

Appendix A. Summary of Evidence from Reviewed Studies

Author (Year)	Intervention	Summary of Effect: Utilization	Summary of Effect: Spending/costs	Summary of Effect: Quality	Assessment of Methodological Quality
Abt Associates (1997)	Medicare Cataract Surgery Alternate Payment Demonstration	<ul style="list-style-type: none"> ▪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 number of 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. 	<ul style="list-style-type: none"> ▪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. 	<ul style="list-style-type: none"> ▪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. 	Poor: small sample, non-representative/self-selected sites, contrived comparison group, overall poor control for secular trends/confounders
Anderson (2005)	Medicare Home Health (HH) Prospective Payment System (PPS)	<ul style="list-style-type: none"> ▪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%). 		<ul style="list-style-type: none"> ▪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. 	Poor: Large differences between pre & post groups

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Brizioli (1996)	Italy inpatient prospective payment	<ul style="list-style-type: none"> ▪The LOS decreased from 13.57 days to 11.69 days, a reduction of 13.89% (p<.05). 	<ul style="list-style-type: none"> ▪The cost per discharge declined by 14% post-PPS (p<0.05). 	<ul style="list-style-type: none"> ▪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 with 3 months. 	Poor: descriptive, no apparent control for secular trends, small sample and short study period (one year before and after change)
Buntin (2009)	Balanced Budget Refinement Act of 1999 (in aggregate; implements PPS for HH, Skillend Nursing Facility [SNF], and Inpatient Rehabilitation Facility [IRF])	<ul style="list-style-type: none"> ▪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%). 			Fair

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Casale (2007)	GeisingerProvenCare	<ul style="list-style-type: none"> ▪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. 	<ul style="list-style-type: none"> ▪There was a 5% reduction in hospital charges. 	<ul style="list-style-type: none"> ▪There was a 15.5% reduction in 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); 30-day readmission rate fell 15.5%, from 7.1% ▪The 19 outcome measures showed no significant differences between control and intervention. 	Fair
Chen (2002)	Medicaid SNF PPS		<ul style="list-style-type: none"> ▪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 endogeneity, PPS significantly negatively associated with cost, suggesting the effect is due to reduced quality. 		Fair

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Chen (2000)	Taiwan inpatient PPS (TPPS)	<ul style="list-style-type: none"> ▪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); 	<ul style="list-style-type: none"> ▪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. 	<ul style="list-style-type: none"> ▪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. 	Poor: descriptive, pre-post with no control for secular trends or confounds
Coburn (1993)	Maine Medicaid nursing home PPS		<ul style="list-style-type: none"> ▪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. 		Fair

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Collins (2007)	Medicare SNF PPS	<ul style="list-style-type: none"> ▪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) 		<ul style="list-style-type: none"> ▪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). 	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	<ul style="list-style-type: none"> ▪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. 	<ul style="list-style-type: none"> ▪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) 	<ul style="list-style-type: none"> ▪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. 	Fair

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Davitt (2008)	Medicare HH PPS	<ul style="list-style-type: none"> ▪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. 	<ul style="list-style-type: none"> ▪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. 		Poor: Small non-representative sample for qualitative interviews, no controls in quantitative analyses.
Dobrez (2010)	Medicare IRF PPS	<ul style="list-style-type: none"> ▪Length of stay was substantially lower for both Medicare (-1.86 days) and (-2.16) non-Medicare fee-for-service patients (both significant with $p<0.01$). 		<ul style="list-style-type: none"> ▪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 off ratio was 0.87 post-PPS, $p<0.01$ for Medicare FFS patients; 0.95 and nonsignif for patients with all other payers. 	Fair

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Eaton (2005)	Medicare HH PPS	<ul style="list-style-type: none"> ▪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. 		<ul style="list-style-type: none"> ▪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. 	Poor: Tracked outcomes for a single cohort of patients across two consecutive time periods.
Ellis (1996)	NH Medicaid IPPS	<ul style="list-style-type: none"> ▪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). 			Fair

