

Practical Costing

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"Economic" Measures of Cost

- Standard economic assumption
 - Purchase price = marginal cost (= average cost)
- Health care (particularly U.S.)
 - Purchase price \neq cost or there is no price to observe
- Difference due to
 - Health care consumers not having adequate information
 - High levels of insurance
 - Regulation
 - Hospital internal pricing policies; free care
 - Economics of scale / fixed costs



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Marginal Costs

- Costs incurred by adding an extra unit of service or saved by reducing a unit of service (excludes "truly" fixed costs)
- In health care, marginal costs generally differ from average costs
- Always want to use marginal cost when evaluating a therapy, not average cost (total cost / total units of service), independent of perspective adopted
- From social perspective (and others?) don't usually use marginal costs
 - Unknown or unappreciated



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Marginal Costs (2)

- Perspective affects determination of marginal costs
 - Payments unlikely to represent marginal costs from social perspective
 - But from payer's perspective payments often do
- What is counted as marginal cost may also vary depending on how program under evaluation is defined
 - e.g., when creating a new program, capital may not already be in place and would be counted as a marginal cost
 - When expanding an existing program, all necessary capital may already be in place and would not be counted as a marginal cost



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Variable vs Fixed Costs

- Economics textbook assumption: In "short run", labor is a variable input while capital is a fixed input (because capital is assumed fixed in short run)
- Increasing output from its current level in short run implies addition of labor but not of capital
- Given enough time, capital can be varied
- Implication: short run marginal cost will usually be higher than long run marginal cost
 - Because there is more freedom to adjust to ideal level of labor and capital in long run



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"Discretionary" Fixed Costs

- Fact that some costs aren't observed to change doesn't mean they are fixed
- Technically, fixed costs are impossible (or foolish) to change
 - e.g., Might maintain a constant staffing level independent of number of patients on a ward, but that's a choice we make
 - Could rent buildings and add or subtract rented space as volume changes
- Cost of discretionary "fixed" costs equals their net benefit in their next best use
 - i.e., their opportunity cost



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Transactions ≠ Social Costs

- Not all transactions represent social opportunity costs
 - Pure profits (monopoly or fortuitous)
 - Fixed costs
 - External benefits
 - Transfers *
 - Social security
 - Disability payments
 - Unemployment benefits
- (although costs of managing and distributing transfers are a cost)



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Difficulties Measuring MSOC

- It is difficult to measure marginal social opportunity cost when:
 - Inputs are not purchased
 - Intermediate inputs are produced in multiproduct firms
 - Inputs are purchased in imperfect markets
- A common solution is to develop second-best approximations of MSOC
 - Identify existing data sets (e.g., government and/or private hospitals, laboratories, etc.)
 - Develop our own estimates



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Translating Service Use to Cost

- If data collection enumerates medical service use (e.g., # of ER or physician visits), need to translate it into a cost that can be compared with effectiveness measure
- Common to
 - Identify medical services
 - Identify price weights (unit costs) and multiply service use times price weights
 - Sum products
- Alternatively, administrative data -- such as billing records -- may provide measures of both medical service use and cost (or expenditure)



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Costing Specific Services



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Outline


- Readily available U.S. data
 - Hospital costs
 - Charges and cost-to-charge ratios
 - DRGs
 - National Inpatient File (HCUP)
 - Physician fees
 - Medicare Fee schedule
 - Hospital outpatient bills
 - Other federal fee schedules
 - Drug prices



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Hospital Costs

- Readily available U.S. hospital cost data
 - Charges and Cost to Charge Ratios (Medicare Cost Report)
 - Diagnosis Related Groups (DRGs)
 - National Inpatient File
- Hospital accounting data



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**Cost-To-Charge Ratios
(Medicare Cost Report)**

- In US, total charges represent amounts hospitals "bill" for services, but not how much hospital services actually cost nor specific amounts that hospitals receive in payment
- CMS cost-to-charge ratios represent quotient of CMS recognized costs divided by hospital charges (operating+capital CCR)
- Web resource: FY 2020/2019 Final Rule Impact Files
<https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/Downloads/FY2020-FR-Impact-File.zip>
<https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/Downloads/FY2019-CMS-1694-FR-Impact.zip>



