoses (e.g., diagnosis-related groups; see Table 2). The Belgian non-medical inpatient PPS and the Medicare SNF PPS used a per diem unit of payment which may be appropriate when length of stay is highly variable.

While this bundle definition does not constrain utilization in terms of length of stay, it does affect incentives to provide services in a given day, and studies on both systems reported either declining or steady length of stay post-PPS.

In the evaluated programs, quality metrics or incentives were rarely integrated into bundled payment systems. Despite the potential for undesired effects of bundled payment on quality of care (as discussed in the introduction), programs generally did not include quality as an intrinsic part of the bundled payment mechanism. Among the programs reviewed, only the Geisinger ProvenCare(SM) program integrated pay-for-performance components into a bundled payment system, and therefore no differential effects across evaluations can be reported for this design feature. It is possible that inclusion of quality-related incentives as a component of future bundled payment programs will change providers' response to the program in a way that impacts quality measures, but the effect is unknown at this time. Other programs used quality measurement in program monitoring and evaluation or as a criterion for program participation but not as a component of the payment method.

Many of the bundled payment programs studied were implemented prior to the recent proliferation of pay-for-performance programs. The science of health care quality measurement and quality incentives has developed since many of the programs were implemented. In some cases, the bundled payment programs reviewed subsequently will be accompanied by a separate pay-for-performance program that addresses the same providers and services. For example, Medicare has a quality pay-for-reporting program, and the Affordable Care Act of 2010 mandates a Medicare hospital value-based purchasing program that will add quality-related incentive payments to the Medicare Inpatient Prospective Payment system, as well as a hospital payment adjustment based on readmission rates. It is unclear how these pay-for-performance programs will interact with the bundled payment programs studied, or the differential impact on quality of including the quality-related incentives as an integrated part of bundled payment or as a standalone program. Among more recent bundled payment programs that have been announced or initiated but not yet evaluated, some use quality measurement in a monitoring and evaluation role (e.g., Medicare Bundled Payments for Care Improvement initiative) while others incorporate pay-for-performance with the bundled payment (e.g., PROMETHEUS Payment).

Some of the reviewed payment systems blended bundled payment and fee-for-service reimbursement. Retaining some facets of fee-for-service may diminish the impact of bundled payment on spending or quality improvement. For example, scaling bundled payment reimbursement rates with utilization presents providers an opportunity to increase revenue by providing additional care. Three of the four Medicare post-acute care prospective payment systems included bundled payment rates which are partially determined by the services provided. The evidence suggests providers increased utilization of services that increase reimbursement rates in blended payment systems while at the same time decreasing utilization of other services and overall length of stay. For example, in the Medicare SNF PPS, the reimbursement rate increased for patients with additional rehabilitation therapy time. Three studies reported the number of rehabilitation therapy minutes increased post-PPS.[25,33,36] One study in particular looked at the issue of SNF rehabilitation therapy time in detail and found SNFs not only increased utilization of rehabilitation therapy minutes, but also increased the probability (by 12 percent) of providing a "nodal" amount of rehabilitation therapy which would qualify a patient for higher reimbursement.[36] In the Medicare HH PPS, reimbursement was higher when home health agencies provided more therapy visits per episode. While the reviewed studies suggested aggregate home health visits per episode (including aide, therapy, and other visits)

declined post-PPS, one study reporting visits by type found an eight percent increase in home health therapy visits per episode post-PPS compared to decreases in the number of aide and nursing visits post-PPS (all $p<0.001$).[58] The Medicare LTACH PPS payment rates also varied with services provided, but the one reviewed study on this payment system did not report utilization outcomes.

The use of risk adjustment and outlier payments to account for patient risk in bundled payment programs differed between the reviewed payment systems. Separate outlier payments were common in bundled payment programs, both for high-cost patients and occasionally for low-cost patients (as in the Medicare post-acute care systems where short-stay patients are reimbursed separately). Risk adjustment approaches were not always well described in international applications of bundled payment. For domestic public applications (namely the Medicare prospective payment systems), the specific approach to risk adjustment was setting-specific. The reviewed studies did not address the effect of outlier or risk adjustment methods on study outcomes.

Reviewed payment systems differed in their approach to establish the initial bundle reimbursement rate. Historical expenditures were typically used to determine the initial bundled payment rates, but programs differed in whether the bundled payment rate was set at an amount estimated to increase, decrease, or maintain historical expenditure levels. The Medicare Inpatient PPS is an example of a program where payment rates were relatively generous in the first years post-implementation. This may have had the effect of mitigating potential adverse impacts on quality in response to the new payment system. At the same time generous initial payments may mitigate the impact of bundled payment on reductions in spending.

The two reviewed Medicare demonstration programs (Participating Heart Bypass and Cataract Alternative Payment demonstrations) are examples of programs where initial bundled payment rates were set at a level lower than historical expenditure. The payment rates were determined by negotiation between Medicare and participating providers, who were selected for participation in the demonstrations based in part on the level of discount over historical expenditure offered to Medicare. In the Medicare Participating Heart Bypass Demonstration, Medicare reduced spending for bundled and non-bundled services from admission through 90 days post-discharge by about ten percent at the seven demonstration sites. Eighty-six percent of this decline was due to the negotiated bundled payment rate between Medicare and the hospital while five percent was from lower post-discharge spending (which was excluded from the bundle) and nine percent was due to shifts in market share towards lower-cost demonstration hospitals. The effect on spending would likely be much lower in a similar bundled payment program with prices set at levels designed to be budget-neutral compared to historical spending. The effect on spending would also likely be lower if hospitals participating in the demonstration were not selected in part on their ability to negotiate low payment rates.

Some bundled payment interventions were implemented in the context of other simultaneous health care spending reduction efforts separate from the bundled payment intervention. The Medicare SNF PPS, for example, was estimated by the Congressional Budget Office to cut SNF spending by almost $10 billion over five years. Reviewed studies provided little evidence on the aggregate impact of the SNF PPS on spending, but one study[34] suggested a decline in the use of any SNF services by beneficiaries was responsible for decreased spending per hospital stay. In another post-acute care setting, the Medicare Home Health PPS was preceded by an Interim Payment System which imposed limits on per-visit and per-beneficiary reimbursement and dramatically curtailed Medicare home health expenditures and utilization (total expenditures fell

from $16 billion in 1997 to less than $8 billion in 1999 and utilization dropped by about 25 percent over the same period).[80] Viewed in this context, the increase in home health spending post-PPS reported in one study[57] appears more as a reaction to previous dramatic declines in home health spending rather than an effect attributable to the switch to bundled payment. Other bundled payment interventions were combined with very modest anticipated spending cuts (e.g., a four percent decline in Japan outpatient dialysis spending) or were loosely motivated by health care cost control efforts. No differential effects were observed for these bundled payment interventions.

The design of bundled payment programs affects the costs of payment administration, including costs to both providers and payers. More complex bundled payment designs are likely to incur higher administration costs. The two reviewed Medicare demonstrations, which included bundles applying to multiple providers and provider types, did report some difficulty in administration of the bundled payment programs, in part due to challenges of distributing payment among the multiple providers participating in the bundled payment.[75,76] Several other studies reported increases in administrative costs related to bundled payment, but no study reported differential impacts by design feature.[40,56,61]

Finally, payment systems differed in implementation strategy, with some systems undergoing a lengthy phase-in period and others immediately supplanting the previous payment system. Three of the four Medicare post-acute care prospective payment systems included phase-in periods. Under the IRF PPS, some facilities had the option to blend the previous cost-based and bundled payment rates for one year. Under the SNF PPS, all SNFs blended cost-based and PPS rates for three years. For the LTACH PPS, hospitals chose either a five year phase-in program or switched to PPS immediately. The HH PPS did not have a phase-in period but instead followed an Interim Payment System which imposed additional controls and caps on the previous cost-based payment system. While gradual phase-in introduces challenges for evaluators, they may be warranted given providers' reported difficulty adjusting administrative staffing, finances, and provider relationships to new reimbursement regimes.[29,35,40,59,75] Interestingly, there appears that there were some selection effects at work where facilities had an option to phase-in a new payment system. The study of the Medicare LTACH PPS[59] reported facilities choosing to immediately adopt the PPS hired additional nursing staff (the opposite effect was hypothesized), perhaps because early adopters outperformed competitors.

Several reviewed studies either directly studied the implementation process of one or more bundled payment systems or included implementation-related anecdotes. Most studies providing survey or anecdotal evidence from providers noted new bundled payment systems faced significant initial resistance from providers/facilities.

Key Question 3. Differential Effects by Key Contextual Factors

Summary of Findings Across Payment Systems

Based on the conceptual model presented in Figure 1, we aimed to address differential effects by key contextual factors including predisposing factors (general financial environment, other incentives, charters and missions of participating organizations, market characteristics, etc.) and enabling factors (capabilities and goals of participating organizations, degree of integration of participating organizations, staffing factors, and patient factors). The effects of most of these contextual factors were not addressed by any studies.

Some studies reported outcomes separately for patients and facilities of different characteristics, although results from appropriate statistical tests to compare these results were rarely included. The most striking of these comparisons involved for-profit versus not-for-profit providers. In general, for-profit providers experienced larger declines in utilization under bundled payment than their not-for-profit counterparts (including U.S. and ex-U.S. hospitals, skilled nursing facilities, inpatient rehabilitation facilities, and home health agencies).[13,33,34,36,46,49,54,68] For-profit providers may have utilized more or more intense ancillary services than their not-for-profit counterparts prior to transitions from fee-for-service to bundled payment reimbursement. No studies examined differential impacts on quality measures by provider profit status.

The four review articles on the Medicare IPPS noted that studies examined the impact of financial pressure on utilization effects. The studies found that hospitals under greater financial pressure had greater reductions in utilization in response to bundled payment. Afendulis et al. (2011) tested whether the Medicare SNF PPS had a differential impact on hospitalized stroke patients in areas with higher integration between hospitals and SNFs (i.e., in areas with less competition).[21] They found the SNF PPS led to larger declines in the use of any SNF services in more integrated areas. They also found spending declined in more integrated areas (by 5.3% from 1997–1999, $p<0.05$) but not in less integrated areas. There were no differential effects in quality measures across more and less-integrated areas. This result may be due to effective self-referral in integrated hospital-SNFs prior to PPS.

Several studies reported outcomes separately for patients with relatively severe disease or injury and patients with relatively less severe disease or injury.[13,26,43,58,68] Others reported outcomes separately for patients with different diagnoses.[46,47,57,60] These studies produced inconsistent results on the differential effects of patient characteristics on quality and utilization measures.

One study reported outcomes separately by geographic region.[53] This study found considerable geographic variation in baseline cost and utilization and in change in cost and utilization attributed to a single bundled payment intervention, the Medicare HH PPS, although no explanation for this differential impact was provided in the reviewed article. Most individual regional outcomes differed from national outcomes with $p<00001$.

Strength of Evidence

For the effect of three specific contextual factors, patient severity, provider for-profit/not-for-profit status, and provider financial pressure, on one outcome, utilization, reviewers graded the strength of evidence as "low." The ratings and specific criteria that form the basis for this assessment of strength of evidence are shown in Appendix D. Seventeen studies addressed the differential effects of key contextual factors on utilization outcomes. These studies had the same risk of bias and residual confounding as described in the discussion of Key Question 1. In addition, the findings were inconsistent and imprecise. The evidence was rated as insufficient to permit an estimation of effects of other contextual factors on utilization outcomes due to sparse and weak or nonexistent evidence.

For other study outcomes, reviewers graded the evidence for this Key Question as insufficient to permit an estimation of effects for any key contextual factor due to the lack of evidence. There were a small number of studies that reported effects of a single contextual factor on spending or quality outcomes, but this evidence was rated as too weak and sparse to permit any conclusions to be drawn.

Description of Key Contextual Factors

Below, we describe several other key contextual factors described in the reviewed studies. However, none of the reviewed studies directly addressed the effects of these contextual factors on study outcomes.

Some bundled payment interventions were implemented in the context of simultaneous but independent health care spending reduction efforts, including payment reforms other than bundled payment. For example, the Medicare Resource-Based Relative Value Scale physician fee schedule was implemented in 1992, overlapping with the time periods examined in several of the reviewed studies. Capitation and the spread of health maintenance organizations are two other examples of reforms that occurred during the time period of bundled payment programs in reviewed studied. Due to the study designs used, studies were not able to differentiate the effects of bundled payment programs from related but independent interventions.

None of the reviewed studies provided insight into differential results by the degree of integration between health care delivery organizations and payers or between various health care delivery organizations. As noted above, most reviewed bundled payment interventions applied to a specific outpatient care settings or to inpatient environments where hospital and physician actors are not integrated. None of the reviewed studies reported on payer or provider competitive environments.

Applicability

The main intended audience for this report is policymakers, payers, and providers in the United States that are considering implementation of a bundled payment program. The findings of this review are likely to be applicable most directly to those considering a bundled payment program targeting single providers. The majority of bundled payment programs in the included studies focused on single institutional providers such as inpatient hospitals, skilled nursing facilities, or inpatient rehabilitation facilities. Many of these interventions included all participating U.S. providers of each type.