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Farrar (2009)	England NHS Payment by Results	<ul style="list-style-type: none"> ▪ LOS fell more quickly in three of four comparisons (3-18 days less per 100 admissions over controls) ▪Proportion of elective care provided as day cases increased more quickly in all comparisons, by 0.4-1.5% more than controls. ▪Number of spells increased in 3 of 4 comparisons (1.33-4.95% over controls). 		<ul style="list-style-type: none"> ▪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. 	Fair
FitzGerald (2009)	Medicare HH PPS	<ul style="list-style-type: none"> ▪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. 			Fair

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FitzGerald (2006)	Medicare HH PPS	<ul style="list-style-type: none"> ▪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 eligibles vs. not, and males vs. females. ▪Probability of HH use declined under IPS, but was relatively flat after implementation of PPS. 			Fair
Frymark (2005)	Medicare IRF PPS	<ul style="list-style-type: none"> ▪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. 		<ul style="list-style-type: none"> ▪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. 	Fair

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DeJong (2005)	Medicare IRF PPS	<ul style="list-style-type: none"> ▪ 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%). 		<ul style="list-style-type: none"> ▪ 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. 	Fair
Gillen (2007)	Medicare IRF PPS	<ul style="list-style-type: none"> ▪ 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. 		<ul style="list-style-type: none"> ▪ 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. 	Poor: Single hospital, 8.5 years between pre/post, obvious differences in baseline chars.

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Grabowski (2011)	Medicare SNF PPS		<ul style="list-style-type: none"> ▪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. 	<ul style="list-style-type: none"> ▪There was a 14.1% increase therapy minutes in DD, and a 8.7% 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). 	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	<ul style="list-style-type: none"> ▪There was no significant change in patients getting rHuEPO ▪11.8% decrease in EPO dosage ▪IV iron prescription more likely post-bundling (10% increase), dosage not affected. 			Fair

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Hutt (2001)	Medicare SNF PPS Demonstration			<ul style="list-style-type: none"> ▪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. 	Fair
Konetzka (2006a)	Medicare SNF PPS			<ul style="list-style-type: none"> ▪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. 	Fair

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Konetzka (2006b)	Medicare SNF PPS			<ul style="list-style-type: none"> ▪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. 	Fair
Konetzka (2004)	Medicare SNF PPS	<ul style="list-style-type: none"> ▪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. 		<ul style="list-style-type: none"> ▪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 	Fair

percent decrease.

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Kulesher (2006)	BBA changes broadly, including Medicare HH PPS and SNF PPS	<ul style="list-style-type: none"> ▪ 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. 	<ul style="list-style-type: none"> ▪ 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. 		Poor: A collection of various univariate analyses. Does not control for obvious confounders.
Lapane (2006)	Medicare SNF PPS	<ul style="list-style-type: none"> ▪ 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). 			Poor: Adequate controlling for patient and SNF characteristics, but no attempt to address changes in Rx rates over time.

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Lapane (2004)	Medicare SNF PPS	<ul style="list-style-type: none"> ▪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). 			Fair
Linn (2005a)	Medicare HH PPS	<ul style="list-style-type: none"> ▪ 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).	<ul style="list-style-type: none"> ▪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. 	Poor: Use of survey data, many details missing, no discussion of potential confounders, graphs and text are inconsistent.

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Lin (2005b)	Medicare HH PPS	<ul style="list-style-type: none"> ▪ 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. 	<ul style="list-style-type: none"> ▪ 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. 		Fair
McCue (2006)	Medicare IRF PPS	<ul style="list-style-type: none"> ▪ 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). 	<ul style="list-style-type: none"> ▪ 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 	<ul style="list-style-type: none"> ▪ No significant difference between PPS and non-PPS groups in Medicare discharges and total discharges. 	Poor: Inadequate follow-up post intervention (1 fiscal year); descriptive with significant differences between control and intervention groups in pre period.

group (about 5% each).

