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Audit and quality assessment of national persian registry of cardiovascular disease(N-PROVE) in terms of comorbidities, angiography, and angioplasty characteristics in Iran

Sayed Mohammad Hashemi Jazi[1,2], Ehsan Shirvani[3], Asieh Mansouri[4], Mohammad Kermani-Alghoraishi[3], Armin Bordbar[5], Fereshteh Sattar[6], Ali Safaei[7], Hossein Farshidi[8], Ahmad Reza Assareh[9], Toba Kazemi[10], Alireza Khosravi[4]

OriginalArticle

Abstract

BACKGROUND: The National Persian Registry of Cardiovascular Disease (N-PROVE) has been established to provide a comprehensive database of cardiovascular diseases in the Iranian community for further investigations and to develop national guidelines for the diagnosis, treatment, and prevention of cardiovascular disease (CVD). As with most clinical registries, a quality control audit is necessary to ensure a comprehensive and accurate registry; the current study aims to assess the validity and quality of the N-PROVE/Angiography/Percutaneous Coronary Intervention (PCI) registry.

METHODS: The current cross-sectional quality assessment study serves as an example of data quality assessment in N-PROVE on a sample of patients registered in the N-PROVE/Angiography/PCI registry since 2020. Accordingly, data of 194 patients, including comorbidities, angiography, and angioplasty characteristics, were collected from the N-PROVE/Angiography/PCI registry as the main database and reevaluated by a panel consisting of a cardiologist and two coronary intervention fellowships as a test database.

RESULTS: The quality control of the population-based healthcare database, the N-PROVE/PCI, revealed that the average error rate in terms of comorbidities, angiography characteristics, angioplasty characteristics, and in total were 3.8%, 2.3%, 3%, and 3.03%, respectively.

CONCLUSION: According to the findings of this study, the N-PROVE/PCI registry had an average error of less than 4% in the assessed dimensions, including comorbidities, angiography, and angioplasty characteristics. Therefore, this registry appears valid and may be used for contemporary epidemiological studies.

Keywords: Registries; Data Management; Cardiovascular Disease; Angiography; Angioplasty

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1- Department of Biostatistics and Epidemiology, School of Health, Isfahan University of Medical Sciences, Isfahan, Iran
2- School of Medicine, Department of Cardiology, Isfahan University of Medical Sciences, Isfahan, Iran.
3- Interventional Cardiology Research Center, Cardiovascular Research Institute, Isfahan University of Medical Sciences, Isfahan, Iran.
4- Hypertension Research Center, Cardiovascular Research Institute, Isfahan University of Medical Sciences, Isfahan, Iran.
5- Department of Cardiology, Musavi Hospital, School of Medicine, Zanjan University of Medical Sciences, Zanjan, Iran.
6- Heart Failure Research Center, Cardiovascular Research Institute, Isfahan University of Medical Sciences, Isfahan, Iran.
7- Isfahan Cardiovascular Research Center, Cardiovascular Research Institute, Isfahan University of Medical Sciences, Isfahan, Iran.
8- Cardiovascular Research Center, Hormozgan University of Medical Sciences, Bandar Abbas, Iran.
9- Atherosclerosis Research Center, School of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.
10- Cardiovascular Diseases Research Center, Birjand University of Medical Sciences, Birjand, Iran.
Address for correspondence: Ehsan Shirvani: Interventional Cardiology Research Center, Cardiovascular Research Institute, Isfahan University of Medical Sciences, Isfahan, Iran. Email: shirvani_x100@yahoo.com
Asieh Mansouri: Hypertension Research Center; Cardiovascular Research Institute, Isfahan University of Medical Sciences. Salman Farsi St, Isfahan, Iran. Email: mansouri.arn@gmail.com

Introduction

The process of research has dramatically evolved over the past decades. Medical evidence is generally obtained from three sources, including randomized clinical trials, administrative claims databases, and data registries[1]. Each of these resources has its dedicated set of applications. The primary aim of clinical trials is to practically approve pharmaceutical or device administration. These studies have highly regulated requirements for source document verification, often with a 100% chart abstraction audit[2]. Another source of information gathering is administrative claims databases, the quality control of which is primarily limited to fields directly related to claims adjudication; a fact that restricts the use of these databases for healthcare research[3]. The last one, registries, are non-randomized observational data sets with the potential to be generalized to the real world. However, the value of registries is deeply dependent on the representativeness of participants and the completeness of enrollment[4]. To generalize each of these cases, the standards of quality must be defined. This raises a question: how can it be verified that sufficient data validation to support improvements in healthcare quality and outcomes has been registered? On the other hand, due to the large volume of data in registries, it is not feasible to meet the stringent requirements used in clinical trials[5].

