Methods for assessing guideline adherence for invasive procedures in the care of chronic coronary artery disease – a scoping review: Supplementary Material

Supplementary file 4: Methods and results

Study	Guideline and treatment decision	Data source and collection	Data and variables	Definition of guideline adherence	Quantification and level of measurement	Extent of guideline adherence
Kiselev et al. 2019 [1]	ESC/EACTS 2014 GL on myocardial revascularization Revascularization	Russian registry Retrospective data entry from patient charts by trained study personnel	- Coronary anatomy - Extent of stenosis - LVEF - Clinical history - Symptom status - Therapy	a) Adherence = revascularization if indication b) Non-adherence = indication without revascularization Indication = class I recommendation	Proportion of adherent/non-adherent treatment A binary measure	a) Procedure performed: 81% adherence b) Procedure indicated: 40% adherence
Epstein et al. 2003 [2]	ACC/AHA 1988 GL on PTCA ACC/AHA 1991GL on CABG Revascularization	Medicare data + patient charts Review of coronary angiography report and charts by trained study personnel	- Extent of coronary artery occlusion - Indication for angiography - Severity of angina - Comorbid conditions and risk factors - Medical/surgical history - Medication - Allergies/intolerances - Results of stress tests	a) Non-adherence = no revascularization if indication Indication = recommendation class I b) Non-adherence = revascularization if no indication No indication = class III recommendation	Proportion of non-adherent treatment A binary measure	a) Procedure indicated: ≈ 76% adherence b) Procedure not indicated: ≈ 94% adherence

Study	Guideline and treatment decision	Data source and collection	Data and variables	Definition of guideline adherence	Quantification and level of measurement	Extent of guideline adherence
O'Connor et al. 2008 [3]	ACC/AHA 2004 GL on CABG CABG	American registry Data contribution by centres	- Coronary anatomy - Extent of stenosis - Extent of ischemia - Symptom status - Shock - Prior treatment - Suitability for surgery/PCI - Hemodynamic stability - Cardiac history (e.g. STEMI) - Area of viable myocardium - Results of non-invasive testing	Useful procedure = Recommendation class I Evidence favours procedure = Recommendation class IIa Evidence less well established = Recommendation class IIb Procedure not useful = Recommendation class III Adherence = CABG if recommendation class I or II	Proportion of useful, evidence favours procedure, evidence less well established and not useful procedures + adherent and non-adherent to guidelines A multi-categorical and a binary measure	87% useful (class I) 11% procedure favoured (class IIa) 2% not useful (class III) Overall: 98% adherence
Witberg et al. 2014 [4]	ESC 2010 GL on myocardial revascularization PCI, CABG	Chart review by study personnel Calculation of SS (and cSS) by a study physician not blinded to mode of revascularization using a web-based calculator	- Clinical, laboratory, angiographic characteristics - SS/cSS	Adherence = PCI/CABG according to indication Indication for PCI = recommendation class IIa No indication for PCI/Indication for CABG = recommendation class III for PCI	Proportion of adherent/non-adherent treatment A binary measure	PCI: 78% adherence CABG: 49% adherence

Study	Guideline and treatment decision	Data source and collection	Data and variables	Definition of guideline adherence	Quantification and level of measurement	Extent of guideline adherence
Leape et al. 2003 [5]	ACC/AHA 1988/1993 GL on PTCA ACC/AHA 1991 GL on CABG PTCA, CABG	Medicare data + patient charts Review of coronary angiography report and charts by trained study personnel	Clinical and laboratory data (e.g. symptoms, extent of CAD)	Justified procedure = recommendation class I Uncertain procedure = recommendation class II No indication for procedure = recommendation class III Adherence= procedures rated as justified and uncertain	Proportion of justified, uncertain, not indicated procedures (and adherent and non-adherent to guidelines) A multi-categorical and a binary measure	PTCA, 1988 GL: - 18% justified (class I), - 55% uncertain (class II) - 27% not indicated (class III) - Overall: 73% adherence PTCA, 1993 GL: - 15% justified (class I), - 58 % uncertain (class II) - 27 % not indicated (class III) - Overall: 73% adherence CABG: - 86% justified (class I), - 12% uncertain (class II) - 2% not indicated (class III) - Overall: 98% adherence
Linder et al. 2018 [6]	NVL 2013 on chronic CAD (ESC/EACTS 2014 GL on myocardial revascularization) PCI	Claims data Data record review using ICD-/OPS-/EBM-Codes by study personnel	- ICD-Code (diagnosis, number of lesioned vessels) - EBM/OPS codes for stents implantation	Adherence = no PCI if indication for CABG Indication = recommendation grade A (/Class I recommendation for CABG and class III recommendation for PCI)	Proportion of adherent/non-adherent treatment A binary measure	67% adherence