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Menke (1998)	Department of Veterans' Affairs Resource Allocation Methodology (RAM)	<ul style="list-style-type: none"> ▪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. 		<ul style="list-style-type: none"> ▪Negligible association between RAM and discharges per patient 	Fair
Murray (2005)	Medicare SNF PPS			<ul style="list-style-type: none"> ▪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 of therapy decreased (7.1 hrs/wk to 6.2 hrs/wk). 	Fair

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Murtaugh (2003)	Medicare HH PPS	<ul style="list-style-type: none"> ▪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. 	<ul style="list-style-type: none"> ▪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). 		Poor: Descriptive: short duration/only covers first year of PPS; poorly controlled for secular trends/confounding variables.
Nayar (2008)	Medicare LTACH PPS	<ul style="list-style-type: none"> ▪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. 			Fair

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Paddock (2007)	Medicare IRF PPS	<ul style="list-style-type: none"> There was little change in predicted LOS in pre and post IRF PPS. 	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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. 	Fair
Perelman (2007)	Belgian inpatient non-medical PPS	<ul style="list-style-type: none"> There was a 1.49% decrease in LOS attributed to change to non-medical PPS. 	<ul style="list-style-type: none"> There was an increase in medical/surgical spending post-PPS (additional 0.8% a year post reform for surgical, 0.5% for medical). 		Fair

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Qu (2011)	Medicare IRF PPS	<ul style="list-style-type: none"> ▪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. 		<ul style="list-style-type: none"> ▪Functional improvement FIM (with a motor component) score gains were not significantly different in the pre-PPS and PPS periods. 	Fair
Schlenker (2005)	Medicare HH PPS	<ul style="list-style-type: none"> ▪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. 		<ul style="list-style-type: none"> ▪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). 	Fair

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Shah (2007)	Medicare IRF PPS			<ul style="list-style-type: none"> ▪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. 	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	<ul style="list-style-type: none"> ▪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. 	<ul style="list-style-type: none"> ▪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. 	<ul style="list-style-type: none"> ▪Little or no impact of PPS on outcomes such as the rate of return to community 60 days after IRF admission and mortality. 	Good: Solid theoretical foundation, admirable IV identification strategy to disentangle effect of marginal versus average reimbursement on costs.

Author (Year)	Intervention	Summary of Effect: Utilization	Summary of Effect: Spending/costs	Summary of Effect: Quality	Assessment of Methodological Quality
Stromberg (1997)	Sweden inpatient PPS	<ul style="list-style-type: none"> 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% ($p < .05$). 	<ul style="list-style-type: none"> Total cost for the year after hip fracture increased by 5% despite decrease in orthopedic costs due to increase in post-acute care utilization. 	<ul style="list-style-type: none"> 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%. 	Poor: Descriptive without discussion of potential confounders.
Tsai (2005)	Taiwan's Bureau of National Health Insurance's case payment system	<ul style="list-style-type: none"> 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). 			Fair

Author (Year)	Intervention	Summary of Effect: Utilization	Summary of Effect: Spending/costs	Summary of Effect: Quality	Assessment of Methodological Quality
Vos (2010)	Netherlands inpatient prospective payment			<ul style="list-style-type: none"> ▪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. 	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	<ul style="list-style-type: none"> ▪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. 	<ul style="list-style-type: none"> ▪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. 	<ul style="list-style-type: none"> ▪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). 	Fair

Author (Year)	Intervention	Summary of Effect: Utilization	Summary of Effect: Spending/costs	Summary of Effect: Quality	Assessment of Methodological Quality
White (2005)	Medicare SNF PPS	<ul style="list-style-type: none"> •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. 	<ul style="list-style-type: none"> •In terms of staffing, there was a significant decrease in costs spent on all nurse types (CNA, LPN, RN, total). 	<ul style="list-style-type: none"> •There was no consistent or significant effect on the quality of care (i.e., "deficiencies," pressure sores, use of restraints). 	Fair
White (2003)	Medicare SNF PPS	<ul style="list-style-type: none"> •ALOS in SNF decreased from 23.8 in 1997 to 22.9 in 2000 	<ul style="list-style-type: none"> •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 to 1.6% in 2000 for for-profit SNFs. Less dramatic decrease for NFP SNFs. 	<ul style="list-style-type: none"> •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. 	Poor: Descriptive: pre-post analysis, no controls or discussion of potential confounders.