Recent interest in bundled payment has focused mostly on programs that bundle payments for multiple providers and/or provider types. The findings of this review are less applicable to these types of programs. There were several reviewed studies of bundled payment across multiple provider types, but these included a small number of participating provider organizations that are not representative of the U.S. delivery system more broadly. More evidence is likely to be available in the future as evaluations of ongoing programs, such as the Medicare Acute Care Episode Demonstration, are published.

The interventions studied were typically specific to a single payer, most often Medicare or various public insurance systems outside the United States. The applicability of findings in studies involving one payer (e.g., Medicare) to other payer contexts is limited due to differences in beneficiary characteristics, provider bargaining power, and competitive pressures.

Interventions implemented in countries other than the United States may have limited applicability to the U.S. context due to differences in health system organization, financing, and delivery. Although non-U.S. studies were screened for comparability to a U.S. delivery setting, in practice this criterion was difficult to apply and no studies were excluded on the basis of nationality.

Most reviewed studies analyzed samples or the universe of national patient and/or provider data (specifically, Medicare data). While this improves generalizability, studies with national scope often focused specifically on a handful of diagnoses or interventions to simplify analyses

and conclusions. For example, many of the Medicare post-acute care studies restricted their analyses to patients receiving care due to a hip fracture, stroke, or joint replacement.

All reviewed studies assessed the impact of bundled payment relative to either fee-for-service or cost-based payment. The magnitude and sign of effects relative to fee-for-service or cost-based payment may differ from absolute effects. For example, bundled payment might slow an increase in absolute spending relative to usual payment. Transitions to bundled payment from other payment methods, e.g., salary or capitation, may have other effects.

Some reviewed bundled payment systems, including Geisinger ProvenCare (SM) and several international systems, involved settings where care for most or all patients was reimbursed by a single payer. Many other reviewed payment systems were implemented by a single payer (e.g., the U.S. Medicare program) but applied to providers with diverse patient populations and multiple payers. The reported effects of bundled payment may not be fully realized if interventions affect only a small portion of providers' overall business. Similarly, providers may not significantly alter behavior if bundled payment interventions are perceived as temporary.

Finally, evidence on bundled payment applies specifically to cases where reimbursement based on episodes of care is both reasonable and feasible. Bundled payment may be less feasible or effective when applied to health care related to conditions without clearly defined treatment regimens, conditions with multiple treatment approaches, or rare conditions.

Recommendations for Further Research

There are several ways that future evaluations could produce a stronger evidence base. Policymakers and evaluation researchers must recognize the tension between producing timely, practical evidence and conducting rigorous evaluations. The most rigorous study designs are usually only feasible when policymakers plan for an evaluation experiment in the course of implementation. We focus our recommendations on improving retrospective quasi-experimental studies which formed the bulk of research reviewed for this report.

Use stronger evaluation study designs. Most reviewed studies used a pre-post design with no comparison group, which creates the possibility that selection and history (i.e., changes in practice over time other than the bundled payment program) bias results. While some reviewed studies rated "fair" and both studies rated "good" controlled for potential confounders including patient characteristics (e.g., age, race/ethnicity, and comorbidities) and facility characteristics (e.g., number of beds, staffing levels, and teaching status), most studies rated "poor" presented results from univariate analyses. The benefits to validity from including a comparison group likely outweigh the associated increase in evaluation time and cost. Comparison groups including non-participating providers similar to participants are likely to be the most promising and feasible option.

Most studies considered a brief time horizon after the implementation of bundled payment systems. For the Medicare post-acute care PPS interventions, most studies used "post" data from less than two years after implementation of the new payment system (11 of 19 skilled nursing facility PPS studies, six of nine inpatient rehabilitation facility PPS studies, and eight of nine home health PPS studies). Given the challenges in implementation and redesign of care processes reported in studies with qualitative components a longer time horizon is likely necessary to observe many important impacts. Studies with follow-up in the range of five years post-implementation might capture longer-term changes in quality effects (particularly health outcomes), evolving practice patterns, new technologies, or supply-side market conditions (i.e.,

closures, mergers, etc.). However, the benefits of a longer time horizon must be balanced against the need for rapid information on program effects and the risk of attributing changes due to secular variation to the payment intervention. Future evaluations could balance these needs by reporting at several points in time post-intervention.

Practical data, time, and funding constraints often dictate the choice of evaluation study design. The limitations intrinsic to retrospective observational studies prevent the reviewed studies from approaching the "gold standard" equivalent of a randomized controlled trial. However, the two studies rated "good" and several studies rated "fair" outlined natural experiments or quasi-experimental strategies to identify the effect of bundled payment on spending and quality outcomes. While the instrumental variables approach is appealing in this context, valid and strong instruments are elusive. One promising natural experiment approach involved exploiting variation due to the staggered implementation of Medicare post-acute care bundled payment interventions, although this approach introduces its own selection concerns. Future evaluations should consider these and related methods that could improve evaluation validity with little effect on the timeliness of results.

Use standardized measures of impact on spending and quality. The measures used to evaluate each bundled payment intervention varied across studies. While different measures are likely more relevant to different interventions and implementations, increased consistency in the use of measures could increase the comparability of future evaluations of the impact of bundled payment. In particular, the use of quality measures was relatively rare and the measures used were inconsistent across studies. Important potential quality effects were often unmeasured, including measures of underuse of appropriate services within bundles, indications of the appropriateness of bundles, measures of the patient experience of care, measures of coordination of care within and across bundles, and health outcomes of bundles of care.[4] Evaluators' collaboratives, such as the Patient-Centered Medical Home Evaluators' Collaborative, are one potential mechanism for identifying priority measurement areas and achieving homogeneity in measures used for a given type of intervention. Evaluation sponsors could also encourage evaluators to use standard measurement approaches or to collaborate with evaluators of similar interventions to harmonize measurement approaches. However, standardization needs to be balanced against the fact that the most relevant and meaningful measures, especially quality measures, may differ across health care settings and diseases/conditions.

Use stratification to understand the impact of bundled payment on specific patient groups. While most reviewed studies reported changes in spending and quality of care on average, few reported changes in outcomes for different patient groups. One study in the latter category found significant differences in the impact of bundled payment systems across patient groups, e.g., women versus men ($p<0.0001$), and dual-eligibles versus Medicare-only beneficiaries ($p<0.0001$).[54] This is perhaps not surprising if the characteristics of a "marginal" patient or service under the prior fee-for-service or cost-based are different from the characteristics of a "marginal" patient or service under bundled payment. Even if aggregate utilization or spending remains constant, changes in incentives may dramatically alter the characteristics of patients or the services provided.

Future research on the impact of payment system changes should focus on the effect of bundled payment on specific patient populations and types of service. In terms of patient characteristics, differential effects by disease/condition severity and payer seem particularly

important. Measuring differential effects by disease/condition severity may be possible where researchers have finer resolution data on patient condition than is captured by case mix systems used to assign patients to bundled payment rates. The question of interest in this case is whether relatively ill patients experience different impacts of bundled payment on utilization or quality measures. The questions of interest in this case are whether payer or providers adjust utilization for certain patient groups, and whether impact in quality measures varies by patient group.

Incorporate quantitative and qualitative measures of program design and contextual factors. Few studies considered how specific design elements or contextual factors affect outcomes. This type of evidence will be critical as Medicare and private payers experiment with various payment and delivery reforms including bundled payment as well as others including global payment or shared savings for accountable care organizations, and seek to identify which aspects of these pilots have the potential to be scaled widely. Important design features to be addressed include the definition of the bundle (how many providers are included, what length of time, which services are included and excluded from the bundle); methods for limiting financial risk and incentives for risk selection, including risk adjustment and outlier payments; use of quality measurement; methods to update payment rates to reflect new technologies; and methods for distributing payment among participating providers. Important contextual factors to be addressed include whether bundled payment is more effective in more highly integrated delivery settings; the role of financial pressure and the general financial environment on responses to bundled payment; and differential effects between subgroups of patients, as discussed above.

Incorporate measurement of ancillary or spillover effects. Only a handful of studies explored broader consequences of bundled payment beyond the setting of care or patient group targeted by the intervention. One study noted that decreases in inpatient length of stay in response to the Swedish inpatient PPS were offset by additional nursing facility care.[70] Another study[22] specifically focused on utilization changes in each Medicare post-acute care setting in response to the implementation of all three prospective payment systems. In general, the implementation of each payment system had a direct effect on the corresponding post-acute care setting and secondary effects as utilization shifted to or from other Medicare post-acute care settings. This complex substitution pattern has important implications. Other substitution effects between Medicare and Medicaid for some post-acute care services and, in the United States and other settings, between private and public payers may also be important. Some studies examined the impact of bundled payment systems implemented by one payer on patients with other payers, but differences between patient populations complicate these results. For example, several studies compared post-acute care outcomes for Medicare and Medicaid or Medicare and "non-Medicare" patients after the implementation of one or more of the Medicare post-acute care prospective payment systems. The obvious differences between Medicare, Medicaid, and privately insured individuals render these comparisons tenuous even in well-controlled studies. Future research should target more similar patient groups to identify spillover effects to patients with different payers.

Other indirect effects of bundled payment were not evaluated by any reviewed study. For example, the introduction of bundled payment may alter incentives for innovators or the adoption of new technologies by providers. Future evaluations should consider these broader implications of bundled payment interventions.

Limitations

While reviewers carefully screened and selected studies for inclusion in this review, it is possible relevant studies were not captured in the initial search or were mistakenly excluded in the title or abstract reviews. The search process may not have identified all non-English language studies. Some relevant evaluations may not have been published or are not included in the data sources reviewed, particularly sources in the grey literature which are not included in literature databases. While the search strategy included *ad hoc* and reference mining searches, including recommendations from a panel of experts, few of the studies from these sources met inclusion criteria. While reviewers aimed to screen non-U.S. studies for comparability to U.S. delivery settings, in practice this criterion was difficult to apply and no studies were excluded based on nationality.

The evidence review is limited by the design and implementation of bundled payment programs that have been evaluated. Most of the bundled payment interventions studied in reviewed articles (16/20) were limited to payments to single institutional providers (e.g., hospitals, skilled nursing facilities) and so have limited generalizability to newer programs including multiple care settings and/or multiple providers. The majority of the reviewed programs were applied simultaneously to all providers by large public payers.

The evidence review is also limited by the strength of the underlying studies. Reviewers identified several main gaps in the evidence reviewed, as described above. A summary of methodological limitations is listed in Appendix A for the studies rated "poor" by reviewers. These and other studies rated "fair" often raised one or more of the following methodological concerns: (1) Limited or no consideration or controls for likely confounders in descriptive or observational studies; (2) small and/or convenience samples of providers; and (3) limited post-intervention data. Small sample size and limited followup time are likely to be particularly important for detecting quality effects which may be relatively rare and develop long post-intervention. As noted above, direct evidence on Key Questions 2 and 3 was extremely limited even though it is crucial to understand the differential effects of bundled payment by design features or contextual factors as various health care payers and systems consider payment reform.

Conclusion

In summary, the introduction of bundled payment was associated with: (1) reductions in health care spending and utilization; and (2) inconsistent and generally small effects on quality measures. These findings were consistent across different bundled payment programs and settings but the strength of the body of evidence was rated as low due mainly to concerns about bias and residual confounding. For policymakers considering implementation of bundled payment programs, this evidence provides some support that the programs are likely to be an effective strategy for reducing health care spending. While the effects on health care quality are less certain, the available evidence doesn't support the worst concerns about potential adverse effects of bundled payment.

Policymakers considering bundled payment programs should also consider several caveats, however. First, future bundled payment programs are likely to differ in important ways from those reviewed in this study. Most of the programs reviewed were single-setting prospective payment systems that replaced fee-for-service reimbursement systems. In contrast, recent and forthcoming bundled payment programs, such as the Medicare national bundled payment

initiative, focus on bundling services provided by different providers over the course of an episode defined by a condition, diagnosis or procedure. The few completed studies of programs involving payment for multiple providers did find evidence for reduced costs and inconsistent impacts on quality, although there were some reports of implementation difficulty. These programs are likely to be more complex than most of the reviewed programs, and therefore may have different effects. Nevertheless, multiple-setting programs present a logical next step building on the largely positive effects of previous single-setting bundled payment programs.

Second, although evidence of effects on quality was inconsistent, bundled payment has the potential to either adversely affect quality or be used as part of a quality improvement strategy. Future bundled payment programs should incorporate a robust quality monitoring and improvement component, potentially as an integrated part of the payment system.

Third, the strength of evidence on bundled payment effects was low, reflecting the difficulty in evaluating large-scale policy interventions that occur in a rapidly changing health care system. Better information from evaluations could improve the impact of bundled payment programs, in particular by illustrating how the programs could be adapted for adoption in the variety of health care delivery contexts found in the United States.