Study	Guideline and treatment decision	Data source and collection	Data and variables	Definition of guideline adherence	Quantification and level of measurement	Extent of guideline adherence
Marino et al. 2020 [7]	ESC/EACTS 2018 GL on myocardial revascularization (ACCF/AHA GL 2012 on stable ischemic heart disease) PCI, Ad hoc PCI	Patient charts Review of chart and coronary angiogram and determination of PTP by study personnel Definition of SS and SYNTAX Revascularization Index, coronary anatomy and presence of 'borderline' stenosis by study personnel	- SS - Coronary anatomy - Significance of stenoses	a) Adherence = PCI if strong recommendation for PCI or similar recommendation for PCI/CABG Strong recommendation = Class I recommendation for PCI and class IIb for CABG Similar recommendation = Class I recommendation for PCI and class I for CABG, class IIa recommendation for PCI and class I/II for CABG b) Non-adherence = ad hoc PCI if indication for heart team discussion Indication = recommendation class I for CABG	Proportion of adherent/non-adherent treatment A binary measure	a) PCI: 91% adherence b) Ad hoc PCI: 17% adherence
Leonardi et al. 2017 [8]	ESC 2013 GL on stable CAD ESC/EACTS 2014 GL on myocardial revascularization Ad hoc PCI, PCI with heart team discussion	Review of chart and coronary angiogram and determination of PTP by study personnel Definition of SS, coronary anatomy and presence of 'borderline' stenosis by study personnel	- Coronary anatomy - Significance of stenoses - SS - Evidence of heart team discussion	a) Adherence = heart team discussion if indication b) Non-adherence = ad hoc PCI if indication for heart team discussion Indication = recommendation class I for heart team, recommendation class I for CABG	Proportion of adherent/non-adherent treatment A binary measure	a) Heart team discussion: 11% adherence b) Ad hoc PCI: 20% adherence

Study	Guideline and treatment decision	Data source and collection	Data and variables	Definition of guideline adherence	Quantification and level of measurement	Extent of guideline adherence
Yates et al. 2014 [9]	ESC/EACTS 2010 GL on myocardial revascularization PCI with heart team discussion	British registry, records on heart team discussion Prospective data collection during PCI in registry by care providers Review of database of all patients discussed by the heart team by study personnel, minutes recorded at each meeting	- Coronary anatomy - Significance of stenoses - Diagnosis - Management plan - Reasons for deviation from expected practice	Adherence = heart team discussion before revascularization if indication Indication = recommendation class I	Proportion of adherent/non-adherent treatment A binary measure	2010: 10% adherence 2011: 19% adherence
Morgan-Hughes et al. 2021 [10]	NICE CG95 (2016) CA	Prospective data collection at participating centres in patient records and picture archiving/communication systems and anonymized collation at audit centre Definition of CTCA as diagnostic or not by reporting cardiologist/radiologist using own criteria	- Demographic information - CTCA results - Diagnostic tests - Revascularization	Non-adherence = Overuse of CA Surrogate: Overuse of CA = CA without strong recommendation and revascularization	Proportion of adherent/non-adherent (overuse of CA) treatment A binary measure	52% adherence

Study	Guideline and treatment decision	Data source and collection	Data and variables	Definition of guideline adherence	Quantification and level of measurement	Extent of guideline adherence
Leung et al. 2007 [11]	ACC/AHA 1999 GL on CA CA	N/A Prospective data recording by study personnel Classification (visual) of chest pain and estimation of the degree of coronary stenosis by experienced study personnel	- Clinical history - Coronary risk factors (e.g. diabetes mellitus, smoking) - Symptoms - Results of electrocardiograms and laboratory tests - Extent of stenosis - Prior treatment	Adherence = CA if recommendation class I or II (Non-adherence = CA if recommendation class III or no recommendation class I or II)	Proportion of adherent/non-adherent treatment A binary measure	53% adherence
Rubboli et al. 2001 [12]	ACC/AHA 1999 GL for CA CA	Chart review by study personnel Charts filled out by catheterization cardiologist	- Clinical diagnosis (indication) - Comorbidities - Cardiovascular risk factors - Laboratory test results - Instrumental examination results - Ongoing treatment	Useful procedure = recommendation class I Evidence favours procedure = recommendation class IIa Evidence less well established = recommendation class IIb Non-useful procedure = recommendation class III Adherence = CA if recommendation class I (useful) or IIa (evidence favours procedure) Uncertain = CA if recommendation class IIb (evidence less well established)	Proportion of useful, evidence favours procedure, evidence less well established and not useful procedures + adherent, uncertain and non-adherent procedures A multi-categorical measure	Approx. 71% useful Approx. 8% favoured (class IIa) 21% less established (class IIb) Overall: 79% adherent (class I /IIa) 21% uncertain (class IIb) 0% non-adherent (class III)