Author (Year)	Intervention	Summary of Effect: Utilization	Summary of Effect: Spending/costs	Summary of Effect: Quality	Assessment of Methodological Quality
Wodchis (2004a)	Medicare SNF PPS			<ul style="list-style-type: none"> ▪ 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). 	Fair
Wodchis (2004b)	Medicare SNF PPS			<ul style="list-style-type: none"> ▪ 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). 	Fair

Author (Year)	Intervention	Summary of Effect: Utilization	Summary of Effect: Spending/costs	Summary of Effect: Quality	Assessment of Methodological Quality
Yip (2002)	Medicare SNF PPS			<ul style="list-style-type: none"> ▪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. 	Poor: Small sample.
Zhang (2008)	Medicare SNF PPS			<ul style="list-style-type: none"> ▪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). 	Fair

Author (Year)	Intervention	Summary of Effect: Utilization	Summary of Effect: Spending/costs	Summary of Effect: Quality	Assessment of Methodological Quality
Zinn (2008)	Medicare SNF PPS	<ul style="list-style-type: none"> ▪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. 			Fair

Appendix B. List of Included Studies

1. Abt Associates, Medicare Cataract Surgery Alternate Payment Demonstration: Final Evaluation Report. 1997, Abt Associates: Cambridge, MA; Bethesda, MD; Chicago, IL.
2. Anderson, M.A., et al., Hospital readmission from home health care before and after prospective payment. *J NursScholarsh*, 2005. 37(1): p. 73-9.
3. Brizioli, E., et al. (1996) Hospital payment system based on diagnosis related groups in Italy: Early effects on elderly patients with heart failure. *Archives of Gerontology & Geriatrics*, 347-355.
4. Buntin, M.B., C.H. Colla, and J.J. Escarce, Effects of payment changes on trends in post-acute care. *Health Serv Res*, 2009. 44(4): p. 1188-210.
5. Casale, A., et al., "ProvenCareSM": A Provider-Driven Pay-for-Performance Program for Acute Episodic Cardiac Surgical Care. *Annals of Surgery*, 2007. 246(4): p. 613-623.
6. Chen, B.H., et al., Comparison of appendectomy medical expense and clinical outcome between fee for service and prospective payment system. *Kaohsiung J Med Sci*, 2000. 16(6): p. 293-8.
7. Chen, L.W. and D.G. Shea, Does prospective payment really contain nursing home costs? *Health Serv Res*, 2002. 37(2): p. 251-71.
8. Coburn, A.F., et al. (1993) Effect of prospective reimbursement on nursing home costs. *Health Services Research*, 45-68.
9. Collins, T., et al., Medicare prospective payment before and after implementation: a review of visits and physical performance among Medicare home health patients after total knee replacements. *Home Healthc Nurse*, 2007. 25(6): p. 401-7.
10. Cromwell, J., et al., Medicare Participating Heart Bypass Center Demonstration: Final Report. 1998, Health Economics Research: Waltham, MA.
11. Davitt, J.K. and S. Choi, The impact of policy on nursing and allied health services. Lessons from the Medicare Home Health Benefit. *Res GerontolNurs*, 2008. 1(1): p. 4-13.
12. DeJong, G., et al., The early impact of the inpatient rehabilitation facility prospective payment system on stroke rehabilitation case mix, practice patterns, and outcomes. *Arch Phys Med Rehabil*, 2005. 86(12 Suppl 2): p. S93-S100.
13. Dobrez, D., et al., Impact of Medicare's prospective payment system for inpatient rehabilitation facilities on stroke patient outcomes. *Am J Phys Med Rehabil*, 2010. 89(3): p. 198-204.
14. Eaton, M.K., The influence of a change in medicare reimbursement on the effectiveness of stage III or greater decubitus ulcer home health nursing care. *Policy PolitNursPract*, 2005. 6(1): p. 39-50.