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Acronyms

AHRQ	Agency for Healthcare Research and Quality
AMSTAR	assessment of multiple systematic reviews
CMG	case mix group
CMS	Centers for Medicare and Medicaid Services
DPU	distinct part unit hospital
DRF	designated receiving facilities
DRG	diagnosis-related groups
DTC	diagnosis treatment combination
EPC	evidence-based practice center
FIM	functional independence measure
GRADE	Grading of Recommendations Assessment, Development and Evaluation
HCFA	Health Care Financing Administration
HH	home health
HHA	home health agency
HHRG	home health resource group
IHA	Integrated Healthcare Association
IOL	interocular lens
IPPS	inpatient prospective payment system
IRF	inpatient rehabilitation facility
KQ	Key Question
LTACH	long-term acute hospital
MBHO	managed behavioral healthcare organization
MD	medical doctor
nd:YAG	neodymium-doped yttrium aluminum garnet
NHS	National Health Service
PBR	payment by results
PPS	prospective payment system
PROMETHEUS	Provider Payment Reform for Outcomes, Margins, Evidence, Transparency Hassle-reduction, Excellence, Understandability and Sustainability
RAM	resource allocation methodology
rHuEPO	recombinant human erythropoetin
RN	registered nurse
RUG	resource utilization group
SES	socioeconomic status
SNF	skilled nursing facility
TEFRA	Tax Equity and Fiscal Responsibility Act
VA	United States Department of Veterans Affairs

Appendix A. Summary of Evidence From Reviewed Studies

Table A1. Narrative summaries of evidence regarding KQ1 and KQ3[2]

Author (Year)	Intervention	Key Question 1 Summary of Effect: Utilization	Key Question 1 Summary of Effect: Spending/costs	Key Question 1 Summary of Effect: Quality	Key Question 3 Summary of Effect
Abt Associates (1997)	Medicare Cataract Surgery Alternate Payment Demonstration	▪No reduction of surgical volume or specific services during the demonstration (i.e. diagnostic tests, intra-ocular lens standardization, post-op visits, total visits, YAG capsulotomy). ▪All providers decreased nd:YAG capsulotomies within 120 days, which may have represented delaying this procedure to receive additional reimbursement. ▪One provider's patients exhibited more favorable pre-op characteristics.	▪In terms of Medicare reimbursement per episode, the Health Care Financing Administration negotiated modest discounts of 2%- 5% (relative to FFS rates) with demonstration providers ▪Providers at 3 of 4 demo sites reported anecdotal information that costs had been reduced.	▪There were some anecdotal examples of care redesign, however they cannot be directly attributed to the demonstration. ▪There were no changes in clinical outcomes (such as visual acuity, complication rates, or change in Snellan lines), which could be attributed to the demonstration.	

[2] KQ2 is omitted as there was no evidence to report.

Table A1. Narrative summaries of evidence regarding KQ1 and KQ3 (continued)

Author (Year)	Intervention	Key Question 1 Summary of Effect: Utilization	Key Question 1 Summary of Effect: Spending/costs	Key Question 1 Summary of Effect: Quality	Key Question 3 Summary of Effect
Afendulis (2011)	Medicare SNF PPS			▪No evidence of adverse effects on health outcomes associated with SNF PPS. Mortality decreased by 1.6% (p<.10) under PPS	▪Total spending growth under SNF PPS was 5.2% lower (p<.05) in high integration areas (integration = degree of integration of hospitals with SNF's in a market areas) ▪In more highly-integrated areas under SNF PPS: probability of any SNF spending was 1.2% lower (p<.05); level of SNF spending, conditional on a SNF admission, was 5.3% lower (p<.05); probability of admission to a rehabilitation hospital was 1.2% higher (P<.05); rehab hospital spending, conditional on admission, was 7.4% lower (p<.01); probability of having an outpatient visit was 1.1% higher (p<.10); no statistically significant effect on outpatient spending (conditional on an op visit); no statistically significant effect on use of home health; home health spending was 8.1% lower (p<.10) (conditional on hh use). ▪No evidence of differential impact on outcomes in high versus low integration areas

Table A1. Narrative summaries of evidence regarding KQ1 and KQ3 (continued)

Author (Year)	Intervention	Key Question 1 Summary of Effect: Utilization	Key Question 1 Summary of Effect: Spending/costs	Key Question 1 Summary of Effect: Quality	Key Question 3 Summary of Effect
Anderson (2005)	Medicare Home Health (HH) Prospective Payment System (PPS)	▪The HH Length of Stay (LOS) was 13.9 days pre-PPS, 11.7 days post-PPS ▪The number of nurses seen pre-PPS was: 1 nurse (54%), 2 nurses (31%), >=3 (15%); Post-PPS: 1 nurse (45%), 2 nurses (20%), 3 or more (35%).		▪On a scale of 1-10 that measured "how ill" a 5.15 was reported pre-PPS, and a 7.42 post=PPS. ▪ HH patients requiring hospital readmission in the post-PPS study were somewhat older, sicker, and more complex to manage at the time of discharge.	
Brizioli (1996)	Italy inpatient prospective payment	▪The LOS decreased from 13.57 days to 11.69 days, a reduction of 13.89% (p<.05).	▪The cost per discharge declined by 14% post-PPS (p<0.05).	▪The number of total discharges increased by 10.34% and the number of classified DRG 127 discharges increased by 13.43%; DRG 127 discharges as a proportion of all discharges increased by 2.8%. ▪There was no significant change in readmission rates within 3 months.	▪Utilization/ Spending: While reductions in length of stay and cost per case were relatively consistent across age groups, there was a larger increase in re-admissions among patient 70 years of age and older.
Buntin (2009)	Balanced Budget Refinement Act of 1999 (in aggregate; implements PPS for HH, Skilled Nursing Facility [SNF], and Inpatient Rehabilitation Facility [IRF])	▪Post-acute care (PAC) substitution in response to PPS generally had magnitudes of <1%. ▪No significant effect on the interaction of patient severity with utilization. ▪In response to individual SNF and HH PPS implementation, there was a decrease in overall PAC utilization (significant but <1%). In response to IRF PPS implementation, there was an increase in overall utilization (significant but <0.5%).			

Table A1. Narrative summaries of evidence regarding KQ1 and KQ3 (continued)

Author (Year)	Intervention	Key Question 1 Summary of Effect: Utilization	Key Question 1 Summary of Effect: Spending/costs	Key Question 1 Summary of Effect: Quality	Key Question 3 Summary of Effect
Casale (2007)	Geisinger ProvenCare	▪There was no change in post-op LOS, but there was a 16% reduction in total LOS; 6.3 Conventional Care Group to 5.3 days ProvenCare Group.	▪There was a 5% reduction in hospital charges.	▪There was a 15.5% reduction in 30 day readmission rate (7.1% to 6%). ▪There was an increase from 59% to 100% adherence for 40 process measures ▪Discharge to home up from 81% to 90.6% (p=.033)15.5%, from 7.1% ▪The 19 outcome measures showed no significant differences between control and intervention.	
Cheh (2001)	Medicare HH PPS Demonstration	▪PPS site provided 17% fewer visits during 4 month episode during demo; 33% fewer visits in 8 months post-episode; 24% fewer visits during combined one year period	▪no sig difference in Med A or B reimbursements; no increase in informal caregiving; no increase in formal residential services, possible decrease in use of nursing home care among PPS patients ▪PPS agencies earned profits by decreasing visits-per-episode, but these appeared to be off-set by increasing overhead costs ▪PPS reduced Medicare payments to PPS agencies	▪no evidence of selection ▪no clinically significant difference in assessed quality of care	▪high-use agencies (those that historically provided more visits) reduced utilization more quickly than low-use, but the total reduction evened out over time)

Table A1. Narrative summaries of evidence regarding KQ1 and KQ3 (continued)

Author (Year)	Intervention	Key Question 1 Summary of Effect: Utilization	Key Question 1 Summary of Effect: Spending/costs	Key Question 1 Summary of Effect: Quality	Key Question 3 Summary of Effect
Chen (2000)	Taiwan inpatient PPS (TPPS)	▪The LOS was longer in FFS (6.63 +/- 3.21 d FFS, 4.37 +/- 1.47 d TPPS, p<.01); ▪The mean operation time decreased (97.5 +/- 41.6 min FFS; 75.8 +/- 32.3 min TPPS; p<.01) ▪Use of general anesthesia decreased (72% FFS – 53.5% TPPS, p<.01);	▪The total hospital cost, costs for room (35.1%), treatment (33.5), pharmacy (34.3%) and examination (25.3%) [p<.01] and anesthesia (9.2%) [p<.05] all decreased under PPS, costs for operation did not change, total cost decreased by 19.0% under TPPS.	▪There was no change in the removal or time to removal of stitches. ▪No differences in frequency of painful incision, clear incision wound on the day of discharge and removal of stitches at hospital (surgical outcomes) ▪There was also no change in the number of days to resume normal activity.	
Chen (2002)	Medicaid SNF PPS		▪In instrumental variables regression controlling for endogeneity of cost and quality, PPS was not significantly associated with total operating cost in 1994. In regressions not controlling for enodogeneity, PPS significantly negatively associated with cost, suggesting the effect is due to reduced quality.		
Coburn (1993)	Maine Medicaid nursing home PPS		▪Total variable costs decreased, patient care costs, and room and board costs decreased three years post-PPS ▪Regression results indicated no significant association between PPS and decreasing Medicaid share of patients: 80.2% in Y3 (last year before PPS) to 75.9% in Y6 (3rd year of PPS). ▪About a third of facilities incurred losses by year 3 post-PPS.		

Table A1. Narrative summaries of evidence regarding KQ1 and KQ3 (continued)

Author (Year)	Intervention	Key Question 1 Summary of Effect: Utilization	Key Question 1 Summary of Effect: Spending/costs	Key Question 1 Summary of Effect: Quality	Key Question 3 Summary of Effect
Collins (2007)	Medicare SNF PPS	▪Decrease in LOS (17.4 days to 8.6 days; no p value reported) ▪Fewer physical therapy visits (10.4 vs 7.2, p=0.041) ▪No change detected in assistive device (e.g., cane)		▪There was no significant change in knee flexion Range of Motion ▪About a 40% decrease in knee extension ROM (p=0.035) ▪ 40% rise in ambulation in feet (p=0.003).	
Cromwell (1998)	Medicare Participating Heart Bypass Center Demonstration	▪All seven hospitals decreased LOS from 0.5-1 day/yr (Only one hospital had ALOS decrease significantly different from competitor trend.) ▪"Most" hospitals reduced ICU stays by one day, and routine stays another 2-3 days.	▪Average Medicare savings was 10%, 86% of which is due to negotiated payment, 5% to decreases in post-discharge care, and 9% to market share ▪3 of 4 hospitals lowered cost (from 2 to 23% in nominal terms, 18-40% in real cost reduction) ▪Mixed evidence for hospital's market share ▪Variable Margins increased significantly at two hospitals and decreased (although remaining positive) at two others. (All four had positive variable margins)	▪There was some evidence of higher patient satisfaction with care in demo hospitals. ▪No difference in CABG appropriateness. ▪There was a 2.4% annual increase in rate of reported complications (p<0.1). ▪Significant improvement trend in inpatient mortality, but trend different from competitors for only 1 hospital. ▪There was a small positive trend in reported complications. ▪No systematic differences in self-reported outcomes.	
Davitt (2008)	Medicare HH PPS	▪The % changes in staffing (n/visits/visits per user) from 1999-2002 were as follows: aides (-21%/-52%/-34%); LPNs and RNs (+16%/-29%/-23%); Therapists (various, not reported here). There was a n:+3.79% in all staff.	▪Directors report of cost containment actions included: eliminating staff, shifting staff roles, training staff on reimbursement methods, increasing use of telephone monitoring, increasing patient and family education and self-care, and cutting services to patients.		

Table A1. Narrative summaries of evidence regarding KQ1 and KQ3 (continued)

Author (Year)	Intervention	Key Question 1 Summary of Effect: Utilization	Key Question 1 Summary of Effect: Spending/costs	Key Question 1 Summary of Effect: Quality	Key Question 3 Summary of Effect
DeJong (2005)	Medicare IRF PPS	▪There was no significant change in LOS after PPS ▪Amount of therapy: Decrease in units (physical and occupational) in the most severe CMGs (roughly 20%), increase in units to moderate CMGs (also roughly 20%).		▪No significant change in case-mix (based on FIM). ▪Facilities took steps to evaluate care processes, particularly at the front and back ends of stays. ▪There were decreases for admission FIM, discharge FIM, and FIM improvement (between 8% and 15%) for severe CMGs. About a 5% decrease in admission FIM for mild CMGs, and a 35% increase in FIM post-PPS for mild CMGs.	▪Quality: FIM score improvement declined 15 percent post-PPS for severe CMGs (from 33.3 to 28.2) but dramatically improved for mild CMGs (41 percent, from 14.0 to 19.8).
Dobrez (2010)	Medicare IRF PPS	▪Length of stay was substantially lower for both Medicare (-1.86 days) and (-2.16) non-Medicare fee-for-service patients (both significant with $p<0.01$).		▪The Discharge motor/cognitive function coefficient (FIM) was -1.1/-0.15 for Medicare FFS patients ($p<0.01/p<0.05$); there were nonsignificant reductions for patients with all other payers. ▪The community discharge ratio was 0.87 post-PPS, $p<0.01$ for Medicare FFS patients; 0.95 and nonsignificant for patients with all other payers.	