Study	Guideline and treatment decision	Data source and collection	Data and variables	Definition of guideline adherence	Quantification and level of measurement	Extent of guideline adherence
				Non-adherence = CA if recommendation class III (not useful)		

ACC = American College of Cardiology, ACCF = American College of Cardiology Foundation, AHA = American Heart Association, CA = Coronary Angiography, CABG = Coronary Artery Bypass Grafting, CAD = Coronary Artery Disease, cSS = clinical Syntax Score, CTCA = Computed Tomography – CA, DM = Diabetes mellitus, EBM = Common Assessment Scale, ESC = European Society of Cardiology, EACTS = European Association for Cardio-Thoracic Surgery, GL = Guideline, ICD = International Classification of Diseases, (LV)EF = (Left Ventricular) Ejection Fraction, LVF = Left Ventricular Function, (N)STEMI = (non-)ST-segment Elevation Myocardial Infarction, NVL = National disease management guideline, OPS = Operation and procedure codes, PCI = Percutaneous Coronary Intervention, PTCA = Percutaneous Transluminal Coronary Angioplasty, PTP = Pre-Test Probability, SS = Syntax Score

References

1. Kiselev AR, Korotin AS, Posnenkova OM, et al. Discrepancy between the European clinical guidelines and myocardial revascularization in patients with stable coronary artery disease in Russia. *Int J Qual Health Care* 2019 May 1;31(4):269-75. doi: 10.1093/intqhc/mzy140

2. Epstein AM, Weissman JS, Schneider EC, et al. Race and gender disparities in rates of cardiac revascularization: do they reflect appropriate use of procedures or problems in quality of care? *Med Care* 2003 Nov;41(11):1240-55. doi: 10.1097/01.mlr.0000093423.38746.8c

3. O'Connor GT, Olmstead EM, Nugent WC, et al. Appropriateness of Coronary Artery Bypass Graft Surgery Performed in Northern New England. *J Am Coll Cardiol* 2008;51(24):2323-8. doi: 10.1016/j.jacc.2008.01.067

4. Witberg G, Lavi I, Gonen O, et al. Long-term outcomes of patients with complex coronary artery disease according to agreement between the SYNTAX score and revascularization procedure in contemporary practice. *Coron Artery Dis* 2014 Jun;25(4):296-303. doi: 10.1097/mca.0000000000000106

5. Leape LL, Weissman JS, Schneider EC, et al. Adherence to practice guidelines: The role of specialty society guidelines. *Am Heart J* 2003;145(1):19-26. doi: 10.1067/mhj.2003.35

6. Linder R, Zeidler J, Verheyen F, et al. Guidelines versus reality: is coronary stent application in three-vessel disease standard or the exception? *Eur J Health Econ* 2018 Jul;19(6):821-30. doi: 10.1007/s10198-017-0924-4

7. Marino M, Leonardi S, Crimi G, et al. Lack of implementation of guidelines recommendations for coronary revascularization in stable patients with complex disease is associated with high rates of incomplete revascularization: Analysis from the Apache study. *Heart Vessels* 2020 Jan;35(1):30-7. doi: 10.1007/s00380-019-01459-1

8. Leonardi S, Marino M, Crimi G, et al. APpropriAteness of percutaneous Coronary interventions in patients with ischaemic HEart disease in Italy: the APACHE pilot study. *BMJ Open* 2017 Sep 5;7(9):e016909. doi: 10.1136/bmjopen-2017-016909

9. Yates MT, Soppa GK, Valencia O, et al. Impact of European Society of Cardiology and European Association for Cardiothoracic Surgery Guidelines on Myocardial Revascularization on the activity of percutaneous coronary intervention and coronary artery bypass graft surgery for stable coronary artery disease. *J Thorac Cardiovasc Surg* 2014 Feb;147(2):606-10. doi: 10.1016/j.jtcvs.2013.01.026

10. Leung DY, Hallani H, Lo ST, et al. How compliant are we with guidelines for coronary angiography in clinical practice? *Intern Med J* 2007;37(10):699-704. doi: 10.1111/j.1445-5994.2007.01390.x

11. Morgan-Hughes G, Williams MC, Loudon M, et al. Downstream testing after CT coronary angiography: time for a rethink? *Open heart* 2021 Feb;8(1). doi: 10.1136/openhrt-2021-001597

12. Rubboli A, La Vecchia L, Casella G, et al. Appropriateness of the use of coronary angiography in a population of patients with ischemic heart disease. *Ital Heart J* 2001 Sep;2(9):696-701.