15. Ellis, R. and T. McGuire, Hospital response to prospective payment: Moral hazard, selection, and practice-style effects. *Journal of Health Economics*, 1996. 15: p. 257-277.
16. Farrar, S., et al., Has payment by results affected the way that English hospitals provide care? Difference-in-differences analysis. *BMJ*, 2009. 339: p. b3407.
17. FitzGerald, J.D., et al. (2006) Impact of changes in Medicare Home Health care reimbursement on month-to-month Home Health utilization between 1996 and 2001 for a national sample of patients undergoing orthopedic procedures. *Medical Care*, 870-878.
18. FitzGerald, J.D., W.J. Boscardin, and S.L. Ettner, Changes in regional variation of Medicare home health care utilization and service mix for patients undergoing major orthopedic procedures in response to changes in reimbursement policy. *Health Serv Res*, 2009. 44(4): p. 1232-52.
19. Frymark, T.B. and R.C. Mullen, Influence of the prospective payment system on speech-language pathology services. *Am J Phys Med Rehabil*, 2005. 84(1): p. 12-21.
20. Gillen, R., H. Tennen, and T. McKee, The impact of the inpatient rehabilitation facility prospective payment system on stroke program outcomes. *Am J Phys Med Rehabil*, 2007.86(5): p. 356-63.
21. Grabowski, D.C., C.C. Afendulis, and T.G. McGuire, Medicare prospective payment and the volume and intensity of skilled nursing facility services. *J Health Econ*, 2011.
22. Hasegawa, T., et al., Changes in anemia management and hemoglobin levels following revision of a bundling policy to incorporate recombinant human erythropoietin. *Kidney Int*, 2011. 79(3): p. 340-6.
23. Hutt, E., et al. (2001) Prospective payment for nursing homes increased therapy provision without improving community discharge rates. *Journal of the American Geriatrics Society*, 1071-1079.
24. Konetzka, R., et al., Effects of Medicare Payment Changes on Nursing Home Staffing and Deficiencies. *Health Services Research*, 2004. 39(3): p. 463-487.
25. Konetzka, R., et al., Medicare Prospective Payment and Quality of Care for Long-Stay Nursing Facility Residents. *Medical Care*, 2006. 44(3): p. 270-276.
26. Konetzka, R., E. Norton, and S. Stearns, Medicare payment changes and nursing home quality: effects on long-stay residents. *Int J Health Care Finance Econ*, 2006. 6(3): p. 173-189.
27. Kulesher, R.R. and M.G. Wilder, Prospective payment and the provision of post-acute care: how the provisions of the Balanced Budget Act of 1997 altered utilization patterns for Medicare providers. *J Health Care Finance*, 2006. 33(1): p. 1-16.
28. Lapane, K.L. and C.M. Hughes, An evaluation of the impact of the prospective payment system on antidepressant use in nursing home residents. *Med Care*, 2004. 42(1): p. 48-58.
29. Lapane, K.L. and C.M. Hughes, Did the introduction of a prospective payment system for nursing home stays reduce the likelihood of pharmacological management of secondary ischaemic stroke? *Drugs Aging*, 2006. 23(1): p. 61-9.