Table A1. Narrative summaries of evidence regarding KQ1 and KQ3 (continued)

Author (Year)	Intervention	Key Question 1 Summary of Effect: Utilization	Key Question 1 Summary of Effect: Spending/costs	Key Question 1 Summary of Effect: Quality	Key Question 3 Summary of Effect
Eaton (2005)	Medicare HH PPS	▪There was a longer LOS post-PPS than pre-PPS (p=.000) Note these are individuals with both a pre and post observation. Also note LOS regression lacks a policy variable to identify post-PPS episodes.		▪The discharge status was questionable; 31.7% discharged to community pre-PPS versus 26.5% post-PPS. ▪The rates of wound improvement to wound deterioration were also questionable: 6.3% pre-PPS vs. 9.5% post-PPS wound improvement, but 22.3% pre-PPS versus 44.3% post-PPS wound deterioration.	
Ellis (1996)	NH Medicaid IPPS	▪Overall, a 4.5 day reduction in LOS (14%) for non-elderly, mentally disabled psychiatric patients appears to be attributable to payment system reform; (1.8 days is pure moral hazard effects and 3.0 days is practice style effect).			▪Utilization: Changes in Length of Stay, and the portions of those changes that can be attributed to moral hazard effects, selection effects, and practice style effects, all vary by hospital type ▪Utilization: Length of stay increased for short-stay patients, and decreased for long-stay patients; virtually all change in average length of stay is accounted for by changes in treatment for the longest stay patients

Table A1. Narrative summaries of evidence regarding KQ1 and KQ3 (continued)

Author (Year)	Intervention	Key Question 1 Summary of Effect: Utilization	Key Question 1 Summary of Effect: Spending/costs	Key Question 1 Summary of Effect: Quality	Key Question 3 Summary of Effect
Farrar (2009)	England NHS Payment by Results	▪ LOS fell more quickly in three of four comparisons (3-18 days less per 100 admissions over controls, p<.01) ▪Proportion of elective care provided as day cases increased more quickly in all comparisons, by 0.4-1.5% more than controls. (p<.01) ▪Number of spells increased in 3 of 4 comparisons (1.33-4.95% over controls, p<.01).		▪Discharge volume increased for trusts. ▪Little evidence on clinical outcomes (30 day postsurgical mortality, emergency readmission after treatment for hip fracture). The only significant result was a 2-year decrease in in-hospital mortality of .28 percentage points in one comparison (p<.01).	
FitzGerald (2006)	Medicare HH PPS	▪Home Health (HH) visits/episode decreased by 10% for joint patients; fell from 20.1 to 18.5 per episode (p<0.0001), 17% decrease for hip patients; dropped from 31.8 to 26.2 per episode post-PPS, larger decrease in for-profit agencies, dual eligible vs. not, and males vs. females. ▪Probability of HH use declined under IPS, but was relatively flat after implementation of PPS.			▪Utilization: Larger (approximately two times as large) declines in visits per episode for for-profit HHAs (in hip fracture and elective joint replacement patients). ▪Utilization: Larger declines in visits per episode , for dual eligible (for elective joint replacement patients only), and for women (for elective joint replacement patients only). ▪Utilization: Slight differences in change in visits per episode across various patient diagnoses

Table A1. Narrative summaries of evidence regarding KQ1 and KQ3 (continued)

Author (Year)	Intervention	Key Question 1 Summary of Effect: Utilization	Key Question 1 Summary of Effect: Spending/costs	Key Question 1 Summary of Effect: Quality	Key Question 3 Summary of Effect
FitzGerald (2009)	Medicare HH PPS	▪During the 120-day episode of care, mean HH visits decreased from 24.0 in 1996 to 14.1 in 2001 (Joint Replacement), 47.1 to 24.3 (Hip Fracture). Regional variation decreased over time. ▪In terms of the probability of HH selection, the national mean decreased from 0.61 in 1996 to 0.54 in 2001 (JR), 0.44 to 0.39 (HF). Little geographic variation in response.			▪Utilization: Hip fracture patients experienced a slightly larger post-PPS decline in the probability of receiving home health care (5 percent) than elective joint replacement patients (2 percent); hip fracture home health users experienced a larger decline in mean home health visits during a 120-day episode; ▪Utilization: The impact of bundled payment on probability of home health use and the number of visits also varied by CMS regional office geography.
Frymark (2005)	Medicare IRF PPS	▪The LOS reduced 7 days post-PPS. ▪Shift towards more speech and language sessions per week: 11% with >5 sessions/wk pre-PPS vs 77% post-PPS.		▪Comprehension of NOMS functional communication measures (FCM): 80% patients made progress post-PPS compared to 67% pre-PPS (p=0.04), otherwise no pre/post differences in improvement ▪Fewer patients achieved multiple levels of functional improvement post-PPS in motor, speech, swallowing, and memory.	

Table A1. Narrative summaries of evidence regarding KQ1 and KQ3 (continued)

Author (Year)	Intervention	Key Question 1 Summary of Effect: Utilization	Key Question 1 Summary of Effect: Spending/costs	Key Question 1 Summary of Effect: Quality	Key Question 3 Summary of Effect
Gillen (2007)	Medicare IRF PPS	▪ LOS shorter (about 5 days mean difference, p<0.001). Effect still significant when controlling for years of education, time from stroke to assessment, depression score, and cognitive impairment.		▪ Post-PPS patients had higher cognitive impairment and depression (on Geriatric Depression Scale). ▪More discharges to institutions (rather than home) post-PPS ▪ Lower discharge FIM (significant) and smaller change in FIM (p<.001) post-PPS.	
Grabowski (2011)	Medicare SNF PPS		▪There was an increase in billing of 4.9%/6.4% for all rehab RUG payment categories, 61.5%/30% for high rehab (SNF placing patients in higher reimbursement codes), DD/DDD specifications, respectively. Only 4.6% increase in "high rehab" categories after controlling for level of payment.	▪There was a 14.1% increase therapy minutes in DD, and a8.7% increase in DDD. There was only a 0.7% increase after controlling for level of payment. ▪There was no change post-PPS in DD or DDD specification (discharge within 20 or 90 days).	

Table A1. Narrative summaries of evidence regarding KQ1 and KQ3 (continued)

Author (Year)	Intervention	Key Question 1 Summary of Effect: Utilization	Key Question 1 Summary of Effect: Spending/costs	Key Question 1 Summary of Effect: Quality	Key Question 3 Summary of Effect
Hasegawa (2011)	Japan outpatient hemodialysis bundling	▪There was no significant change in patients getting rHuEPO ▪11.8% decrease in EPO dosage (p<.001) ▪IV iron prescription more likely post-bundling (10% increase), dosage not affected (p<.001)			▪Utilization: rHuEPO dosage decreased by 13.9% percent for relatively sicker patients and by 7.4% percent for healthier patients. The percent of relatively sicker and relatively healthier patients receiving IV iron increased by 6.5% percent and 11.3% percent, respectively. ▪Utilization: private hospitals were more likely to prescribe rHuEPO after reform (by 5.2 percent, compared to no change in the aggregate sample and a negative, insignificant change in private clinics and public hospitals)
Hutt (2001)	Medicare SNF PPS Demonstration			▪The amount of physical, occupational therapy received per stay by the highest-functioning patients increased in participating sites (19.3 to 26.5 visits per stay, but not in nonparticipating sites. ▪No association between PPS demo participating and community discharge at 30, 60, and 90 days.	▪Utilization: Use of physical therapy and occupational therapy increased for the highest functioning patients in PPS facilities, relative to those in non-PPS facilities. There was no significant difference among patients at lower functional levels at admission; Despite increased therapy provision, community residence 60 days after admission did not change for highest functioning patients in PPS facilities.

Table A1. Narrative summaries of evidence regarding KQ1 and KQ3 (continued)

Author (Year)	Intervention	Key Question 1 Summary of Effect: Utilization	Key Question 1 Summary of Effect: Spending/costs	Key Question 1 Summary of Effect: Quality	Key Question 3 Summary of Effect
Johnson (1994)	Michigan arthroscopic surgery bundling pilot		▪Reduction in spending of $125,539 compared to estimated payment for same patients under FFS; total payment under bundled payment was $193,000. ▪Hospital revenue of $96,500 compared to estimated FFS revenue of $84,892 (increase of $11,608). ▪Surgeon revenue of $96,500 compared to estimated FFS revenue of $51,877 (increase of 42,623).		
Konetzka (2004)	Medicare SNF PPS	▪In terms of professional staffing, the PPS has the strongest negative effect on the sum of RN and LPN hours per patient day, given a mean ratio of 1.2 hours/day, marginal effects of .2–.4 hours translate roughly to a 17–33 percent reduction attributed to PPS.		▪The estimated marginal effect of PPS after the full phase-in is an increase in regulatory deficiencies of .64 per survey, or about a 12 percent increase over the mean number of deficiencies (5.4). The estimated marginal effect that we can attribute to BBRA is a decrease in deficiencies of .18 per survey, or about a 3 percent decrease.	▪Quality: While no strong pattern of differential staffing was observed between for-profits and nonprofits or between chain and independent facilities, the authors note there is somewhat stronger evidence that hospital-based facilities reacted more strongly than freestanding facilities to PPS and the BBRA rate adjustments; No strong pattern of differential quality effects between for-profits and NFPs or between chain and independent facilities

Table A1. Narrative summaries of evidence regarding KQ1 and KQ3 (continued)

Author (Year)	Intervention	Key Question 1 Summary of Effect: Utilization	Key Question 1 Summary of Effect: Spending/costs	Key Question 1 Summary of Effect: Quality	Key Question 3 Summary of Effect
Konetzka (2006a)	Medicare SNF PPS			▪The probability of developing a UTI or pressure sore increased among long-stay residents post-PPS. Effects were proportional to the percent of Medicare residents in a facility. A 10% Medicare facility would be expected to have 2.6 more UTIs and 1.1 more pressure sores per quarterly assessment per 100 residents because of PPS.	
Konetzka (2006b)	Medicare SNF PPS			▪On average, the change to prospective payment increased the probability that a nursing home resident acquired a stage-2-or-above pressure sore by .0021 and a urinary tract infection by .0020 on any given quarterly assessment; The rate effect variable shows only a marginally significant effect for urinary tract outcomes and is nonsignificant for pressure sores.	▪Quality: The study examined deficiency differences by facility type (for-profit/non-profit) and market (high-occupancy area/low-occupancy area); although some differential effects were observed, the study reported no consistent, statistically significant differences in overall effect based on these variables; No consistent, statistically significant differences in overall impact on quality measures by facility characteristic.

Table A1. Narrative summaries of evidence regarding KQ1 and KQ3 (continued)

Author (Year)	Intervention	Key Question 1 Summary of Effect: Utilization	Key Question 1 Summary of Effect: Spending/costs	Key Question 1 Summary of Effect: Quality	Key Question 3 Summary of Effect
Kulesher (2006)	BBA changes broadly, including Medicare HH PPS and SNF PPS	▪In Delaware (DE), SNFs per 1000 beneficiaries decreased by 3.8% from 1997-2000 after a 16.4% increase from 1991-1996. ▪ In DE, there was an increase of 9.4% from 1997-2000 (unk. Base) in SNF LOS days ▪HH visit/user after a decrease of -5% from 1991-1996. 1997-2000 decreases for NFP SNFs ▪DE: -17.2% decrease from 1997-2000 after 4.7% increase from 1991-1996.	▪The SNF $ per patient in Delaware increased by 13.3% from 1997-2000 after a 10% increase from 1991-1996 ▪The HH $/ per patient in Delaware decreased 7.9% from 1997-2000 after 9.8% increase from 1991-1996.		
Lapane (2004)	Medicare SNF PPS	▪No change in likelihood in antidepressant use or SSRI post-PPS: (OR, 1.05; 95% CI, .93 – 1.18) or SSRI (OR, .98; 95% CI, .86 – 1.12) being used after PPS (2000 relative to 1997).			
Lapane (2006)	Medicare SNF PPS	▪Post-PPS:Pre-PPS Odds Ratio for Rx antiplatelets was 1.21 to 1.37 depending on patient group. ▪No relationship between PPS and use of anticoagulants for stroke prevention. Increased likelihood of use of antiplatelets post-PPS (OR 1.26, p<0.05).			