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**Cost-To-Charge Ratios
(Medicare Cost Report) (Cont.)**

- Advantages
 - Readily available from all hospitals
 - Uniform methodology
- Disadvantages
 - Works on averages (how bad is that?)
 - Includes fixed costs
 - Not easy to estimate costs of intermediate products (i.e., bundles of services such as a procedure)



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2015 Operating Cost-To-Charge Ratios *

	Urban Classification			Total
	Large Urban	Other Urban	Rural	
New England	.467	.452	.471	.461
Mid Atlantic	.419	.393	.420	.409
South Atlantic	.286	.316	.494	.325
E.N. Central	.257	.280	.449	.269
E.S. Central	.330	.304	.361	.328
	.308	.285	.337	.301
	.329	.321	.417	.346
	.292	.294	.387	.300
	.286	.269	.365	.322
	.233	.252	.300	.255

* Row 1, Simple average; Row 2, Weighted by average daily census



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2015 Operating Cost-To-Charge Ratios

W.N.	.326	.350	.439	.379
Central	.286	.310	.360	.306
W.S.	.265	.302	.410	.321
Central	.225	.235	.312	.237
Mountain	.234	.305	.399	.309
	.215	.288	.376	.255
Pacific	.249	.287	.387	.270
	.228	.263	.364	.240
Puerto Rico	.529	.549	.	.537
	.523	.514	.	.520
Total	.302	.318	.404	.333
	.274	.285	.353	.284

Source: FY 2015 IPPS Final Rule Impact PUF-CN.xlsx



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Of Local Interest

Code	Hospital	Operating C-to-C	
		2019	2020
390111	HUP	.152	.149
390223	Presbyterian	.151	.146
390226	Pennsylvania	.196	.196
390027	Temple	.120	.109
390174	Jefferson	.196	.198
390195	Lankenau	.175	.169
390290	Hahneman	.095	.095

* FY 2020 IPPS FR and CN Impact File.xlsx



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Diagnosis Related Groups (DRGs)

- Used by Medicare and a large number of insurers to reimburse hospital services
- Set of relative weights for hospitalizations (identified by ICD-9-CM code and level of concomitant conditions)
 - i.e., cost of other hospitalizations reported in relative terms compared to cost of average hospitalization
 - e.g., DRG weight of 2.0 considered twice as costly as DRG weight of 1.0



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Initial Development

- DRG weights initially based on relative average charge for different types of hospitalization
 - Hospitalizations assigned to DRGs
 - Average hospital charge per DRG estimated
 - Relative weight equaled DRG-specific average hospital charge divided by average charge for all hospitalizations
- Charges for hospitalizations in individual DRGs not very homogeneous
 - Use of DRG weights explained about 10% of variation in charges



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Changes, October 2007

- Relative weights changed to reflect costs rather than charges
 - Unweighted mean of weights relatively unchanged, although medical weights on average increased ~1% while surgical weights on average decreased ~1%
- Expanded concomitant condition coding
 - Without; With; With major
- Eliminated age coding
- Changed outlier threshold
- Renumbered DRGs



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Advantages / Disadvantages

- Advantages
 - Readily available
 - Uniform methodology
- Disadvantages
 - Different conditions in DRG may have widely varying costs
 - Cannot (without adjustment) distinguish different levels of intensity of care within DRG
 - Based originally on charges; did not explain large amount of variation
 - Do not include physician fees



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DRG Web Resource

<https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/Downloads/FY2018-CMS-1677-FR-Table-5.zip>



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SELECTED DRG DATA (Table 5, 2019 Final Rule)

DRG	MDC	Surg/ Med	Description	Rel Wght	Geo LOS	Arith LOS
001	PRE	Surg	Heart transplan or implant w/MCC	26.4106	29.1	37.5
002	PRE	Surg	Heart transplant or implanc w/o MCC	13.4227	15.1	18.0
263	05	Surg	Vein ligation & stripping	2.3922	4.2	6.3
264	05	Surg	Other circulatory system O.R. proc	3.1586	6.5	9.2
280	05	Med	Acute MI, discharged alive w/MCC	1.6571	4.2	5.4
281	05	Med	Acute MI, discharged alive w/CC	0.9796	2.6	3.2
282	05	Med	AMI, discharged alive w/o CC/MCC	0.7490	1.8	2.2
283	05	Med	Acute MI, Expired w/MCC	1.8047	3.0	4.8
284	05	Med	Acute MI, Expired w/CC	0.7666	1.7	2.3
285	05	Med	Acute MI, expired w/o CC/MCC	0.5964	1.3	1.6