30. Lin, C.J. and M. Meit, Changes in Medicare home health care use and practices in rural communities: 1997 to 2001. *J Aging Health*, 2005. 17(3): p. 351-62.
31. Lin, C.J., et al., The financial impact of interim and prospective payment systems on home health providers in rural communities. *J Health Care Poor Underserved*, 2005. 16(3): p. 576-87.
32. McCue, M.J. and J.M. Thompson, Early effects of the prospective payment system on inpatient rehabilitation hospital performance. *Arch Phys Med Rehabil*, 2006. 87(2): p. 198-202.
33. Menke, T.J., et al., Impact of an all-inclusive diagnosis-related group payment system on inpatient utilization. *Med Care*, 1998. 36(8): p. 1126-37.
34. Murray, P.K., et al., Rehabilitation services after the implementation of the nursing home prospective payment system: differences related to patient and nursing home characteristics. *Med Care*, 2005. 43(11): p. 1109-15.
35. Murtaugh, C.M., et al., Trends in Medicare home health care use: 1997-2001. *Health Aff (Millwood)*, 2003. 22(5): p. 146-56.
36. Nayar, P., The impact of Medicare's Prospective Payment System on staffing of long-term acute care hospitals: the early evidence. *Health Care Manage Rev*, 2008. 33(3): p. 264-73.
37. Paddock, S.M., et al., Did the Medicare inpatient rehabilitation facility prospective payment system result in changes in relative patient severity and relative resource use? *Med Care*, 2007. 45(2): p. 123-30.
38. Perelman, J. and M.C. Closon, Hospital response to prospective financing of in-patient days: the Belgian case. *Health Policy*, 2007. 84(2-3): p. 200-9.
39. Qu, H., et al., Impact of Medicare prospective payment system on acute rehabilitation outcomes of patients with spinal cord injury. *Arch Phys Med Rehabil*, 2011. 92(3): p. 346-51.
40. Schlenker, R.E., M.C. Powell, and G.K. Goodrich, Initial home health outcomes under prospective payment. *Health Serv Res*, 2005. 40(1): p. 177-93.
41. Shah, P., A. Heinemann, and L. Manheim, The Effect of Medicare's Prospective Payment System on Patient Satisfaction: An Illustration with Four Rehabilitation Hospitals. *Am. J. Phys. Med. Rehabil.*, 2007. 86(3): p. 169-175.
42. Sood, N., M.B. Buntin, and J.J. Escarce, Does how much and how you pay matter? Evidence from the inpatient rehabilitation care prospective payment system. *J Health Econ*, 2008. 27(4): p. 1046-59.
43. Stromberg, L., G. Ohlen, and O. Svensson, Prospective payment systems and hip fracture treatment costs. *ActaOrthopScand*, 1997. 68(1): p. 6-12.
44. Tsai, Y.W., et al., The effect of changing reimbursement policies on quality of in-patient care, from fee-for-service to prospective payment. *Int J Qual Health Care*, 2005. 17(5): p. 421-6.

45. Vos, L., et al., Does case-mix based reimbursement stimulate the development of process-oriented care delivery? *Health Policy*, 2010. 98: p. 74-80.
46. Wen, Y.P. and S.Y. Wen, Do closed-system hospitals shift care under case payment? Early experiences comparing five surgeries in Taiwan. *Chang Gung Med J*, 2008. 31(1): p. 91-101.
47. White, C., Rehabilitation therapy in skilled nursing facilities: effects of Medicare's new prospective payment system. *Health Aff (Millwood)*, 2003. 22(3): p. 214-23.
48. White, C., Medicare's prospective payment system for skilled nursing facilities: effects on staffing and quality of care. *Inquiry*, 2005. 42(4): p. 351-66.
49. Wodchis, W.P., B.E. Fries, and R.A. Hirth, The effect of Medicare's prospective payment system on discharge outcomes of skilled nursing facility residents. *Inquiry*, 2004. 41(4): p. 418-34.
50. Wodchis, W.P., Physical rehabilitation following medicare prospective payment for skilled nursing facilities. *Health Serv Res*, 2004. 39(5): p. 1299-318.
51. Yip, J.Y., K.H. Wilber, and R.C. Myrtle, The impact of the 1997 Balanced Budget Amendment's prospective payment system on patient case mix and rehabilitation utilization in skilled nursing. *Gerontologist*, 2002. 42(5): p. 653-60.
52. Zhang, N.J., L. Unruh, and T.T. Wan, Has the Medicare prospective payment system led to increased nursing home efficiency? *Health Serv Res*, 2008. 43(3): p. 1043-61.
53. Zinn, J., et al., Restructuring in response to case mix reimbursement in nursing homes: a contingency approach. *Health Care Manage Rev*, 2008. 33(2): p. 113-23.