Table A1. Narrative summaries of evidence regarding KQ1 and KQ3 (continued)

Author (Year)	Intervention	Key Question 1 Summary of Effect: Utilization	Key Question 1 Summary of Effect: Spending/costs	Key Question 1 Summary of Effect: Quality	Key Question 3 Summary of Effect
Lin (2005a)	Medicare HH PPS	▪ Increased use of RN services, home health aide services, and a decrease in physical therapy. ▪81% of agencies reported increased demands on informal caregivers, ▪Increases in patients served, visits per patient, length of time patients on service; decreases in length of visit, and number of hospital readmissions. ▪ 51% of HHAs report employees performing new activities, 53% report increased staff turnover, and 59% report increased use of overtime as a result of PPS.	A survey showed HHA financial position: 64% of HHAs report improvement with PPS relative to IPS (22% worsened, rest undecided).	▪When measuring administrative burden, approximately two thirds of the agencies indicated that the OASIS added a heavy burden on their resources, whereas one third indicated that it added some burden. ▪A survey revealed that 84% of HHAs reported staff experienced “increased job-related stress” due to PPS. ▪30% of HHA respondents reported an increase in number of hospital readmissions.	
Lin (2005b)	Medicare HH PPS	▪Total HH visits decline 41% and Medicare visits declined 42%, from 1997 to 2001. The HH total users declined 8%, Medicare users declined 12%, from 1997 to 2001.	▪HHA profit was $511 per non-LUPA episode (reimb-cost) post-PPS ▪ 40% of HHAs in rural Pennsylvania reported financial vulnerability continued under PPS, but 64% reported financial situation improved with the change from the IPS.		

Table A1. Narrative summaries of evidence regarding KQ1 and KQ3 (continued)

Author (Year)	Intervention	Key Question 1 Summary of Effect: Utilization	Key Question 1 Summary of Effect: Spending/costs	Key Question 1 Summary of Effect: Quality	Key Question 3 Summary of Effect
McCue (2006)	Medicare IRF PPS	▪IRFs sticking with the old cost-based reimbursement system had a greater reduction in LOS (2.33 days) than those that switched to PPS (1.35 days).	▪No significant difference between groups in Medicare payment per discharge; Smaller growth for PPS group (2.6%) compared to old cost-based group (12.83%) ▪Reduction in operating cost per discharge for PPS group (-5.8%) compared to an increase for cost-based group (0.4%) ▪Operating margin and total profit margin were higher for PPS group (about 12.5% each) compared to cost-based group (about 5% each).	▪No significant difference between PPS and non-PPS groups in Medicare discharges and total discharges.	
Menke (1998)	Department of Veterans' Affairs Resource Allocation Methodology (RAM)	▪Decline in ALOS steepest during Resource Allocation Methodology (RAM) years for 17 of 22 groups; RAM associated with <5 percentage point greater decline in ALOS for medical groups, 4 to 6.5 percentage point greater decline for surgical groups. Larger impact for psychiatric patients. Similar effects on inpatient days per patient.		▪Negligible association between RAM and discharges per patient	▪Utilization: Reductions in length of stay varied based on patient diagnosis; RAM reduced length of stay relative to comparison payment methods for 17 of 22 diagnoses; the most significant changes were seen among psychiatric diagnoses

Table A1. Narrative summaries of evidence regarding KQ1 and KQ3 (continued)

Author (Year)	Intervention	Key Question 1 Summary of Effect: Utilization	Key Question 1 Summary of Effect: Spending/costs	Key Question 1 Summary of Effect: Quality	Key Question 3 Summary of Effect
Murray (2005)	Medicare SNF PPS			▪Home discharge planned, family/friend contact, restraint use, history mental illness, can make needs understood, normal vision, motor score, and stroke rates lower post-PPS ▪Provision of rehab therapy increased (68% to 90%). Largest increases for quintiles with lower predictive scores, amount f therapy decreased (7.1 hrs/wk to 6.2 hrs/wk).	
Murtaugh (2003)	Medicare HH PPS	▪The average HH visits per user decreased 24% in first year of PPS, from 2000-2001. ▪The number of users (per 1000 beneficiaries) .decreased by 8% in first year of PPS; from 2000 to 2001.	▪Payment per HH visit increased by 51% in first year of PPS 2000-2001 (38% adjusted for inflation and change in service mix). ▪The overall mean annual payment for HH users went up 11%; Ortho: up 41%; Neuro.: up 21%; Diabetes: down 20%; burn/trauma: down 7% ▪HH spending/visit went up from $59.37 in 2000 to $82.18 in 2001 (adjusting for inflation and mix of HH disciplines).		▪Utilization: Payments increased in real terms for some diagnosis categories (by 41 percent for orthopedic diagnoses and 21 percent for neurological diagnoses) and decreased for others (by 18 percent for diabetes diagnoses and 7 percent for burn or trauma diagnoses); Decreases in visits were similar across diagnoses ranging from a 19 percent decrease in orthopedic diagnoses to a 26 percent decrease for diabetes diagnoses.
Nayar (2008)	Medicare LTACH PPS	▪Staffing: From a multivariate regression: 1 additional full-time equivalents per 1000 inpatient days post-PPS. Raw change: +12.42% off base of 9 from 2001-2004.			

Table A1. Narrative summaries of evidence regarding KQ1 and KQ3 (continued)

Author (Year)	Intervention	Key Question 1 Summary of Effect: Utilization	Key Question 1 Summary of Effect: Spending/costs	Key Question 1 Summary of Effect: Quality	Key Question 3 Summary of Effect
Paddock (2007)	Medicare IRF PPS	▪There was little change in predicted LOS in pre and post IRF PPS.	▪In terms of percentage w/ cost above the payment group average, there was a 5.5% reduction post-PPS for all conditions, +DH25, -6% for hip fracture, -4% for lower extremity joint replacement, -5.5% for stroke. ▪In terms of percentage with LOS above the payment group average, there was an 11% reduction post-PPS for all conditions, -11.5% for hip fracture, -11% for lower extremity joint replacement, and -9.5% for stroke.	▪There were few major changes in the % with FIM score (motor, cognitive, and total) below payment group average. The largest was a 0.41% decrease in cases with below-average FIM motor score (i.e., an improvement). There was a reduction in patients with high predicted probability of 150-day mortality post PPS.	▪Spending: A post-PPS reduction in spending per case was larger for hip fracture patients (about 6 percent below predicted spending) than for joint replacement or stroke patients (about 4 percent and 5.5 percent below predicted spending, respectively).
Perelman (2007)	Belgian inpatient non-medical PPS	▪There was a1.49% decrease in LOS attributed to change to non-medical PPS (p<.05).	▪There was an increase in medical/surgical spending post-PPS (additional 0.8% a year post reform for surgical, 0.5% for medical, both p<.05).		▪Utilization: In the year of the reform average length of stay decreased in high-SES hospitals and increased in low-SES hospitals. In later years, average length of stay decreased in low-SES hospitals and did not change in high-SES hospitals
Qu (2011)	Medicare IRF PPS	▪There was a significant decrease in LOS for Medicare patients (5.8 days/yr) post-PPS, and shorter LOS for non-Medicare patients (1.3 days/yr) post-PPS.		▪Functional improvement FIM (with a motor component) score gains were not significantly different in the pre-PPS and PPS periods.	▪Utilization: Significantly longer length of stay for only Medicare incomplete tetraplegia patients (p<0.05), and not for incomplete paraplegia, complete paraplegia, or incomplete tetraplegia

Table A1. Narrative summaries of evidence regarding KQ1 and KQ3 (continued)

Author (Year)	Intervention	Key Question 1 Summary of Effect: Utilization	Key Question 1 Summary of Effect: Spending/costs	Key Question 1 Summary of Effect: Quality	Key Question 3 Summary of Effect
Rosenthal (1999)	Case Rate for managed behavioral health care	▪Visits per episode reduced by 25% under case rate (p<.01) ▪Patients under case rate more likely to receive meds, be referred for self-help, or referred to a community mental health center		▪No effect of case-rate on probability of single visit episodes (a measure of patient selection) ▪No effect of case-rate on Global Assessment of Functioning scores	▪Additional reduction in visits per episode of 22.3% among providers with intensive utilization review (p<.01) ▪Higher share of FFS revenue increases visits, 34% at 50% FFS revenue compared to no FFS revenue (p<.05)
Rosenthal (2000)	Case Rate for managed behavioral health care	▪Visits per episode reduced by 20%-25% (depending on model specs) under case rate (p<.05)			▪Additional reduction in visits per episode of 22.3% among providers with intensive utilization review (p<.01); ▪Higher share of FFS revenue increases visits, 34% at 50% FFS revenue compared to no FFS revenue (p<.05)
Schlenker (2005)	Medicare HH PPS	▪Significant decrease in HH visits/episode post-PPS (about 3 days aggregated over SN, therapy, and aide after adjusting for HHRG off a base of 18, about a 16.6% decline); Separately, decreases of -1.76 for SN and -1.69 for aide and an increase of 0.45 for therapy. ▪There was a shift toward higher levels of weight distribution in Home Health Resource Groups in PPS period.		▪Generally, there was improvement in ADLs post-PPS (sig. odds ratios of 1-1.7 for 5 of 7 ADLs and for all three ADL stabilization measures, not significant >1 for one more, and sig. <1 for two more; Mixed results for IADLs, with post-PPS "winners" outpacing losers. ▪Generally modest changes in various clinical outcomes (risk adjusted).	▪Quality: While results in the stratified analyses were generally similar to the pooled analysis noted above, there were some differential effects, e.g., the measure "stabilization in transferring" was likely to worsen post-PPS for the least dependent patients (odds ratio 0.883, p=0.002) while more dependent patients were more likely to improve post-PPS (odds ratio = 1.631, p<0.001)

Table A1. Narrative summaries of evidence regarding KQ1 and KQ3 (continued)

Author (Year)	Intervention	Key Question 1 Summary of Effect: Utilization	Key Question 1 Summary of Effect: Spending/costs	Key Question 1 Summary of Effect: Quality	Key Question 3 Summary of Effect
Shah (2007)	Medicare IRF PPS			▪There was an increase in observed patient satisfaction from 60.3 to 63.4% (P < 0.01) after PPS implementation. ▪Adjusted motor FIM gain decreased (19.5 to 17.9, p<.05); cognitive FIM gain increased (1.4 to 2.9 (p<.05) in all sites after PPS.	
Sood (2008)	Medicare IRF PPS	▪There was a 3 to 11% decline in LOS post PPS depending on condition and pre-PPS payment limit, all significant, p<0.01. Larger decreases for IRFs with high pre-PPS payment limits.	▪Average payment per discharge up between 18-23% post-PPS ▪Marginal payment (estimated): Between 2-9% decrease in costs. ▪IV: Marginal cost per discharge fell 11% for stroke, 8% for hip, and 7% for joint replacement as a result of lower marginal reimbursement post-PPS. ▪The elasticity of costs with respect to average reimbursement ranged from 0.26 to 0.34.	▪Little or no impact of PPS on outcomes such as the rate of return to community 60 days after IRF admission and mortality.	
Stromberg (1997)	Sweden inpatient PPS	▪ALOS decreased by 42% after PPS (p<0.05). Hospital days post-fracture decreased but were replaced by nursing home days. Total hospital and nursing home days increased by 8% (p<.05).	▪Total cost for the year after hip fracture increased by 5% despite decrease in orthopedic costs due to increase in post-acute care utilization.	▪Patients discharged to own home decreased from 56% to 43% while patients discharged to institution increased from 36% to 54%. ▪Mortality decreased from 8% to 3%.	▪Spending: Under PPS, inpatient bed-days and costs related to hip fracture increased by 18% and 15% respectively for Stockholm hospitals in general, but decreased by 23% and 15% in a hospital operating a dedicated hip fracture unit.

Table A1. Narrative summaries of evidence regarding KQ1 and KQ3 (continued)

Author (Year)	Intervention	Key Question 1 Summary of Effect: Utilization	Key Question 1 Summary of Effect: Spending/costs	Key Question 1 Summary of Effect: Quality	Key Question 3 Summary of Effect
Tsai (2005)	Taiwan's Bureau of National Health Insurance's case payment system	▪After the case payment system was implemented, LOS decreased by 0.59 days ($P < 0.0001$), the number of minimally required services increased by 2.19 to 4.24 items ($P < 0.0001$), the number of optional service items decreased by 0.32 items ($P < 0.0001$), and drug prescription decreased slightly by 0.58 to 0.99 items ($P < 0.0001$) per hospitalization. ▪23.74% increase in surgeries post-case payment (descriptive stat).			▪Utilization: Average length of stay decreased by 0.59 days, 0.67 days, and 0.83 days at medical centers, district hospitals, and regional hospitals, respectively.
Vos (2010)	Netherlands inpatient prospective payment			▪81% of hospitals undertook projects to establish care programs; 33% of care delivery was organized in care programs; 75.4% of hospitals appointed process owners. ▪93.5% of hospitals have clinical protocols for specific diseases; 75% have organizational protocols for routing patients.	
Wen (2008)	Taiwan hospital case payment	▪LOS yielded a 0.6 day decrease in first year, additional 0.26 day decrease in second year relative to FFS period, ▪Summary: decrease in 0.15 outpatient visits by year 2 after smaller increase in year 1 post-PPS.	▪Decrease of 2% in first year for log inpatient $, unclear on incremental decrease in second year ▪Decrease of 7% in first year for log x-ray $, additional decrease in second year ▪Increase of 4% in first year for log lab test $, decrease in second years.	▪The total inpatient and outpatient claims decreased 2% in the first year of CP, and 12% in the second year, relative to pre-CP, ▪The number of diagnoses at intake increased indicating more unhealthy patients ($p<.01$).	