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DRG Reimbursement

- Relative weights aren't payments
 - Payment rates set by Congress annually
 - 2013 base payment rates
 - Operating base rate, \$5348.76
 - Capital base rate, \$425.49
- 2014 base payment rate represents 0.7% increase over 2013 base rate
 - *Acute Care Hospital Inpatient Prospective Payment System. Payment System Fact Sheet Series." ICN 006815 April 2013
 - *FY 2014 IPPS Final Rule Increases IPPS Operating Rates by 0.7 Percent"



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2015 Base Payment Changes

- Payment for hospitals will be directly impacted by whether they participate in submitting quality data and are meaningful Electronic Health Record (EHR) users
 - No submission or use: eligible for a percentage increase that is 0.75% above operating standardized payment
 - Submission or use but not both: eligible for a percentage increase that is 1.425% to the operating standardized amount
 - Both submission and use: eligible for a percentage increase that is 2.2% to the operating standardized amount



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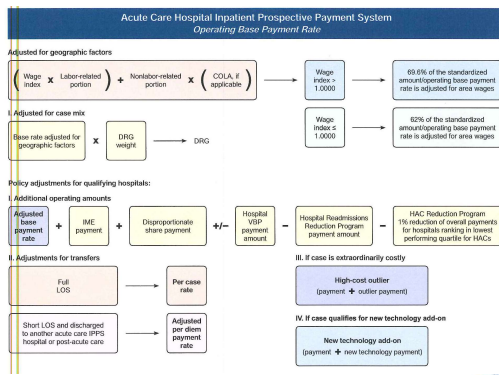
DRG Reimbursement (2)

- Base payment divided into labor-related and nonlabor
 - Labor-related adjusted by wage index
 - Nonlabor adjusted by cost of living adjustment
- Additional percentage add-ons are made if hospital:
 - Treats a high-percentage of low income patients (disproportionate share)
 - Is a teaching hospital (indirect graduate medical education)
 - Has outlier cases

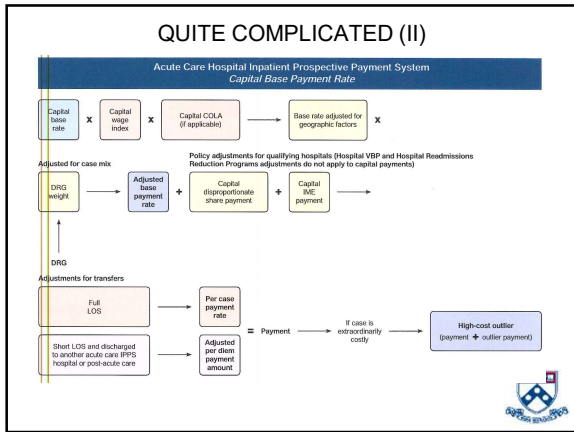


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QUITE COMPLICATED



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Additional Policy Objectives

- Electronic Health Record (EHR) Incentive Programs and Clinical Quality Measure (CQM) Reporting: Payments for participating in electronic reporting of CQM for the EHR incentive program and the inpatient quality reporting (IQR) programs
- Hospital Value-Based Purchasing (VBP) Program: Payments for meeting or exceeding performance standards such as care coordination and 30-day mortality
- Hospital-Acquired Conditions (HAC) Reduction Program: Reduction in payments for being in the lowest quartile (worst) of hospital-acquired conditions

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Additional Policy Objectives (2)

- Hospital Readmissions Reduction Program: Reduced payments for excess readmissions
- Transfer policy: Reduced reimbursement if patients stay 1 or fewer days below the geometric mean LOS and patient is transferred to another acute care hospital
- Sole County Hospitals
- Medicare Dependent Hospitals
- Low volume Hospitals

For recent details see: <https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/downloads/acutepaymtyshftsht.pdf>

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2017/2019 Operating Base Payment Rates *