Registries with acceptable coverage and appropriate data quality can encompass diverse entities to create a comprehensive population-based schedule. In addition to the standard information about demographic characteristics such as gender, date of birth, residence, insurance coverage, emigration, educational level, and marital status that can provide valuable insights into the socioeconomic status of the population[6, 7], data registries might offer other information. This includes the quality of healthcare provision, accessibility to medical care, hospital admissions and their etiology, patient vitality, prescribed medications, and generally the quality of healthcare and its shortcomings[8]. The ultimate goal of these registries is to enhance the quality of the healthcare system and ensure equal access to treatment, as community health services provide tax-financed universal healthcare to all citizens, guaranteeing free access to care at general practitioners and hospitals. However, these derivations are deeply dependent on the quality of the collected data [6, 9].

In this regard, the authors can centrally support registries whose accuracy, completeness, and consistency have been thoroughly assessed [4]. Given this, data quality programs must be designed to evaluate the data in three domains, including a data quality report (DQR), internal quality assurance protocols, and an annual data audit program [1].

Globally, cardiovascular events (CVEs) account for more than one-third of all-cause mortality worldwide, ranking as the primary cause of morbidity and mortality [10]. However, cardiovascular diseases (CVD) account for 31% of deaths, while this cause accounts for 38% in Iran[11].

Percutaneous coronary intervention (PCI) provides a comprehensive view of the anatomy and pathologies of coronary arteries responsible for CVDs related to coronary arteries. Therefore, to date, this modality is considered the most significant means to assess, diagnose, and even manage coronary artery disease[12].

The importance of CVD as the primary health concern worldwide clarifies the need to create a disease registry to gain a comprehensive view of ongoing CVD care and management, including medical, intensive, and interventional care such as coronary angiography and PCI. This promotes its quality, encourages healthcare providers to lean towards a more patient-based self-care approach, and to adopt better healthcare services by identifying the gaps and challenges in treatment and care [8, 13, 14]. The Persian Registry Of cardioVascular diseasE (N-PROVE) was established in 2016[15] as the scale-up of a primary local registry titled Persian Registry Of cardioVascular diseasE (PROVE) that was developed by Givi et al. in 2014[11] according to the WHO Multinational Monitoring of trends and determinants in Cardiovascular disease (MONICA) method for CVEs and as a demonstration study for checking the feasibility and practicality of a large-scale registry[16]. This registry was designed by the Iranian Network of Cardiovascular Research (available via URL: http://heart-net.ir/) with multiple aims including "*to assess the efficacy and outcomes of various CVD interventions, to determine the costs and effectiveness of different diagnosis and treatment methods, to follow the survival and quality of life*

of CVD patients and finally as useful evidence for developing national guidelines on diagnosis, treatment, and prevention of CVD".

The need for assessment of the validity and quality of registry data increases as a patient registry expands [1]. The quality assessment process is programmed to perform and report annually on a random sample of registered patients. The current study is an example of a data quality assessment that has been conducted on a sample of patients registered in the N-PROVE/Angiography/PCI registry.

Methods

Questionnaire

There are several questionnaires in the N-PROVE database, including demographic/history and risk factors, clinical presentation, angiography, angioplasty, discharge, and follow-up. The list of variables in each questionnaire, data entry location and personnel, and quality assessment method are presented in the Appendix (Table A1 to A3). All questionnaires are completed when the patient is in the hospital, but the follow-up forms are completed by a phone call at one, three, and twelve months after PCI for post-PCI cardiovascular events assessment. More details are mentioned elsewhere[16]. The quality assessment process is fulfilled in various methods according to the type of registered data. The accuracy of demographic and basic data is checked via telephone contact with the patient by a nurse who is blinded about registered data. This nurse fills a new empty form according to the patient's telephone report. Clinical and hospital data are checked by comparing registered data with hospital records. Angiography and angioplasty registered data are checked by re-observing and re-interpreting films. Disagreements at every three stations are discussed in the quality control committee. Then, the registered data are corrected according to the final decision of the committee[15].