Appendix C. List of Studies Excluded at Full-Text Review

No.	Citation	Reason for Exclusion
1.	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. <i>Stroke</i> , 2010. 41(3): p. 504-9.	Intervention not bundled payment
2.	Rinere O'Brien, S., Trends in inpatient rehabilitation stroke outcomes before and after advent of the prospective payment system: a systematic review. <i>J NeurolPhysTher</i> , 2010. 34(1): p. 17-23.	Review article
3.	Zinn, J., et al., Determinants of performance failure in the nursing home industry. <i>SocSci Med</i> , 2009. 68(5): p. 933-40.	Does not report an outcome of interest
4.	Weech-Maldonado, R., A. Qaseem, and W. Mkanta, Operating environment and USA nursing homes' participation in the subacute care market: a longitudinal analysis. <i>Health Serv Manage Res</i> , 2009. 22(1): p. 1-7.	Does not report an outcome of interest
5.	Ngo, L., et al., Use of physical and occupational therapy by Medicare beneficiaries within five conditions: 1994-2001. <i>Am J Phys Med Rehabil</i> , 2009. 88(4): p. 308-21.	Looks at BBA in aggregate, not a single bundled payment intervention
6.	Choi, S. and J.K. Davitt, Changes in the Medicare home health care market: the impact of reimbursement policy. <i>Med Care</i> , 2009. 47(3): p. 302-9.	Does not report an outcome of interest
7.	Nguyen-Oghalai, T.U., et al., Discharge setting for patients with hip fracture: trends from 2001 to 2005. <i>J Am GeriatrSoc</i> , 2008. 56(6): p. 1063-8.	Does not report an outcome of interest
8.	Qaseem, A., R. Weech-Maldonado, and W. Mkanta, The Balanced Budget Act (1997) and the supply of nursing home subacute care. <i>J Health Care Finance</i> , 2007. 34(2): p. 38-47.	Does not report an outcome of interest
9.	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. <i>Health Policy</i> , 2007. 81(2-3): p. 300-8.	Intervention of interest was price change associated with PPS, not bundling
10.	Dobrez, D.G., A.T. Lo Sasso, and A.W. Heinemann, The effect of prospective payment on rehabilitative care. <i>Arch Phys Med Rehabil</i> , 2004. 85(12): p. 1909-14.	Does not test effect of bundled payment on outcomes
11.	Zinn, J.S., et al., The impact of the prospective payment system for skilled nursing facilities on therapy service provision: a transaction cost approach. <i>Health Serv Res</i> , 2003. 38(6 Pt 1): p. 1467-85.	Does not report an outcome of interest
12.	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. <i>J Am Med DirAssoc</i> , 2003. 4(3 Suppl): p. S105-9.	Does not test effect of bundled payment on outcomes
13.	McCall, N., et al., Utilization of home health services before and after the Balanced Budget Act of 1997: what were the	Intervention is IPS (cost-based with hard caps) not PPS/bundled

	initial effects? Health Serv Res, 2003. 38(1 Pt 1): p. 85-106.	
14.	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 test effect of bundled payment on outcome of interest - compares ALOS between Austria and Canada but does not include PPS specific effect
15.	Khaliq, A.A., R.W. Broyles, and M. Robertson, The use of hospital care: do insurance status, prospective payment, and the unit of payments make a difference? J Health Hum ServAdm, 2003. 25(4): p. 471-96.	Medicare IPPS
16.	Matarelli, S.A., The impact of the rehabilitation prospective payment system on case management. Case Manager, 2001. 12(2): p. 53-6.	Does not test effect of bundled payment on outcomes
17.	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
18.	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 test effect of bundled payment on outcomes
19.	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
20.	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
21.	Desai, A., et al., <i>Is there "Cherry Picking" in the ESRD Program? Perceptions from a Dialysis Provider Survey.</i> Clin J Am Soc Nephrol, 2009. 4: p. 772-777.	Intervention not bundled payment
22.	Lin, H., S. Xirasagar, and C. Tang, <i>Costs per discharge and hospital ownership under prospective payment and cost-based reimbursement systems in Taiwan.</i> Health Policy and Planning, 2004. 19(3): p. 166-176.	Does not directly compare bundled payment to alternative