	2017	2019
Quality data/meaningful use	5516.63	5649.52
Quality data/~meaningful use	5406.73	5528.28
~Quality data/meaningful use	5479.90	5609.11
~Quality data/~meaningful use	5370.09	5487.87

* 2017, Federal Register; 2019, Reimbursement Alliance Group

- Incentive greater for meaningful use of EMR (2.2%), less for submission of quality data (0.8%); both, 3.0%



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National Inpatient sample (NIS / HCUP)

- Largest all-payer inpatient care database in the US
- Contains clinical and resource use information included in a typical discharge abstract
 - Only national hospital database containing charge (cost) information on all patients, regardless of payer
- Has data from approximately 8 million hospital stays each year
 - In 2008, represents 20% stratified sample of U.S. community hospitals



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NIS / HCUP

- Allows for hospital costs by subgroup
 - Diagnosis Related Group (DRG)
 - Diagnoses and procedures
- Hospital, county, and state identifiers for links to other datasets
- Severity and patient level controls
 - Age, gender, race, expected primary and secondary payer, Median household income for patient's ZIP Code
- Most recent dataset for which online calculator is available appears to be 2016



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Subset of Data Elements

- Admission source: (1) ER, (2) another hospital, etc.
- Admission type: (1) emergency, (2) urgent, etc.
- Number of diagnoses coded on original record
- Diagnosis Related Group (DRG) in use on discharge date
- Principal and secondary diagnoses
- Principal and secondary procedures
- For each procedure, number of days from admission
- Costs/Charges (costs derived using CCR)



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Other HCUP Databases

- National Kids Inpatient Database (KID)
- Nationwide Emergency Department Sample (NEDS) & Statewide Emergency Department Databases (SEDD)
- State Ambulatory Surgery Databases (SASD)



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HCUP Calculator

<http://hcupnet.ahrq.gov/>

"National Statistics on All Stays" Create your own statistics...

	LOS	Charge	Cost
All Hosp, 2016 (N = 35.7M)	4.6 (0.019)	\$46,977 (576)	\$11,715 (106)

* Average cost to charge ratio: 0.249 (11,715/46,977)



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U.S. Physician Data: The Medicare Fee Schedule

- Changing???
- Used by Medicare to reimburse physician services
- Set of relative value units (RVUs) for medical services (identified by CPT code)
- RVUs report relative cost of providing a service
 - i.e., some service designated as baseline level of work (RVU = 1.0); work for all other services reported in relative terms compared to baseline
 - e.g., RVU of 2.0 considered twice work (twice as costly) as RVU of 1.0



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U.S. Physician Data: The Medicare Fee Schedule (2)

- Separate RVUs estimated for work involved in procedure (physician work RVUs), malpractice, and practice expenses (facility fees)
- Payment = RVU * \$/RVU (set annually by Congress)
- As with DRGs, payments becoming more complicated to further policy objectives



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Initial Development

- RVUs developed in extensive study conducted by clinicians, economists, statisticians, measurement psychologists, and survey researchers
- Expert panels of physicians within specialties enumerated tasks within specialty and assigned RVUs to tasks
- Expert panels of physicians from multiple specialties developed cross walks between RVUs in different specialties (e.g., RVU of 1.0 in specialty A might have been determined to be equivalent to RVU of 0.95 in specialty B)



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Advantages and Disadvantages

- Advantages
 - Readily available
 - Files
- <https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/PhysicianFeeSched/Downloads/RVU19A.zip>
 - Look up calculator
 - <https://www.cms.gov/apps/physician-fee-schedule/overview.aspx>
- Uniform methodology
- Disadvantages
 - May be difficult to identify services provided in individual physician / patient encounters



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Selected 2019 Medicare Fee Schedule RVUs

CPT/ HCPCS	Description	Work RVU	Tot NF RVU	Tot Fac RVU	MP RVU
99201	Office/op visit, new: problem focused hist & exam; straight forward med decis making; ~10 min	0.48	0.76	0.23	0.05
99203	Office/op visit, new: detailed hist & exam; med decis making of low complexity; ~30 min face-to-face	1.42	1.49	0.59	0.14
99205	Office/op visit, new: comprehensive hist & exam; med decis making of high complexity, ~60 min	3.17	2.38	1.31	0.21