Procedure

Quality assessment in N-PROVE is performed periodically at 3-6 month intervals. The current cross-sectional quality assessment study is an example of data quality assessment in N-PROVE that has been conducted on a sample of patients registered in the N-PROVE/Angiography/PCI registry between August 2020 and May 2021. Considering an error rate of 3% according to Rasmussen et al.[8] with α=0.05 and d=0.02, a sample size equal to 124 patients was calculated. These patients were selected from various cardiac centers connected to N-PROVE/Angiography/PCI proportionally to the total number of registered patients in each center ($n=\frac{Z^2_{1-\frac{\alpha}{2}}P(1-P)}{d^2}$). Ultimately, 199 cases were entered into the study. After determining the number of patients needed from each center proportionally to the total patients registered in each center, the patients were selected using a systematic random sampling method. A list of selected patients, in terms of their center, was then presented to the data collection team. The data in this study consisted of the patient's demographic and clinical history, including age, gender, hypertension (HTN), diabetes mellitus (DM), chronic kidney disease (CKD), dyslipidemia (DLP), and current smoking (yes/no), and opium consumption (yes/no). Procedure-related data included the involved epicardial coronary arteries territories, the number, length, and stenosis severity of coronary arteries lesions for all patients, and the number, length, and width of the stents, TIMI (Thrombolysis in Myocardial Infarction) flow prior to and after angioplasty, antegrade and retrograde flow, the angioplasty administered techniques (stent embedding, balloon angioplasty), and bifurcation for those who underwent angioplasty. Demographic and clinical data were collected via telephone contact with the patient by an expert who was blinded about the main registered data. Procedure-related data were collected by observing angiography and PCI films by an experienced cardiologist and two fellowships of interventional cardiology with more than 50 PCI operations per month.

Statistical analysis

For the current study, a new database was created that was completely similar to the N-PROVE/Angiography/PCI database. Then, new data collected from the study sample were entered into this database. In this study, the N-PROVE/Angiography/PCI database and the new database were named as the main-database and test-database, respectively. After completely entering the recollected data of the study sample into the test-database, data of the study sample were extracted from both databases and merged together into a unique file using the patient's National Code as the key variable. In line with a quality assurance

Table 1. Demographic characteristics of participants, N-PROVE/Angiography/PCI, 2020, Iran

Variable		Total (N=194) Mean (SD) or Number (%)	Male (N=131) Mean (SD) or Number (%)	Female (N=63) Mean (SD) or Number (%)	P-value
Age (year)		61.13 (10.9)	63.46 (9.6)	60.01 (11.3)	0.029
Body mass index (kg/m²)		26.72 (4.5)	26.16 (4.0)	28.00 (5.3)	0.054
Education	**Illiterate**	7 (3.6)	4 (6.3)	3 (2.3)	.
	Elementary	4 (2.1)	*	4 (3.1)	
	Guidance	1 (0.5)	*	1 (0.8)	
	High school	1 (0.5)	*	1 (0.8)	
	Bachelor	2 (1.0)	1 (1.6)	1 (0.8)	
	Unknown	179 (92.3)	58 (92.1)	121 (92.4)	

N-PROVE: national persian registry of cardiovascular disease; PCI: percutaneous coronary intervention; SD: standard deviation
* Unknown education level

Table 2. Difference Between Main and Test databases in terms of risk factors, N-PROVE/Angiography/PCI, 2020, Iran

Variable	Main, n (%)	Test, n (%)	Error, n (%)	Kappa Statistic
Diabetes	54 (27.84)	59 (30.41)	6 (3.09)	0.93
Hypertension	90 (46.39)	98 (50.52)	9 (4.64)	0.91
CKD	2 (1.03)	2 (1.03)	2 (1.03)	1.00
Dyslipidemia	49 (25.26)	61 (31.44)	12 (6.19)	0.88
Smoking	46 (23.7)	57 (29.4)	11 (5.67)	0.85
Opium	13 (6.70)	17 (8.76)	4 (2.06)	0.86

N-PROVE: national persian registry of cardiovascular disease; PCI: percutaneous coronary intervention; CKD: chronic kidney disease

assessment study in Denmark, and in line with a study on "*Quality assurance of the Western Denmark Heart Registry*" by Rasmussen et al. [8], a binary variable named Error (yes/no) was defined as the frequency of divergence between the main and test database in the "yes" answer for each variable. In addition, Kappa statistics, as an agreement indicator, were calculated for all variables. All analyses were performed by the Statistical Package for Social Science (SPSS) (version 24, SPSS Inc., Chicago, IL).

