

CLINICAL **OUTCOMES ASSESSMENT** PROGRAM
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Appropriateness of Percutaneous Coronary Interventions in Washington State

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Presenter Disclosure Information

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Financial Disclosure:

- No relevant financial relationship exists.
- Supported in part by VA HSR&D-QUERI RRP 09-140
 - The views expressed are those of the authors and do not necessarily reflect the position or policy of the Department of Veterans Affairs or the United States government.

Background

- **PCI is critical tool in the management of CAD**
- **In patients with ACS, PCI reduces mortality and recurrent MI**
- **For stable CAD, the benefit of PCI is small, temporary, and not cost-effective**



Background

- **More than 1.2 million PCI are performed annually in the U.S. at \$26 billion in cost**
- **Appropriateness of PCI in the current era are in question**
- **Understanding PCI appropriateness may support effective and efficient use**

Background

Appropriate Use Criteria for Coronary Revascularization

- Developed by the ACC in partnership with multiple professional organizations
- National standard to quantify ‘appropriateness’ of PCI for a variety of clinical scenarios



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Clinical Scenarios in the Appropriate Use Criteria

- **Clinical presentation (e.g. ACS, stable angina)**
- **Severity of angina (CCS classification)**
- **Extent of ischemia on noninvasive testing and other prognostic factors (e.g. low EF, DM)**
- **Extent of anti-anginal therapy**
- **Extent of anatomic disease**

Definition of Appropriate Coronary Revascularization

“Coronary revascularization is appropriate when the expected benefits, in terms of survival or health outcomes (symptoms, functional status, and/or quality of life) exceed the expected negative consequences of the procedure.”

Example Ratings

Low Risk Findings on Noninvasive Study					
Symptoms					
Med. Rx					
Class III or IV Max Rx	U	A	A	A	A
Class I or II Max Rx	U	U	A	A	A
Asymptomatic Max Rx	I	I	U	U	U
Class III or IV No/min Rx	I	U	A	A	A
Class I or II No/min Rx	I	I	U	U	U
Asymptomatic No/min Rx	I	I	U	U	U
Coronary Anatomy	CTO of 1 vz.; no other disease	1-2 vz. disease; no Prox. LAD	1 vz. disease of Prox. LAD	2 vz. disease with Prox. LAD	3 vz. disease; no Left Main

Intermediate Risk Findings on Noninvasive Study					
Symptoms					
Med. Rx					
Class III or IV Max Rx	A	A	A	A	A
Class I or II Max Rx	U	A	A	A	A
Asymptomatic Max Rx	U	U	U	U	A
Class III or IV No/min Rx	U	U	A	A	A
Class I or II No/min Rx	U	U	U	A	A
Asymptomatic No/min Rx	I	I	U	U	A
Coronary Anatomy	CTO of 1 vz.; no other disease	1-2 vz. disease; no Prox. LAD	1 vz. disease of Prox. LAD	2 vz. disease with Prox. LAD	3 vz. disease; no Left Main



PCI Appropriateness in NCDR

- **More than 350,000 PCI performed nationally, 85% appropriate and 4% inappropriate**
 - Acute indications 99% appropriate
 - Non-acute indications 50% appropriate and 12% inappropriate
- **Considerable variation in PCI appropriateness by facility**



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Objective

- **Describe the appropriateness of all PCI performed in Washington State**
- **Explore facility level variation in PCI appropriateness**



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Methods

Washington State COAP

- Statewide QI program for coronary revascularization
- NCDR version 4 data elements

Mapping to the Appropriate Use Criteria

- Significant stenosis $>50\%$ left main or $>70\%$ other epicardial coronary
- Maximal anti-ischemic medical therapy at least 2 classes of therapy
- Mapping minimized influence of missing data

Analysis

Appropriateness of PCI stratified by indication

- Acute (acute myocardial infarction or unstable angina with high-risk features)
- Non-acute (stable angina)

Results: Patient Population

12,528 PCIs Performed at 30 Sites
 in Washington State

3503 (28%) Not Mapped to the Appropriate Use Criteria
 No Appropriateness Rating in the Criteria, n=1147 (33%)
 UA without High-Risk Features, n=911 (79%)
 Other, n=236 (21%)
 Missing Necessary Data, n=2356 (67%)
 Missing non-invasive risk assessment, n=2029 (86%)
 Other missing data, n=327(14%)