Table A1. Narrative summaries of evidence regarding KQ1 and KQ3 (continued)

Author (Year)	Intervention	Key Question 1 Summary of Effect: Utilization	Key Question 1 Summary of Effect: Spending/costs	Key Question 1 Summary of Effect: Quality	Key Question 3 Summary of Effect
White (2003)	Medicare SNF PPS	▪ALOS in SNF decreased from 23.8 in 1997 to 22.9 in 2000	▪The average SNF rehabilitation charge per hospital stay decreased 44.6% (from $421) between 1997 and 2000; largest decrease for for-profit freestanding SNFs, less dramatic decrease for NFP SNFs, and small increase in charges for hospital-based SNFs ▪The distribution in patients by charges shifted in patients with >$200 charges, from 19% in 1997 to 1.6% in 2000 for for-profit SNFs. Less dramatic decrease for NFP SNFs.	▪The probability of being discharged to a SNF following a hospital stay decreased from 16.3% in 1997 to 14.7% in 2000; total SNF days decreased from 42.0 M in 1997 to 36.9 M in 2000.	▪Spending: A significant decline in rehabilitation charges per stay for for-profit, freestanding SNFs was offset by smaller decline for not-for-profit SNFs and a small increase in charges for hospital-based SNFs.
White (2005)	Medicare SNF PPS	▪PPS effect has strong negative associated with nurse staffing, smaller effect among nonprofit. Average effect is decrease of 13 minutes of nurse time per day.	▪In terms of staffing, there was a significant decrease in costs spent on all nurse types (CNA, LPN, RN, total).	▪There was no consistent or significant effect on the quality of care (i.e., "deficiencies," pressure sores, use of restraints).	
Wodchis (2004a)	Medicare SNF PPS			▪Medicare beneficiaries more likely to be discharged to home post-PPS, but non-Medicare residents had an even better improvement. ▪The relative risk for discharge to death was 0.81 ($p<0.001$) for Medicare beneficiaries post-PPS, but overall higher relative risk (1.58) for Medicare beneficiaries (gap shrunk, but still there).	

Table A1. Narrative summaries of evidence regarding KQ1 and KQ3 (continued)

Author (Year)	Intervention	Key Question 1 Summary of Effect: Utilization	Key Question 1 Summary of Effect: Spending/costs	Key Question 1 Summary of Effect: Quality	Key Question 3 Summary of Effect
Wodchis (2004b)	Medicare SNF PPS			▪There was an increased probability of any rehab therapy (3% increase), decreased therapy time (4% average expected rehab time) post-PPS. ▪12 percentage point increase in the probability of therapy time at one of these nodes post-PPS (45, 150, 325, 500, and 720 mins of therapy).	
Yip (2002)	Medicare SNF PPS			▪Post-PPS patients had lower physical functioning score (10.52 vs. 20.10) and physical summary scores (24.11 vs. 26.52) and higher role emotional scores (68.44 vs. 55.83) ▪Patients received 5 less physical therapy days under PPS (18.53 to 13.09 days), patients received 46.6% of physical therapy and 54.4% of occupational therapy (in minutes) under PPS compared to before.	
Zhang (2008)	Medicare SNF PPS			▪After acuity and quality adjustment, there was a gradual decline in efficiency from a mean of 0.198 in 1997 to 0.131 in 2003 (resident days over operational expenses). BBA, BBRA, and BIPA each decreased efficiency between 1 and 2/100's of a point. Other factors important (e.g., HHI).	

Table A1. Narrative summaries of evidence regarding KQ1 and KQ3 (continued)

Author (Year)	Intervention	Key Question 1 Summary of Effect: Utilization	Key Question 1 Summary of Effect: Spending/costs	Key Question 1 Summary of Effect: Quality	Key Question 3 Summary of Effect
Zinn (2008)	Medicare SNF PPS	Medicaid case mix index and Medicare PPS increased administrative nurse staffing by, on average, 5.5% and 4.0%, respectively. ▪Complementary with direct care staffing: increase in total direct care nurse staffing by 0.5 hrs. per day associated with 12% increase in admin nurse hrs. per day.			▪Utilization: "Medium" SNFs (between 100 and 199 beds) and "large" SNFs (200 or more beds) had about 5 percent higher administrative nurse staffing post-PPS compared to "small" SNFs (fewer than 100 beds). The study reported no differences in administrative nursing levels between chain and non-chain SNFs and for-profit vs. not-for-profit SNFs.

Table A2. Study characteristics

Author (Year)	Intervention	Design	Provider Locations (n)	Study enrollment (n)	Controls included for multivariate analyses	Assessment of Methodological Quality
Abt Associates (1997)	Medicare Cataract Surgery Alternate Payment Demonstration	Observational	4	Total: 5,343 Intervention: 4,565	None	Poor: small sample, non-representative/ self-selected sites, contrived comparison group, overall poor control for secular trends/confounders
Afendulis (2011)	Medicare SNF PPS	Observational	NR	507,350	Patient characteristics: age, gender, and race; 30 risk-adjustment variables (Elixhauser et al., 1998); total prior year Medicare inpatient spending. Health care market at baseline (by 3-digit Zip Code): percent of SNF beds integrated with a hospital; percent hospital beds by ownership status, facility size, teaching status, and system membership; percent SNF beds by ownership status and facility size; number SNF beds per population aged 66 or older; Herfindahl-Hirschman indices of hospital and SNF competition. Area-level measures of the generosity of Medicare reimbursement for both hospital and SNF services.	Fair
Anderson (2005)	Medicare Home Health (HH) Prospective Payment System (PPS)	Observational	1	Total: 144 Intervention:76	None	Poor: Large differences between pre & post groups
Brizioli (1996)	Italy inpatient prospective payment	Descriptive	4	Total: 1,987 Intervention: 1,056	None	Poor: descriptive, no apparent control for secular trends, small sample and short study period (one year before and after change)

Table A2. Study characteristics (continued)

Author (Year)	Intervention	Design	Provider Locations (n)	Study enrollment (n)	Controls included for multivariate analyses	Assessment of Methodological Quality
Buntin (2009)	Balanced Budget Refinement Act of 1999 (in aggregate; implements PPS for HH, Skilled Nursing Facility [SNF], and Inpatient Rehabilitation Facility [IRF])	Observational	NR	Total: 4,717,315 Intervention: NR	Time trend, policy implementation variables, demographics (age, gender, Medicaid coverage, race, residence (MSA), urban/rural status, comorbidities and complications); discharging hospital characteristics (case average daily census, teaching status, ownership, Medicare patient percentage, case mix index, low-income percentage).	Fair
Casale (2007)	Geisinger ProvenCare	Observational	3 hospitals	Total: 254 Intervention: 117	None	Fair
Cheh (2001)	Medicare HH PPS Demonstration	Trial randomized at agency level	91 agencies (48 treatment, 43 control)	Approx. 114,000	Patient data (patient health and functioning), agency data, market-area data	Fair
Chen (2000)	Taiwan inpatient PPS (TPPS)	Descriptive	1	Total: 199 Intervention: 99	None	Fair
Chen (2002)	Medicaid SNF PPS	Observational	4,635	Total: NR Intervention: NR	Output (patient days by payer); wages, quality of care and quality of life measures; case-mix (based on ADL data); ownership type; geographic and market characteristics, staffing	Poor: descriptive, pre-post with no control for secular trends or confounds
Coburn (1993)	Maine Medicaid nursing home PPS	Observational	103-139 per year (762 facility-years)	Total: NR Intervention: NR	Nursing home size (# beds), ownership (non-profit/for-profit & chain/non-chain), facility type (ICF only or multi-level), occupancy rate, Medicaid share of total inpatient days, case-mix (3 measures), nursing intensity (in hours per patient day), quality of care (3 measures), bed supply (per 1000 pop =>age 65 in market area)	Fair

Table A2. Study characteristics (continued)

Author (Year)	Intervention	Design	Provider Locations (n)	Study enrollment (n)	Controls included for multivariate analyses	Assessment of Methodological Quality
Collins (2007)	Medicare SNF PPS	Descriptive	1 hospital-based HHA in the Scranton/Wilkes-Barre area of PA	Total: 39 Intervention: 25	None	Poor: Small n, four year gap between pre/post, no attempt to address changes over time, or confounders, ambiguous quality metrics.
Cromwell (1998)	Medicare Participating Heart Bypass Center Demonstration	Observational	7	Varies by analysis. 10,572 in intervention and 64,178 for control group in some main analyses	Generally: Changes in case mix.	Fair
Davitt (2008)	Medicare HH PPS	Observational	22 medical directors for survey component; 24,852 (year-HH agency obs, universe active in each of three periods)	Total: NR Intervention: NR	None	Poor: Small non-representative sample for qualitative interviews, no controls in quantitative analyses.
DeJong (2005)	Medicare IRF PPS	Observational	3	Total: 539 Intervention: 304	Univariate for relevant outcomes	Fair
Dobrez (2010)	Medicare IRF PPS	Observational	132	Total: 98,151 Intervention: 44,634	Patient chars (age, gender, admission motor and cognitive function on FIM); facility chars (census region indicators, urban/rural, ownership, free standing vs unit), quarterly time trend	Fair
Eaton (2005)	Medicare HH PPS	Observational	NR	Total: 555 Intervention: NR	Univariate: Comorbidities directly related to tissue and wound healing; Diagnoses: diabetes, circulatory deficiencies, nutritional deficiencies, paralysis of any type, muscle-related chronic illness, and immune deficiencies; home environment/caregiver support; home sanitation	Poor: Tracked outcomes for a single cohort of patients across two consecutive time periods.

Table A2. Study characteristics (continued)

Author (Year)	Intervention	Design	Provider Locations (n)	Study enrollment (n)	Controls included for multivariate analyses	Assessment of Methodological Quality
Ellis (1996)	NH Medicaid IPPS	Observational	28 hospitals	Total: 13,704 Intervention: 3,204	Demographic variables (patient's sex, age group [classified into four categories], race [coded using a dummy for nonwhite]and the average per capita income in the patient's town in 1990 as a proxy for the patient's own average income), provider dummies, and time dependent variables	Fair
Farrar (2009)	England NHS Payment by Results	Observational	297 (England: 248, Scotland:49)	Total: NR Intervention: NR	Fixed effects for HRGs and hospital trusts, and interaction for each combination of HRGs and trusts	Fair
FitzGerald (2006)	Medicare HH PPS	Observational	NR	Total: 2,800,000 Intervention: 10,000	Time trend, policy indicators, **patient** covariates (age, gender, race, SES, state aid, reason for Medicare, comorbidities, surgical characteristics); **institutional** covariates/SNF (teaching status, profit status, relative size, day of discharge, urban/rural); **home health** covariates (profit status, age of agency, CON flag); **regional** covariates (beds, providers per capita, mco penetration, CMS region, postacute care supply, Medicare managed care market penetration)	Fair
FitzGerald (2009)	Medicare HH PPS	Observational	NR	Total: 2,800,000 Intervention: NR	Patient: age, gender, race, SES, receipt of state aid, reason for Medicare entitlement, Charlson comorbidity index, surgical characteristics. Institution: teach status, proft status, day of discharge, relative size, rural/urban. HH: profit status, agency age, operating under CON or simple business licensure. Region: zip code % population age 65+, county managed care penetration rate, CMS region indicator; Monthly time trend.	Fair

Table A2. Study characteristics (continued)

Author (Year)	Intervention	Design	Provider Locations (n)	Study enrollment (n)	Controls included for multivariate analyses	Assessment of Methodological Quality
Frymark (2005)	Medicare IRF PPS	Observational	96	Total: 13,863 Intervention: 2,631	FCM scores, details about patient demographics, diagnosis, service delivery and amount, frequency and intensity of services, FIM scores at admission, FIM scores at discharge, and the patient's discharge disposition	Fair
Gillen (2007)	Medicare IRF PPS	Observational	1	Total: 945 Intervention: 409	None	Poor: Single hospital, 8.5 years between pre/post, obvious differences in baseline chars.
Grabowski (2011)	Medicare SNF PPS	Observational	17,554	Total: 496,049 Intervention: 292,669	Person-level covariates: Age, sex, race, marital status, education, Medicare Part B coverage, ADL score, fall, fracture, hip fracture, stroke, hypertension, cancer, COPD, depression, resists care. Facility-level covariates: hospital-based facility, chain member facility, profit status, government facility, number of beds. Time trend.	Good: Robust DDD identification strategy; comprehensive data; careful accounting of payment level changes accompanying PPS, robust sensitivity analyses, good controls for confounding.
Hasegawa (2011)	Japan outpatient hemodialysis bundling	Observational	53	Total: 3,206 Intervention: 1,622	None, but potential confounders discussed (e.g., dose trends, case mix changes)	Fair
Hutt (2001)	Medicare SNF PPS Demonstration	Observational	35 facilities in 3 states	Total: 2,067 Intervention: NR	Case mix and other nonspecified patient factors (state, clinical and demographic risk factors)	Fair
Johnson (1994)	Michigan arthroscopic surgery bundling pilot	Descriptive	1	111	None	Poor: Descriptive study with small, selected sample of patients and providers.