Ethical Consideration

The study proposal, which met the ethical criteria of the Helsinki declaration, was submitted to the Ethics Committee of Isfahan University of Medical Sciences and approved under the code IR.MUI.MED.REC.1399.924. The study protocol was explained to the patients, and their consent was obtained. Patients were under no obligation to answer the questions asked via telephone contact.

Results

Among 194 patients, 63 (32%) were female. Demographic characteristics of patients are presented in Table 1. As shown, the mean age in men was significantly higher than in women. The body mass index was higher in women compared with men. Education was unknown in 92% of patients due to being a non-essential variable during form completion.

The quality of data relating to the cardiovascular risk factors entered into the first questionnaire in the N-PROVE (demographic/history and risk factors) in two phases of Main and Test databases is demonstrated in Table 2. Given that, the highest rate of discrepancy was noted in dyslipidemia (6.19%), while the least was for chronic kidney disease (CKD), accounting for 1.03%. Nevertheless, the kappa coefficient ranges from 0.85-1 for all the comorbidities.

Table 3 shows the quality of data registered in the

Table 3. Difference Between Main and Test databases in terms of Angiography Characteristics, N-PROVE/ Angiography/PCI, 2020, Iran

Variable		Main, n (%)	Test, n (%)	Error, n (%)	Kappa Statistic
Diagnosis φ	Single vessel disease	44 (30.1)	41 (28.1)	6 (4.1)	0.75
	Two vessels disease	37 (25.3)	45 (30.8)	16 (11.0)	0.60
	Three vessels disease	33 (22.6)	28 (19.2)	4 (2.7)	0.73
	Left main artery lesion	3 (2.1)	4 (2.7)	2 (1.4)	0.56
	Aortic valve replacement	0 (0)	0 (0)	0 (0)	-
	Coronary artery bypass grafting	15 (10.3)	15 (10.3)	0 (0)	1.00
	Coronary artery bypass grafting versus percutaneous coronary intervention	1 (0.7)	1 (0.7)	0 (0.0)	1.00
	Minimal coronary artery disease	15 (10.3)	14 (9.6)	3 (2.05)	0.73
	Intermediate coronary artery disease	0 (0)	0 (0)	0 (0)	-
	Severe aortic regurgitation (Yes)	0 (0)	0 (0)	0 (0)	-
	Severe aortic stenosis (Yes)	0 (0)	0 (0)	0 (0)	-
Dominancy of lesion	Right	134(91.8)	122(83.6)	2 (1.37)	0.51
	Left	4 (2.7)	12 (8.2)	8 (5.48)	0.48
	Codominant	3 (2.1)	8 (5.5)	6 (4.11)	0.34
Severity of stenosis	≤ 49%	18 (12.3)	20 (13.7)	6 (4.1)	0.70
	50-69%	21 (14.4)	20 (13.7)	6 (4.1)	0.63
	70-99%	62 (42.5)	65 (44.5)	8 (5.5)	0.82
	≥100%	12 (8.2)	12 (8.2)	1 (0.7)	0.91
Recommendation	Life style modification and follow-up	2 (1.4)	4 (2.7)	2 (1.4)	0.66
	Medical treatment	43 (29.5)	39 (26.7)	1 (0.68)	0.90
	Medical treatment if percutaneous coronary intervention failed	2 (1.4)	2 (1.4)	0 (0)	1.00
	Trans Aortic Valve Implantation	0 (0)	0 (0)	0 (0)	-
	Viability study	0 (0)	1 (0.7)	1 (0.7)	-
Length of the lesion *	Diffuse	27 (18.5)	38 (26.0)	14 (9.6)	0.67
	Discrete	56 (38.3)	54 (37.0)	8 (5.48)	0.74
	Tubular	28 (19.2)	24 (16.4)	4 (2.74)	0.72
TIMI Flow at baseline γ	0	19 (13.01)	18 (12.33)	4 (2.74)	0.72
	1	3 (2.05)	5 (3.42)	4 (2.74)	0.23
	2	9 (6.16)	11 (7.53)	3 (2.05)	0.79
	3	94 (64.38)	93 (63.70)	6 (4.11)	0.81
Lesion characteristics	Aneurysm	0 (0)	0 (0)	2 (1.4)	-
	Ectasia	6 (4.1)	6 (4.1)	1 (0.68)	0.82
	Dissection	0 (0)	0 (0)	0 (0)	-
	Ostial	8 (5.48)	8 (5.48)	1 (0.68)	0.87
	Calcified	7 (4.79)	8 (5.48)	1 (0.68)	0.93
	Bifurcation	6 (4.11)	6 (4.11)	0 (0.0)	1.00
	Eccentric	5 (3.4)	8 (5.5)	4 (2.74)	0.65
	Muscle bridge	1 (0.68)	2 (1.37)	1 (0.68)	0.66
	Diminutive	0 (0)	1 (0.7)	3 (2.05)	-
	Thrombotic lesion	2 (1.37)	3 (2.05)	1 (0.68)	0.80
	Patent stent	7 (4.79)	6 (4.11)	1 (0.68)	0.76
	Stent restenosis	3 (2.05)	2 (1.37)	0 (0.0)	0.80
	Stent thrombosis	1 (0.68)	1 (0.68)	0 (0.0)	1.00