9,025 PCI Mapped to
 Appropriate Use Criteria for
 Coronary Revascularization



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Patient Demographics

Characteristic	Total (n=12,528)	Appropriate (n=7708)	Uncertain (n=853)	Inappropriate (n=464)	Not Classified (n=3503)
Age	65 _± 12	65 _± 13	67 _± 11	67 _± 10	65 _± 11
Men	8841 (71%)	70%	77%	72%	71%
White race	11,278 (90%)	89%	92%	93%	91%

Patient Clinical Characteristics

Characteristic	Total (n=12,528)	Appropriate (n=7708)	Uncertain (n=853)	Inappropriate (n=464)	Not Classified (n=3503)
Prior MI	3696 (30%)	28%	38%	28%	32%
Prior PCI	4800 (38%)	34%	45%	40%	45%
Prior CABG	2287 (18%)	17%	44%	33%	13%
HTN	9539 (76%)	75%	81%	78%	77%
Dyslipidemia	9610 (77%)	75%	85%	78%	80%
Diabetes mellitus	4123 (33%)	32%	36%	39%	34%
Peripheral vascular disease	1262 (10%)	10%	12%	14%	13%
Cerebrovascular disease	1530 (12%)	12%	12%	14%	13%
Heart failure	1224 (10%)	9%	13%	10%	11%
COPD	1520 (12%)	13%	10%	9%	12%
Prior valve surgery	197 (2%)	1%	3%	2%	1%
Hemodialysis	247 (2%)	2%	2%	2%	2%
Current smoker	2917 (23%)	26%	15%	14%	20%

Site Characteristics

Characteristic	Total (n=12,528)	Appropriate (n=7708)	Uncertain (n=853)	Inappropriate (n=464)	Not Classified (n=3503)
Procedural volume	608 ₊ 343	602 ₊ 344	629 ₊ 300	614 ₊ 320	618 ₊ 351
< 100	644 (5%)	6%	2%	3%	3%
100-399	3636 (29%)	28%	26%	29%	33%
> 400	8247 (66%)	66%	72%	68%	64%
CABG program	11,303 (90%)	88%	97%	95%	92%

Overall Appropriateness of PCI

Indication	Total (n=12,528)	Appropriate (n=7708)	Uncertain (n=853)	Inappropriate (n=464)	Not Classified (n=3503)
Acute Indications	8492 (68%)	6921 (82%)	40 (<1%)	70 (1%)	918 (11%)
Non-Acute Indications	4036 (32%)	788 (20%)	812 (20%)	387 (10%)	2049 (51%)



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PCI Appropriateness for Acute Indications

PCI Indication	Total (n=8492)	Appropriate (n=6921)	Uncertain (n=40)	Inappropriate (n=70)	Not Classified (n=1461)
Acute STEMI	1846 (22%)	93%	0%	0%	7%
STEMI > 12 hrs from symptom onset					
Unstable	86 (1%)	70%	0%	0%	30%
Stable	59 (1%)	0%	0%	100%	0%
STEMI with PCI after lytics					
Successful lytics	70 (1%)	0%	57%	16%	27%
Failed lytics (Rescue PCI)	69 (1%)	88%	0%	0%	12%
Non-STEMI or high- risk UA	5444 (64%)	93%	0%	0%	7%
Non-high risk UA	918 (11%)	0%	0%	0%	100%



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PCI Appropriateness for Non-Acute Indications – Part I

PCI Indication	Total (n=4036)	Appropriate (n=788)	Uncertain (n=812)	Inappropriate (n=387)	Not Classified (n=2049)
Angina Severity					
No symptoms	1159 (29%)	7%	14%	13%	66%
Class I	391 (10%)	23%	16%	4%	57%
Class II	1727 (43%)	24%	18%	4%	55%
Class III	535 (13%)	54%	8%	1%	36%
Class IV	209 (5%)	49%	11%	0%	40%
Number of anti-anginal medications					
0	1601 (40%)	15%	22%	12%	50%
1	1794 (44%)	14%	19%	10%	56%
≥ 2	641 (16%)	44%	18%	2%	36%
Anti-anginal medications					
B-blockers	2183 (85%)	30%	9%	2%	59%
Nitrates	469 (18%)	9%	3%	0%	88%
CCB	484 (19%)	14%	4%	1%	82%
Ranolazine	34 (1%)	3%	3%	0%	94%
Other	18 (1%)	17%	0%	0%	83%