Table A2. Study characteristics (continued)

Author (Year)	Intervention	Design	Provider Locations (n)	Study enrollment (n)	Controls included for multivariate analyses	Assessment of Methodological Quality
Konetzka (2004)	Medicare SNF PPS	Observational	18,134	Total: Intervention: NR	State fixed effects, time (year) fixed effects, facility characteristics such as ownership(for-profit, government, chain, hospital-based), size (# of beds, % private pay), level of care and resident case mix; availability of ventilator care, physical therapy, and occupational therapy; skilled services provided; % of residents with depression, psychiatric diagnoses, and dementia; county economic and demographic factors such as the level of competition, income, and population density.	Fair
Konetzka (2006a)	Medicare SNF PPS	Observational	1,406	Total: 262743 Intervention: NR	Resident-level severity controls (age, gender, a group of diagnoses, dependence in Activities of Daily Living [ADLs] and a validated measure of cognitive functioning called the Cognitive Performance Score; Facility fixed effects; Time fixed effects	Fair
Konetzka (2006b)	Medicare SNF PPS	Observational	1,704	Total: 395,264 Intervention: NR	Patient: age, gender, comorbidity, ADLs, Cognitive Performance Score, Medicare payer status (at the individual level). Facility fixed effects.	Fair
Kulesher (2006)	BBA changes broadly, including Medicare HH PPS and SNF PPS	Descriptive	NR	Total: NR Intervention: NR	None	Poor: A collection of various univariate analyses. Does not control for obvious confounders.
Lapane (2004)	Medicare SNF PPS	Observational	524	Total: 8,149 Intervention: 5,209	Individual characteristics: (age, race/ethnicity; comorbidities; number, CVD, stroke, HTN, DM); measures of physical, social and cognitive functioning (ADL, CPS); SNF characteristics: (ownership, chain membership, number of beds, payer mix)	Poor: Adequate controlling for patient and SNF characteristics, but no attempt to address changes in prescription rates over time.

Table A2. Study characteristics (continued)

Author (Year)	Intervention	Design	Provider Locations (n)	Study enrollment (n)	Controls included for multivariate analyses	Assessment of Methodological Quality
Lapane (2006)	Medicare SNF PPS	Observational	1,226	Total: 10,331 Intervention: 5,243	Gender, age, physical condition and cognitive impairment levels, comorbidities, SNF beds, ownership, occupancy rates, Medicare and Medicaid share, staffing, service availability indicators	Fair
Lin (2005a)	Medicare HH PPS	Observational	69 of 83 rural PA HHA's in survey; 10 rural HHA's in data analysis	Total: 12,720 Intervention: 6,995	None	Poor: Use of survey data, many details missing, no discussion of potential confounders, graphs and text are inconsistent.
Lin (2005b)	Medicare HH PPS	Observational	Structured interviews: n=68; microdata analysis: 10 rural HHAs in northwest PA for detailed analysis and all designated 'rural' HHA's in PA for "macro-level" analysis	Total: NR Intervention: NR	None	Fair
McCue (2006)	Medicare IRF PPS	Descriptive	146, 120 transitioning to PPS in 2002, 26 which stayed with cost-based	Total: NR Intervention: NR	None	Poor: Inadequate follow-up post intervention (1 fiscal year); descriptive with significant differences between control and intervention groups in pre period.
Menke (1998)	Department of Veterans' Affairs Resource Allocation Methodology (RAM)	Observational	172	Total: NR Intervention: NR	Patient: age, gender, race, married, military cohort, service-connected disability, discharge destination, comorbidities. Hospital: teaching status, beds, urban/rural, region. Market: beds, MDs, HMO members.	Fair

Table A2. Study characteristics (continued)

Author (Year)	Intervention	Design	Provider Locations (n)	Study enrollment (n)	Controls included for multivariate analyses	Assessment of Methodological Quality
Murray (2005)	Medicare SNF PPS	Observational	940	Total: 68,575 Intervention: 61,569	109 variables including demographics, insurance status, frequency of family contacts, mental health and dementia measures, communication ability, vision, level of daily activities, functional status, continence, pressure ulcers, pain, BMI, comorbidities, body control and contracture, medical stability.	Fair
Murtaugh (2003)	Medicare HH PPS	Descriptive	NR	Total: (1997-2001): 144,725 (2000-2001): 50357 Intervention: 24453	None	Poor: Descriptive: short duration/only covers first year of PPS; poorly controlled for secular trends/confounding variables.
Nayar (2008)	Medicare LTACH PPS	Observational	212	Total: NR Intervention: NR	Hospital chars (ownership, payer mix, beds, teaching indicators, discharges); market chars (population, income, concentration), time trend	Fair
Paddock (2007)	Medicare IRF PPS	Observational		Total: 809,544 Intervention: 446,002	Patient characteristics (age, gender, race, number of acute care stays in 6 mos prior to IRF, complications and comorbidities), facility and geographic chars for referring acute care hospital (average daily census, case-mix index, Medicaid util rate, low-income patient proportion, beds, wage index, urban/rural status, state or census region), Medicare share	Fair
Perelman (2007)	Belgian inpatient non-medical PPS	Observational	125	Total: 11,633,227 Intervention: NR	Age group, diagnosis related groups, death and transfer rates, low and high SES percentages, time trend, cost sharing percent for hospitals for excessive days	Fair
Qu (2011)	Medicare IRF PPS	Observational	12	Total: 3,406 Intervention: 296	Trend in LOS, patient age, level of neurologic impairment, admission motor FIM score	Fair

Table A2. Study characteristics (continued)

Author (Year)	Intervention	Design	Provider Locations (n)	Study enrollment (n)	Controls included for multivariate analyses	Assessment of Methodological Quality
Rosenthal (1999)	Case Rate for managed behavioral health care	Observational	26 in experimental group (unspecified number of controls)	21,673	Patient characteristics identifying severity of illness; provider characteristics including dollar amount of case rate, share of revenue from fee-for-service, use of intense utilization review, staffing model, compensation model	Fair
Rosenthal (2000)	Case Rate for managed behavioral health care	Observational	26 in experimental group (unspecified number of controls)	49,463 episodes	Patient characteristics: age, gender, primary beneficiary, diagnosis, episode utilization, prior chemical dependency utilization, prior inpatient utilization. Provider characteristics: staffing model, provider size, compensation model, use of utilization review, proportion of revenue received via FFS contracts	Fair
Schlenker (2005)	Medicare HH PPS	Observational	NR	Total: 164,810 Intervention: 28,806	37 risk factors used in CMS outcome reports	Fair
Shah (2007)	Medicare IRF PPS	Observational	4 (all affiliated with a midwestern network of inpatient and outpatient rehabilitation centers and have distinct case-mix characteristics)	Total: 8,082 Intervention: 4,806	Respondent type (patient vs. proxy), age, gender, functional gain (based on FIM), and discharge destination	Poor: The patient sample is large, but they're taken from a small number of related provider institutions. In that sense, it's probably not representative.
Sood (2008)	Medicare IRF PPS	Observational	1,145	Total: 430,539 Intervention: NR	Demographics (age, gender, race, MSA, rural/urban); health status (comorbid condition #, complication #, any comorbid indicator, any complication indicator); condition-specific factors (various indicators and severity factors). IV to disentangle avg from marginal payment effects.	Good: Solid theoretical foundation, strong instrumental variables identification strategy to disentangle effect of marginal versus average reimbursement on costs.
Stromberg (1997)	Sweden inpatient PPS	Descriptive	5	Total: 2,331 Intervention: 1,271	None	Poor: Descriptive without discussion of potential confounders.

Table A2. Study characteristics (continued)

Author (Year)	Intervention	Design	Provider Locations (n)	Study enrollment (n)	Controls included for multivariate analyses	Assessment of Methodological Quality
Tsai (2005)	Taiwan's Bureau of National Health Insurance's case payment system	Observational		Total: 23,638 Intervention: 13,073	Hospital type (size), sex, comorbidy/complications indicators, secondary procedures.	Fair
Vos (2010)	Netherlands inpatient prospective payment	Observational	96 hospitals surveyed, 62 responded	Total: Intervention: NR	None	Poor: Cross-sectional survey, no adjustment for confounders, the intervention is poorly specified, self-reported data, and the relationship between the items measured through the survey and the intervention itself isn't clear.
Wen (2008)	Taiwan hospital case payment	Observational	3	Total: 22,327 Intervention: 14,928	age, number of diagnoses, gender, hospital indicators, procedure indicators	Fair
White (2003)	Medicare SNF PPS	Descriptive	9,748	Total: 3,490,000 Intervention: NR	Market competition, ownership status, Medicare resident fraction, state dummies	Poor: Descriptive: pre-post analysis, no controls or discussion of potential confounders.
White (2005)	Medicare SNF PPS	Observational	all Medicare hospitals and nursing facilities	Total: 41,000,000 Intervention: 6,444,800	None	Fair
Wodchis (2004a)	Medicare SNF PPS	Observational	SNF's in Michigan and Ohio	Total: 106,126 Intervention: 39,140	Patient: admission age, gender, admission from hospital, admission from SNF, diagnoses, use of indwelling catheter, tube feeding, and oxygen therapy. Facility: occupancy rate, % of facility residents who were Medicare; % who were Medicaid, profit status, hospital-based. Market: competition. Time trend.	Fair
Wodchis (2004b)	Medicare SNF PPS	Observational	NR	Total: 99,952 Intervention: 43,805	Resident controls (diagnoses, functional comorbidity, age, gender, discharge expected within 90 days, staff prognosis, ADL/CPS score)	Fair

Table A2. Study characteristics (continued)

Author (Year)	Intervention	Design	Provider Locations (n)	Study enrollment (n)	Controls included for multivariate analyses	Assessment of Methodological Quality
Yip (2002)	Medicare SNF PPS	Observational	3	Total: 214 Intervention: 94	Demographic characteristics (age and sex), risk factors (primary diagnosis [orthopedic, stroke, and other diagnoses such as shingles, pneumonia, cellulitus, chronic renal failure, gastric ulcer], number of comorbidities, mental summary and hospital length of stay, setting, and payment mechanism.	Poor: Small sample.
Zhang (2008)	Medicare SNF PPS	Observational	8,361	Total: NR Intervention: NR	Resident acuity, nursing home deficiency citations, CMS regions, hospital wage index, CPI, organizational factors (RN/resident day, RN/total nursing personnel, ownership, chain membership, % Medicare and Medicaid residents, size, occupancy rate), market factors (competition, average Medicaid reimbursement rate)	Fair
Zinn (2008)	Medicare SNF PPS	Observational	9,817	Total: NR Intervention: NR	Facility fixed effects. Facility interactions: profit status, chain affiliation, bed size. Area factors: Medicaid rate (state), Herfindahl index (county), avg. no. of empty nursing home beds (county), ratio of RNs to hospital beds (county), ratio of LPNs to hospital beds (county), % MCO penetration (county), per capita income (county), area wage index (county). Facility acuity index. Year dummies.	Fair

Appendix B. Included Studies

Primary Studies Included in the Review

1. Abt Associates, Medicare Cataract Surgery Alternate Payment Demonstration: Final Evaluation Report. 1997, Abt Associates: Cambridge, MA; Bethesda, MD; Chicago, IL.
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Review Articles Included in the Review of the Medicare Inpatient Prospective Payment System

1. Chulis, G.S. Assessing Medicare's prospective payment system for hospitals. Med Care Rev. 1991 Summer;48(2):167-206.

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3. Feinglass, J., Holloway, J.J. The initial impact of the Medicare prospective payment system on U.S. health care: a review of the literature. Med Care Rev. 1991 Spring;48(1):91-115.