N-PROVE: national persian registry of cardiovascular disease; PCI: percutaneous coronary intervention;
φ Coronaries stenosis is defined as more than 50% stenosis for Left Main (LM) and more than 70% stenosis for one, two or three major vessels as single (SVD), two (2VD) and three (3VD) vessel disease respectively; * Length of the lesion is defined as discrete (less than 1 centimeter), tubular (between 1 to 2 centimeter), diffuse (more than 2 centimeter); γ TIMI: Thrombolysis in myocardial infarction is defined as coronary grade flow (0: no perfusion, I: penetration without perfusion, II: partial perfusion, III: complete perfusion)

Table 4. Difference Between Main and Test Databases in terms of Angioplasty Characteristics, N-PROVE, N-PROVE/Angiography/PCI, 2020, Iran

Variables		Main, n (%)	Test, n (%)	Error, n (%)	Kappa Statistics
Pre-angioplasty TIMI	0	13 (14.44)	14 (15.56)	3 (3.33)	0.78
	1	6 (6.67)	6 (6.67)	3 (3.33)	0.46
	2	13 (14.44)	13 (14.44)	3 (3.33)	0.73
	3	55 (61.11)	53 (58.89)	6 (6.67)	0.68
Post-angioplasty TIMI	0	1 (1.1)	2 (2.22)	1 (1.11)	0.66
	1	0 (0)	1 (1.11)	1 (1.11)	0.00
	2	0 (0)	2 (2.22)	2 (2.22)	0.00
	3	87 (96.67)	82 (91.11)	0 (0.0)	0.52
Lesion type +	A	8 (8.89)	13 (14.44)	6 (6.67)	0.63
	B1	25 (27.78)	29 (32.22)	9 (10.0)	0.63
	B2	24 (26.67)	18 (20.00)	1 (1.11)	0.75
	C	20 (22.22)	26 (28.89)	8 (8.89)	0.71
Technical Bifurcation lesion		2 (2.22)	2 (2.22)	0 (0.00)	1.00
If ACS Is This Culprit Lesion		27 (30.00)	37 (41.11)	13 (14.44)	0.75
Lesion site	LAD	46 (51.11)	9 (10.00)	3 (1.5)	0.91
	LCX	19 (21.11)	37 (41.11)	42 (21.1)	0.76
	RCA	21 (23.33)	37 (41.11)	38 (19.1)	0.78
	Ramus	2 (2.22)	3 (3.33)	1 (1.11)	0.00
Lesion complication		1 (1.11)	1 (1.11)	0 (0)	1.00
Previous treated lesions		2 (2.22)	3 (3.33)	2 (2.22)	0.48

angiographic questionnaire. The highest errors were detected in the diagnosis section, two vessel disease in particular (11%), and diffuse type of length of lesion (9.6%). The least consistency between the Main and Test database was detected in the assessment of dominancy, ranging from 0.34-0.51.

The quality of data registered in the angioplasty questionnaire is presented in Table 4. It revealed the highest rate of discrepancy in culprit lesions (14.44%). The worst kappa coefficient as the representative of data consistency was noted in post-angioplasty TIMI. Detailed information is shown in Table 4.

Discussion

In general, registries have been proposed to collect large population-based data of a target disease and provide a comprehensive view of the quality of care delivered and the outcomes achieved. Additionally, registries can provide policymakers with insights to improve the scope of health-related issues, assist them in prioritizing intervention settings, and ultimately, enhance disease control and prevention strategies [11].