* \$36.0391 / RUV (conversion factor)



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"Bundled" Office Visit Costs

- Medical Expenditure Panel Survey Stat Brief #166
Expenses for Office-Based Physician Visits by Specialty, 2004*
- Dentistry: 155
- GP: 101
- Pediatrics: 98
- Ob/Gyn: 153
- Ophthalmology: 206
- Orthopedics: 210
- Psychiatry: 95
- Dermatology: 142
- Other: 235

* Also see #157, Regional Differences in Total and Out-of-Pocket Expenditures for Selected Types of Office-Based Visits, 2004



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Medical Expenditure Panel Survey Statistical Briefs

- #111: Expenses for a Hospital Emergency Room Visit, 2003
 - Average expenditure*: \$560
 - Average if surgical procedure performed: \$904
 - Average if 1+ nonsurgical services† provided: \$637
 - Average if no special service provided: \$302

* Direct payments from individuals, private insurance, Medicare, Medicaid, Workers' Compensation, and miscellaneous other sources. Expenditures include those for both facility and separately billed physicians' services

† Laboratory test, sonogram or ultrasound, X-ray, mammogram, MRI, CAT scan EKG, ECG, EEG, vaccination, anesthesia, and other miscellaneous diagnostic tests



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2019 Clinical Diagnostic Laboratory Fee Schedule

HCPC	Short Description	Nat Rate
85520	Heparin assay	14.55
85525	Heparin neutralization	13.15
85530	Heparin-protamine tolerance	14.55
85536	Iron stain peripheral blood	7.18
85540	WBC alkaline phosphatase	9.56
85549	Muramidase	20.83
85576	Blood platelet aggregation	24.91
85597	Phospholipid platelet neutralization	19.97
85610	Prothrombin time	4.37
85612	Viper venom prothrombin time	17.49

<https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/ClinicalLabFeeSched/Clinical-Laboratory-Fee-Schedule-Files-Items/19CLABQ1.html?DLPage=1&DLEntries=10&DLSort=2&DLSortDir=ascending>



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April 2019 Medicare Durable Good Fee Schedule

HCPC	Short Description	Ceiling	Floor
A5500	Diab shoe for density insert	87.85	65.89
A5501	Diabetic custom molded shoe	263.51	197.63
A5503	Diabetic shoe w/roller rocker	43.49	32.62
A6010	Collagen based wound filler	35.66	30.31
A6023	Collagen dressing>48 sq in	219.12	186.25
V2745	Tint, any color/solid/grad	13.54	10.16
V2750	Anti-reflective coating	25.17	19.30

<https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/DMEPOSFeeSched/Downloads/DME19-B.zip>



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HOME HEALTH VISIT COSTS *

Visit Type	N. Agen.	Mean Cost	S.D.	Min	Max
Skilled nurse	4609	87.68	35.10	12.65	756.89
Physical therapist	4287	104.40	43.37	12.29	663.63
Occupat therapist	3492	107.78	52.31	10.20	773.86
Speech therapist	3292	110.50	58.60	10.84	724
Med/Soc services	3661	139.77	82.01	10.20	883.8
Home health aid	4603	40.30	20.97	5.67	848.7

* Cost data used in establishing the Home Health Agency(HHA) Per-Visit Cost Limits for fiscal periods beginning after October 1, 1999. The cost and statistical data were obtained from Free Standing Medicare HHA cost reports (Form 1728-94) for full cost reporting periods beginning on or after October 1, 1994 and settled by March 1998. Data may no longer be maintained by CMS



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Medicare Fee Schedules Home Page

- <http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/FeeScheduleGenInfo/index.html?redirect=/FeeScheduleGenInfo/>



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Drug Prices

- Average wholesale price (AWP) commonly used in literature as estimate of drug prices
- AWP an unregulated number found by courts to be a fairly artificial construct that has been gamed by pharmaceutical industry
- Historically, AWP represented average price charged by wholesalers to doctors and pharmacies derived from an industry-wide formulaic 20%-25% markup between actual acquisition cost and AWP
- Over time, actual margins have fallen to 2%-3%, and 20%-25% markups no longer reflect actual wholesaler margins