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Appendix C. Studies Excluded at Full-Text Review

Table C1. Primary studies excluded from the general review

No.	Citation	Reason for Exclusion
1.	**Herwartz H, Strumann C. On the effect of prospective payment on local hospital competition in Germany. Health Care Manag Sci. 2012;15:48-62**	Does not report an outcome of interest
2.	Tung, Y.C. and G.M. Chang, The effect of cuts in reimbursement on stroke outcome: a nationwide population-based study during the period 1998 to 2007. Stroke, 2010. 41(3): p. 504-9.	Intervention not bundled payment
3.	Rinere O'Brien, S., Trends in inpatient rehabilitation stroke outcomes before and after advent of the prospective payment system: a systematic review. J Neurol Phys Ther, 2010. 34(1): p. 17-23.	Review article
4.	Zinn, J., et al., Determinants of performance failure in the nursing home industry. Soc Sci Med, 2009. 68(5): p. 933-40.	Does not report an outcome of interest
5.	Weech-Maldonado, R., A. Qaseem, and W. Mkanta, Operating environment and USA nursing homes' participation in the subacute care market: a longitudinal analysis. Health Serv Manage Res, 2009. 22(1): p. 1-7.	Does not report an outcome of interest
6.	Ngo, L., et al., Use of physical and occupational therapy by Medicare beneficiaries within five conditions: 1994-2001. Am J Phys Med Rehabil, 2009. 88(4): p. 308-21.	Looks at BBA in aggregate, not a single bundled payment intervention
7.	Choi, S. and J.K. Davitt, Changes in the Medicare home health care market: the impact of reimbursement policy. Med Care, 2009. 47(3): p. 302-9.	Does not report an outcome of interest
8.	Nguyen-Oghalai, T.U., et al., Discharge setting for patients with hip fracture: trends from 2001 to 2005. J Am Geriatr Soc, 2008. 56(6): p. 1063-8.	Does not report an outcome of interest
9.	Qaseem, A., R. Weech-Maldonado, and W. Mkanta, The Balanced Budget Act (1997) and the supplyof nursing home subacute care. J Health Care Finance, 2007. 34(2): p. 38-47.	Does not report an outcome of interest
10.	Lee, K. and S. Lee, Effects of the DRG-based prospective payment system operated by the voluntarily participating providers on the cesarean section rates in Korea. Health Policy, 2007. 81(2-3): p. 300-8.	Intervention of interest was price change associated with PPS, not bundling
11.	Dobrez, D.G., A.T. Lo Sasso, and A.W. Heinemann, The effect of prospective payment on rehabilitative care. Arch Phys Med Rehabil, 2004. 85(12): p. 1909-14.	Does not report an outcome of interest
12.	Zinn, J.S., et al., The impact of the prospective payment system for skilled nursing facilities on therapy service provision: a transaction cost approach. Health Serv Res, 2003. 38(6 Pt 1): p. 1467-85.	Does not report an outcome of interest
13.	Phillips, V.L., et al., Changes in the nursing facility-hospital interface after the prospective payment system: the effects on patients with infections in the post-acute care setting. J Am Med Dir Assoc, 2003. 4(3 Suppl): p. S105-9.	Does not report an outcome of interest
14.	McCall, N., et al., Utilization of home health services before and after the Balanced Budget Act of 1997: what were the initial effects? Health Serv Res, 2003. 38(1 Pt 1): p. 85-106.	Intervention is IPS (cost-based with hard caps) not PPS/bundled
15.	Leonard, K.J., et al., The effect of funding policy on day of week admissions and discharges in hospitals: the cases of Austria and Canada. Health Policy, 2003. 63(3): p. 239-57.	Does not report an outcome of interest
16.	Khaliq, A.A., R.W. Broyles, and M. Roberton, The use of hospital care: do insurance status, prospective payment, and the unit of payments make a difference? J Health Hum Serv Adm, 2003. 25(4): p. 471-96.	Intervention is Medicare IPPS

Table C1. Primary studies excluded from the general review (continued)

No.	Citation	Reason for Exclusion
17.	Matarelli, S.A., The impact of the rehabilitation prospective payment system on case management. Case Manager, 2001. 12(2): p. 53-6.	Does not report an outcome of interest
18.	Cromwell, J., D.A. Dayhoff, and A.H. Thoumaian, Cost savings and physician responses to global bundled payments for Medicare heart bypass surgery. Health Care Financ Rev, 1997. 19(1): p. 41-57.	More complete findings in final report
19.	Averill, R.F., et al., Evaluation of a prospective payment system for hospital-based outpatient care. J Ambul Care Manage, 1997. 20(3): p. 31-48.	Does not report an outcome of interest
20.	Weaver, F.M., et al. (1996) Evaluation of a prospective payment system for VA contract nursing homes. Evaluation & the Health Professions, 423-442.	Per diem payment before and after intervention - intervention did not change unit of payment
21.	Easton, L.S., R. Cogen, and M. Fulcomer (1991) Effect of Medicare prospective payment system on a home health agency: changes in patient population and services provided. Applied Nursing Research, 107-112.	Intervention is Medicare IPPS
22.	Desai, A., et al., *Is there "Cherry Picking" in the ESRD Program? Perceptions from a Dialysis Provider Survey.* Clin J Am Soc Nephrol, 2009. **4**: p. 772-777.	Intervention not bundled payment
23.	Lin, H., S. Xirasagar, and C. Tang, *Costs per discharge and hospital ownership under prospective payment and cost-based reimbursement systems in Taiwan.* Health Policy and Planning, 2004. **19**(3): p. 166-176.	Does not directly compare bundled payment to alternative

Table C2. Review studies excluded from the Medicare Inpatient Prospective Payment System review

No.	Citation	Reason for Exclusion
1.	Braunstein C, Schlenker R. The impact of change in Medicare payment for acute care. Geriatr Nurs. 1985 Sep-Oct;6(5):266-70. PMID 3935520.	Not a review article
2.	Eccles Martin P, Shepperd S, Scott A, et al. An overview of reviews evaluating the effects of financial incentives in changing healthcare professional behaviours and patient outcomes. Cochrane Database of Systematic Reviews. Chichester, UK: John Wiley & Sons, Ltd; 2010.	Not a review article
3.	Iezzoni LI. Changes in payment policies: impact on physicians' office testing. Med Clin North Am. 1987 Jul;71(4):751-62. PMID 3295424.	Not a review article
4.	Lerner WM. The differential effects of a change in reimbursement on public and private university hospitals. Med Care Rev. 1990 Winter;47(4):503-23. PMID 10113014.	Does not examine an outcome of interest
5.	Manton KG, Vertrees JC, Wrigley JM. Changes in health service use and mortality among U.S. elderly in 1980-1986. J Aging Health. 1990 May;2(2):131-56. PMID 10106584.	Not a review article
6.	Muller A. Medicare prospective payment reforms and hospital utilization. Temporary or lasting effects? Med Care. 1993 Apr;31(4):296-308. PMID 8464247.	Not a review article
7.	Sloan FA, Morrisey MA, Valvona J. Effects of the Medicare prospective payment system on hospital cost containment: an early appraisal. Milbank Q. 1988;66(2):191-220. PMID 3054469.	Not a review article
8.	Varney RA, Schroeder DJ. "Trade-off" between medical cost controls and quality of care? Maybe, maybe not! Part II. J Qual Assur. 1990 Apr-Jun;12(2):14-7, 43. PMID 10170552.	Not focused on IPPS

Appendix D. Strength of Evidence

Table D1 below summarizes the reviewers grading of evidence for each of the outcomes examined in Key Question 1. Tables D2 and D3 address each outcome for Key Questions 2 and 3, respectively.

For a complete explanation of the criteria for grading the strength of evidence, please refer to the EPC Methods Guide: Owens DK, Lohr KN, Atkins D, et al. Grading the strength of a body of evidence when comparing medical interventions. In: Agency for Healthcare Research and Quality. Methods Guide for Comparative Effectiveness Reviews [posted July 2009]. Rockville, MD. Available at: http://www.effectivehealthcare.ahrq.gov/index.cfm/search-for-guides-reviews-and-reports/?pageaction=displayproduct&productid=318**.**

Reviewers considered the optional coherence domain, however none of the results described were deemed implausible, so this domain was omitted from the table below.

Table D1. Strength of evidence for Key Question 1

Key Question 1: impact of bundled payment on health care spending and quality measures				**Overall Strength of Evidence: Low**			
Outcome:	*Finding:*			*Programs:*	*Studies, Poor:*	*Studies, Fair:*	*Studies, Good:*
Costs, Spending	Decline in spending of 10 percent or less.			13	11	10	2
Outcome SOE:	*Risk of Bias:*	*Consistency:*	*Directness:*	*Precision:*	*Residual Confounding:*	*Strength of Association:*	
Low	High	Consistent	Direct	Precise	Likely, but cannot assess direction	Weak	
Outcome:	*Finding:*			*Programs:*	*Studies, Poor:*	*Studies, Fair:*	*Studies, Good:*
Utilization	Decrease in utilization and costs of services included in the bundle, often measured reductions in length of stay or utilization of specific services (between 5 percent and 15 percent reductions in many cases).			17	15	27	1
Outcome SOE:	*Risk of Bias:*	*Consistency:*	*Directness:*	*Precision:*	*Residual Confounding:*	*Strength of Association:*	
Low	High	Consistent	Direct	Precise	Likely, but cannot assess direction	Weak	
Outcome:	*Finding:*			*Programs:*	*Studies, Poor:*	*Studies, Fair:*	*Studies, Good:*
Quality measures	Inconsistent and generally small effects on quality; for a given bundled payment intervention, either some quality measures improved while others worsened, or studies of the same intervention arrived at different conclusions about the effect of bundled payment on related quality measures.			13	14	23	2
Outcome SOE:	*Risk of Bias:*	*Consistency:*	*Directness:*	*Precision:*	*Residual Confounding:*	*Strength of Association:*	
Low	High	Inconsistent	Direct and indirect (process and intermediate outcomes) evidence available	Imprecise	Likely, but cannot assess direction	Weak	

Table D2. Strength of evidence for Key Question 2

Key Question 2: differential impacts by design feature			**Overall Strength of Evidence: Insufficient**			
Outcome:	*Finding:*		*Programs:*	*Studies, Poor:*	*Studies, Fair:*	*Studies, Good:*
Costs, Spending	Insufficient evidence to report findings; no studies directly address key question.		0	0	0	0
Outcome SOE:	*Risk of Bias:*	*Consistency:*	*Directness:*	*Precision:*	*Residual Confounding:*	*Strength of Association:*
N/A	N/A	N/A	N/A	N/A	N/A	N/A
Outcome:	*Finding:*		*Programs:*	*Studies, Poor:*	*Studies, Fair:*	*Studies, Good:*
Utilization	Insufficient evidence to report findings; no studies directly address key question.		0	0	0	0
Outcome SOE:	*Risk of Bias:*	*Consistency:*	*Directness:*	*Precision:*	*Residual Confounding:*	*Strength of Association:*
N/A	N/A	N/A	N/A	N/A	N/A	N/A
Outcome:	*Finding:*		*Programs:*	*Studies, Poor:*	*Studies, Fair:*	*Studies, Good:*
Quality measures	Insufficient evidence to report findings; no studies directly address key question.		0	0	0	0
Outcome SOE:	*Risk of Bias:*	*Consistency:*	*Directness:*	*Precision:*	*Residual Confounding:*	*Strength of Association:*
N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table D3. Strength of evidence for Key Question 3

Key Question 3: differential impacts by contextual factor					**Overall Strength of Evidence: Insufficient**		
Outcome: Costs, Spending	*Finding:* Four studies report few, program-specific results for provider characteristics including ownership, size, chain affiliation, and use of a dedicated hip fracture unit and for patient health condition. Evidence for this outcome is too weak and sparse to permit any conclusion to be drawn.			*Programs:* 4	*Studies, Poor:* 3	*Studies, Fair:* 2	*Studies, Good:* 0
Outcome SOE: Insufficient	*Risk of Bias:* High	*Consistency:* Unknown (no overlap among studies)	*Directness:* Indirect (indirect comparisons)	*Precision:* Imprecise	*Residual Confounding:* Likely, but cannot assess direction	*Strength of Association:* Weak	
Outcome: Utilization	*Finding:* Context-specific evidence on two contextual factors, patient disease/condition severity and provider profit status, was presented by several studies. In general, for-profit providers experienced greater declines in utilization than their not-for-profit counterparts. Disease/condition severity was not consistently related to differential utilization outcomes. Four review articles concluded that hospitals under greater financial pressure had greater reductions in utilization under the Medicare Inpatient Prospective Payment System. No evidence on other contextual factors.			*Programs:* 11	*Studies, Poor:* 3	*Studies, Fair:* 15	*Studies, Good:* 1
Outcome SOE: Low (provider profit status, provider financial pressure, patient severity); Insufficient (all others)	*Risk of Bias:* High	*Consistency:* Inconsistent	*Directness:* Indirect (indirect comparisons)	*Precision:* Imprecise	*Residual Confounding:* Likely, but cannot assess direction	*Strength of Association:* Weak	
Outcome: Quality measures	*Finding:* Three studies report few, program-specific results for provider ownership and profit status and patient severity. Evidence for this outcome is too weak and sparse to permit any conclusion to be drawn.			*Programs:* 3	*Studies, Poor:* 0	*Studies, Fair:* 5	*Studies, Good:* 0
Outcome SOE: Insufficient	*Risk of Bias:* High	*Consistency:* Unknown (no overlap among studies)	*Directness:* Indirect (indirect comparisons)	*Precision:* Imprecise	*Residual Confounding:* Likely, but cannot assess direction	*Strength of Association:* Weak	

Source: Authors' analysis of reviewed studies
Note: SOE is Strength of Evidence