Given the importance of data quality and accuracy in patient registries, annual audit assessments are required. In this regard, the British Cardiovascular Intervention Society Registry, which includes all PCIs performed in Britain (including England, Scotland, Wales, and Northern Ireland), has been established since 1994 to assess the data of approximately 80,000 new PCIs. Therefore, the data are presented to the professional society at the annual autumn meeting and analyzed to assess the structure, appropriateness, process, and outcomes of PCI[17].

In this study, we re-entered data from a sample of patients into a new database that was completely similar to the N-PROVE/Angiography/PCI database and assessed the differences between the two databases. We observed a very remarkable consistency between the main and test databases on angiography and PCI data (a consistency >90% in most fields). The achieved kappa coefficient was more than 0.75 in most of the entities, representing the significant consistency of data between the Main and Test databases. A similar study was performed to evaluate the accuracy of the Western Denmark Heart Registry and reported an overall error rate of less than 3%, which decreased to less than 1.5%

for procedure-specific registrations [8]. Another study by Messenger and colleagues, who evaluated data abstraction for the CathPCI Registry, reported less than 5% of errors in the National Cardiovascular Data Registry [1].

Despite the high accuracy of the registered data, there was a noteworthy discrepancy between the main and test databases regarding a few variables. In this study, the severity of tortuosity had the highest discrepancy between the N-PROVE/Angiography/PCI registry and reassessments. This error was followed by the severity of stenosis and the length of the lesion. However, the lowest kappa coefficients were reported in regard to the dominancy of the lesions and post-PCI TIMI scores. These findings are considerably associated with inter-observer bias. It appears this bias is a result of insufficient attention of the users to comprehensive online help instructions while filling fields.

Similar differences were noted in the diagnosis of ACS. From the authors' point of view, this inconsistency is related to the structure of the health care system. In this system, in a number of centers, the patient is visited by several physicians with different educational degrees or levels of experience in a particular level of education during admission to discharge. This leads a physician who is, for example, only in charge of angiography not to be careful enough in completing the patient's clinical presentation form. The authors' suggested solution is to complete all registry forms exclusively by emergency room users.

Another reason for discrepancies in the authors' registry is the use of different definitions for a concept. For instance, the observed discrepancies about two- or three-vessel disease may have arisen from the fact that some physicians consider previously treated vessels from angioplasty as healthy vessels, while others do the opposite. All the above cases emphasize the necessity of adhering to dictionary definitions as the primary method to increase consistency among users and the accuracy of registered data.

On the other hand, some differences are due to discrepancies in treatment decisions among different physicians. Whether a patient should receive medical treatment or PCI may, however, be a different decision between two physicians.

Limitations and strength

A strength of this study is the auditing of the accuracy of registry data by a panel consisting of a cardiologist and two interventional cardiology fellowships. This fact enhances the quality of reassessments and minimizes potential differences. However, the number of included data, which is 1% of all angiographies, appears insufficient to generalize the findings. The authors recommend further studies to improve assurance regarding the quality and accuracy of the registry.

Conclusion

This study demonstrated that the N-PROVE/Angiography/PCI registry has a very good accuracy and may be utilized for contemporary epidemiological studies. The overall average error rate in this registry was 3.03% (3.8%, 2.3%, and 3% in terms of comorbidities, angiography, and PCI characteristics, respectively). However, the authors suggest repeated training in terms of using dictionary and unique definitions, as well as correcting some structures to improve data quality.

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Conflict of interest

None.

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Author's contribution

SMHJ and MKA planned the original study. ES

designed and managed data collection and entry. AM analyzed data, drafted results section of manuscript and critically revised all versions of manuscript. AB and FS improved interpretation. AS wrote first draft of the manuscript. MKA conceptualized the paper substantially. HF, ARA, TK and AK managed main registry database that was main source of this study data. All authors read and approved the final manuscript.