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ASP

- For non-Part D drugs, Medicare has moved to reimbursing drugs by use of a small mark-up of average sales price (ASP)
 - ASP represents sales price including volume discounts, prompt pay discounts, cash discounts, free goods that are contingent on any purchase requirement, chargebacks, and rebates
 - Applies to physician-administered drugs (e.g., chemotherapy infused in physicians' offices)



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ASP / AWP Comparison

- US Inspector General's office* has reported:
 - Median difference between ASP and AWP: 49%
 - Generic drugs: ASP 68% less than AWP at median
 - Single source brand drugs: ASP 26% less than AWP
 - Multisource branded drugs: ASP 30% less than AWP

* Medicaid Drug Price Comparison: Average Sales Price To Average Wholesale Price, Office of the Inspector General, DHHS, June 2005



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Selected 2019 ASP Prices

HCPCS	Description	Dosage	'19 Payment limit	'16 Payment limit
90371	Hep b ig, im	1 ML	\$125.369	\$111.332
90632	Hep a vaccine, adult im	1 ML	59.652	37.383
90656	liv3 vaccno prsv im	0.5 ML	19.773	17.717
J0130	Abciximab injection	10 MG	\$1429.071	\$1136.511
J2020	Linezolid injection	200 MG	\$9.051	\$15.779
J3370	Vancomycin hcl injection	500 MG	\$4.768	\$2.979
J3480	Inj potassium chloride	2 MEQ	\$0.184	\$0.129
J9181	Etoposide injection	10 MG	\$0.741	\$0.687
J9226	Supprelin LA implant	50 MG	\$34970.232	\$26205.503
J9260	Methotrexate sodium inj	50 MG	\$2.638	\$2.375

<https://www.cms.gov/apps/ama/license.asp?file=/Medicare/Medicare-Fee-for-Service-Part-B-Drugs/McrPartBDrugAvgSalesPrice/downloads/April-2019-ASP-Pricing-File.zip>



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AMP

- Medicaid upper limits based on average manufacturers price (AMP) plus a dispensing fee for pharmaceuticals
 - AMP represents average price paid to manufacturer by wholesalers for drugs distributed to retail pharmacy class of trade including discounts and other price concessions provided by manufacturer, but without regard to customary prompt pay discounts extended to wholesalers



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AMP / AWP Comparison

- US Inspector General's office* has reported:
 - Generic drugs: AMP between 65% (simple average) and 74% (sales-weighted average) less than AWP
 - Single-branded drugs: AMP 25% less than AWP
 - Multisource branded drugs: AMP between 35% and 40% less than AWP

* Medicaid Drug Price Comparisons: Average Manufacturer Price to Published Prices, Office of the Inspector General, DHHS, June 2005



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Thomson Reuters Redbook

- Provides
 - AWP
 - Wholesale Acquisition Cost (WAC)
 - Direct Price (DP)
 - Suggested Retail Price (SRP)
 - Federal Upper Limit (FUL)



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VA Federal Supply Schedule (FSS)

- Some of most complete / accessible pharmaceutical price lists
- Web address:
<https://www.va.gov/opal/docs/nac/fss/vaFssPharmPrices.xlsx>



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Selected 2019 FSS (Big-4) Prices

NDC	Description	Dosage	Price *
781-5381-92	Atorvastatin (90 tabs) (B†)	10 MG	3.75
54-0012-25	Flecainide (100 tabs)	150 MG	\$96.38
186-1090-05	Metoprolol XL (100 tabs)	50 MG	\$94.08
61570-0111-01	Ramipril (100 tabs)	2.5 MG	\$401.02
61570-0111-01	Ramipril (100 tabs)	2.5 MG	593.37
87-6060-05	Metformin HCL (100 tabs)	500 MG	\$73.91
24658-0290-90	Metformin HCL (90 tabs)	500 MG	\$2.36
00904-5684-61	Omeprazole (100 cap)	20 MG	\$14.73‡
00135-0196-02	Nicotine patch 24 hours (14)	7 mg	\$18.49‡



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Other Federal Drug Price Lists

- National Average Drug Acquisition Cost survey (NADAC) and National Average Retail Prices Survey (NARP)
 - <http://www.medicaid.gov/Medicaid-CHIP-Program-Information/By-Topics/Benefits/Prescription-Drugs/Survey-of-Retail-Prices.html>



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