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PCI Appropriateness for Non-Acute Indications – Part II

PCI Indication	Total (n=4036)	Appropriate (n=788)	Uncertain (n=812)	Inappropriate (n=387)	Not Classified (n=2049)
Noninvasive risk assessment					
Low-risk	349 (9%)	16%	38%	30%	16%
Intermediate-risk	585 (14%)	31%	42%	11%	16%
High-risk	390 (10%)	65%	16%	3%	16%
Unknown	2712 (67%)	18%	6%	2%	74%
Coronary disease					
1 or 2 borderline	114 (3%)	6%	18%	38%	39%
1 non-prox LAD	1629 (40%)	14%	13%	7%	67%
1 proximal LAD	355 (9%)	42%	12%	1%	45%
2 non-prox LAD	806 (20%)	19%	12%	5%	63%
2 proximal LAD	320 (8%)	36%	17%	4%	44%
3 vessel disease	825 (20%)	39%	22%	6%	33%
Left main	276 (7%)	43%	19%	8%	29%
CTO	243 (6%)	10%	25%	5%	60%
Prior Bypass	872 (22%)	22%	31%	9%	38%

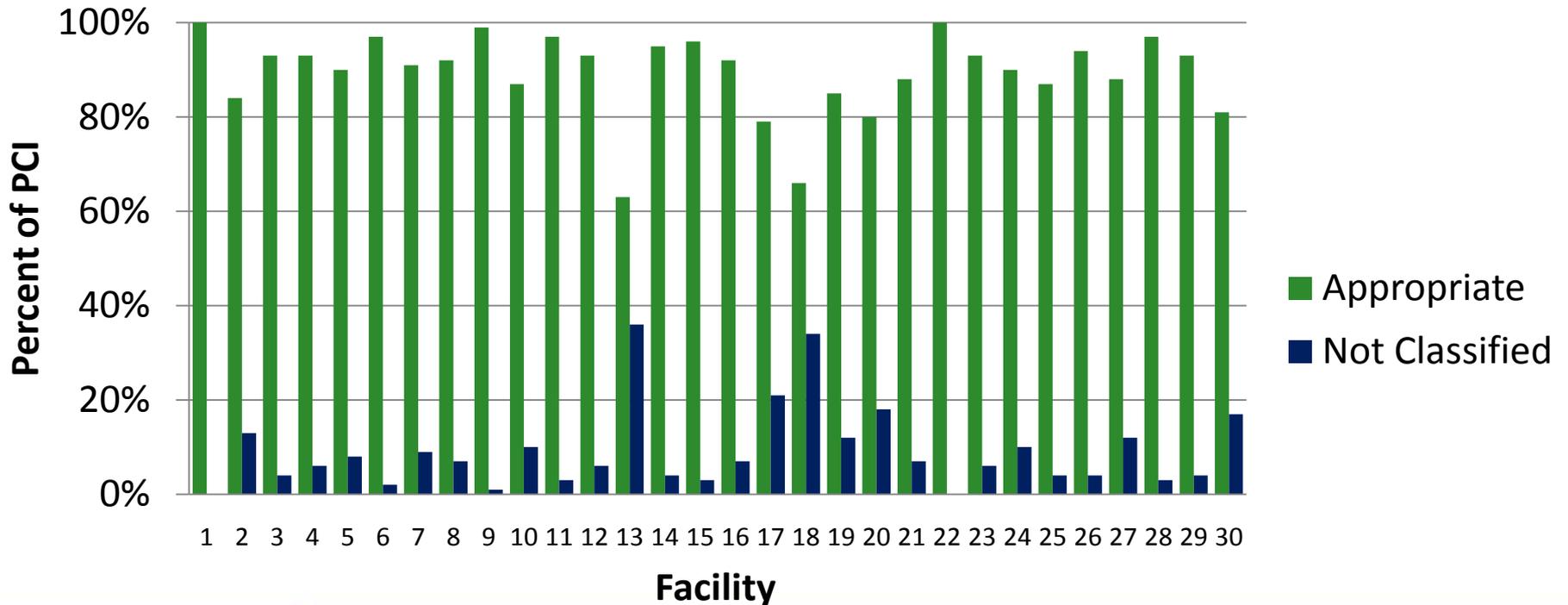


PCI Appropriateness for Non-Acute Indications – Assumed Stress Test Results

Assumption for Missing Stress Test	Total	Appropriate	Uncertain	Inappropriate	Not Classified
Low-Risk	4036	18%	40%	41%	2%
Intermediate-Risk	4036	26%	51%	22%	2%
High-Risk	4036	55%	33%	10%	2%

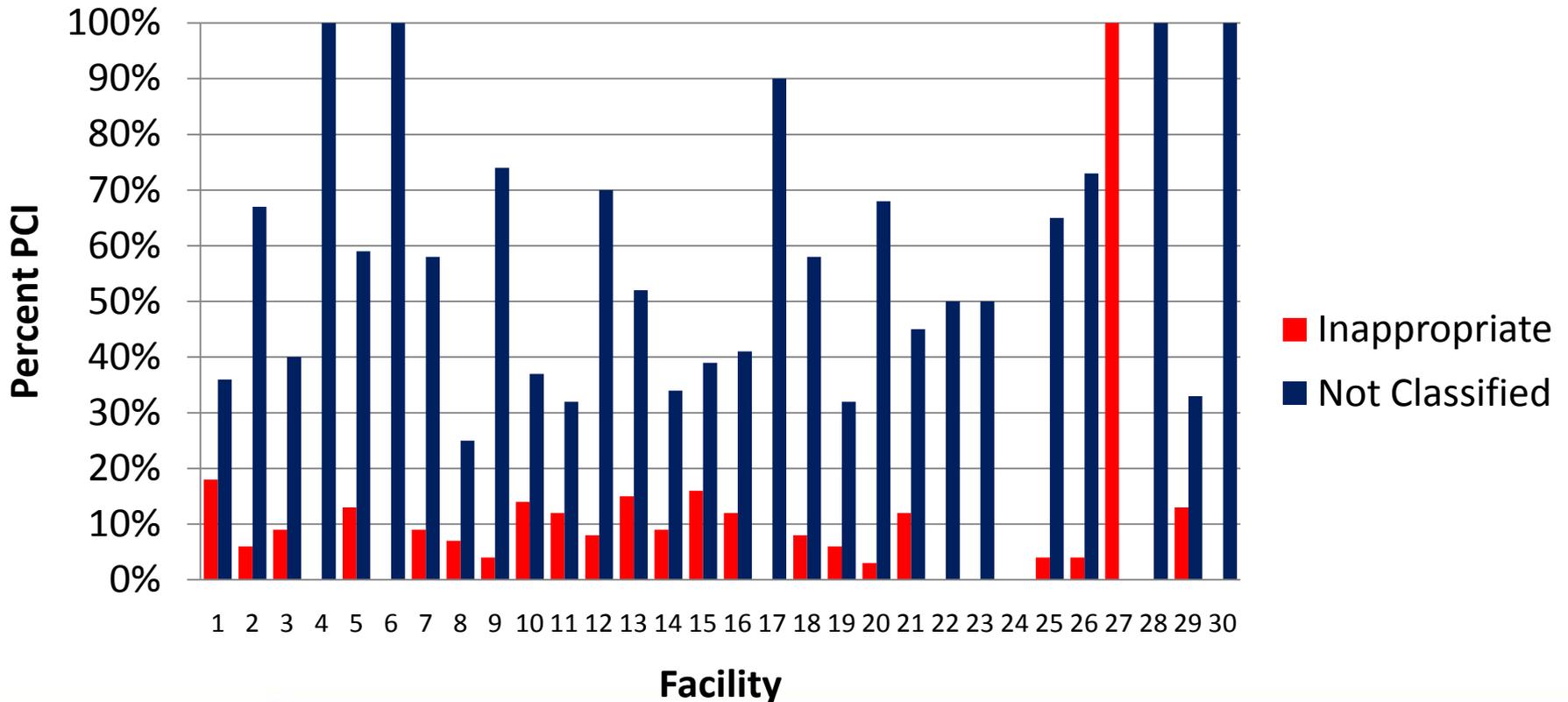
PCI Appropriateness by Facility

Acute Indications After Excluding UA without High-risk Features



PCI Appropriateness by Facility

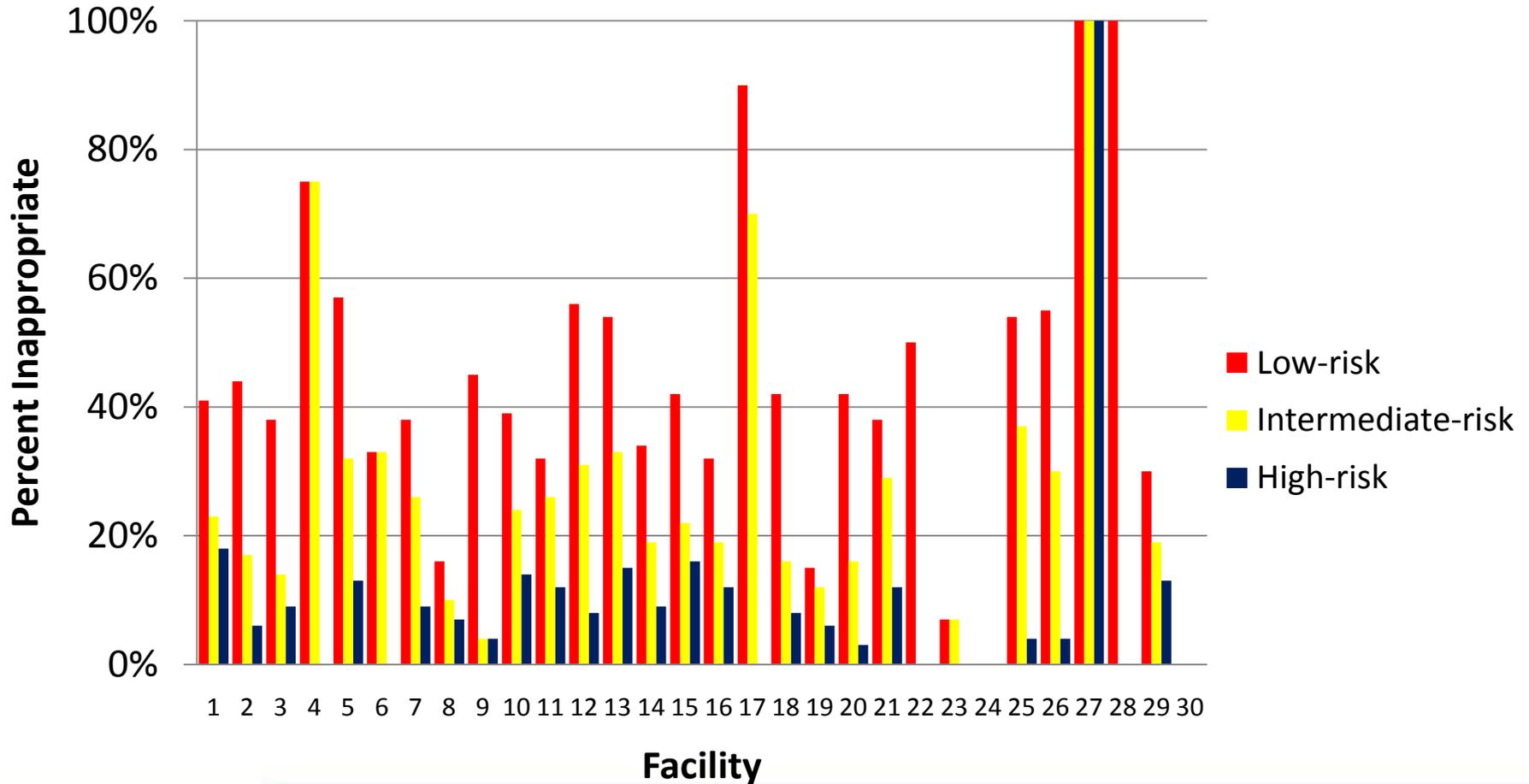
Non-Acute Indications





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PCI Appropriateness by Facility – Influence of Assumed Stress Test Results



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Conclusion

Of the >9000 PCI performed in Washington State that could be mapped to the Appropriate Use Criteria for Revascularization more than 85% were appropriate

Of PCI for non-acute indications, 10% were inappropriate even after assumptions to maximize appropriateness



Conclusions

Challenges in the application of Appropriate Use Criteria for quality improvement

- Missing data on non-invasive stress testing with wide variation by facility
- Influence of revascularization approach

Conclusion

Application of appropriate use criteria may identify appropriate practice patterns and facilitate highly effective and efficient care

Similar appropriateness across practice settings is a reasonable goal; complete elimination of “inappropriate” use is not



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Thank you