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Appendix

Table A1. details of baseline characteristics questionnaire in N-PROVE

Location	Data entry of personnel	Data collection questionnaire	Type of registered data		quality assessmen method
Catheterization laboratory	Trained nurse under supervision of cardiologist	Baseline characteristics	General	First and last name Birth-date Gender Nationality National code Phone numbers Insurance status Education level	Telephone contact with patient
			History and Risk factors	Height weight Smoking Alcohol consumption Diabetes mellitus Hypertension Dyslipidemia CKD (chronic kidney disease) Currently On Dialysis History of prior MI History of prior CABG History of prior PCI Positive Family History Cerebrovascular Disease Heart Failure (>14 days) Peripheral Arterial Disease Non-Coronary Heart Surgery Atrial Fibrillation	
			Clinical presentation	Stable angina Unstable angina STEMI Non-STEMI Heart failure Peripheral Vascular Disease Arrhythmia Valvular Heart Disease Cardiogenic Shock Within 24h Cardiac Arrest Within 24h Cardiomyopathy or LV Systolic Dysfunction Asymptomatic Other Explanations (Clinical) History of performed less invasive imaging studies History of performed invasive imaging studies	Comparing with hospital records

N-PROVE: national persian registry of cardiovascular disease; MI: myocardial infarction; CABG: coronary artery bypass grafting; PCI: percutaneous coronary intervention; STEMI: ST elevation myocardial infarction

Table A2. details of Angiography questionnaire in N-PROVE

Location	Data entry of personnel	Type of registered data	Quality assessment method
Catheterization laboratory	Cardiology resident's/ cardiology fellows/ Interventional Cardiologists	Cardiologist name Angiography date Angiography time Date entry name Data intendant name Medications Contrast volume Contrast type Fluor dose Referring status (elective, urgent,) Angiography approach Done LV assessment Pressure data (LV, Aorta, PA, RV) Aorta Root Angiography Aortic Diameter (ml) Aortic Dissection LV parameters Non-normal vessel/s name Percent Of Stenosis Length (diffuse, discrete, tubular) Ectasia (yes/no) Aneurysmal (yes/no) Dissection (yes/no) Ostial (yes/no) Severe tortuosity (yes/no) Heavy calcified (yes/no) Bifurcation (yes/no) Eccentric (yes/no) Muscle bridge (yes/no) Diminutive (yes/no) Thrombotic (yes/no) Location (distal/Mid/Proximal) Stent patent Stent restenosis Stent thrombosis Run off (antegrade/retrograde) TIMI flow (0/1/2/3) Dominancy (Right/left/codominant) Diagnosis (SVD/2VD/3VD/LM/sever AS/sever MR/sever AR/no epicardial coronary artery disease/intermediate coronary artery disease/minimal CAD/renal artery stenosis/residual vessels disease/sever peripheral vascular disease/coronary ectasia Graft diagnosis (yes/no) Recommendation (medical treatment/PCI/CABG/AVR/CABG VS multi-vessels PCI/life style modification and follow-up/medical treatment if failed PCI/multi vessels PCI/MV repair/ MVR/not cardiac treatment/PCI with planned CABG/peripheral vascular intervention/PTMC/PTPA/PTRA/TAVI/TV repair/viability study/ In case of PCI: PCI on what lesion	Re-observing and re-interpreting films

N-PROVE: national persian registry of cardiovascular disease; LV: left ventricle; PA: pulmonary artery; RV: right ventricle; TIMI: Thrombolysis in myocardial infarction; SVD: single vessel disease; 2VD: two vessel disease ; 3VD: three vessel disease; LM: left main; AS: aortic stenosis; MR: mitral regurgitation; AR: aortic regurgitation; CAD: coronary artery disease; PCI: percutaneous coronary intervention; CABG: coronary artery bypass grafting; AVR: aortic valve replacement; MV: mitral valve; MVR: mitral valve replacement; PTMC: percutaneous transvenous mitral commissurotomy; PTPA: percutaneous transluminal pulmonary angioplasty; PTRA: percutaneous transluminal renal angioplasty; TAVI: transcatheter aortic valve implantation; TV: tricuspid valve

Table A3. details of PCI questionnaire in N-PROVE

Location	Data entry of personnel	Type of registered data	Quality assessment method
Catheterization laboratory	Cardiology resident's/ cardiology fellows/ Interventional Cardiologists	Operator name Angioplasty date Angioplasty time Date entry name Data intendant name Contrast volume Fluor dose Fluor type Other Procedure Associated With PCI Atrial Access Site Emergency of Procedure Cardiogenic shock Assessed Pre PCI LVEF Indication Procedure Medications (24h Prior and During PCI) Native lesion name Graft Lesion Lesion Name (Target Vessel) Segment number Ostial Lesion type Length of vessel Reference vessel diameter Stenosis (Pre-PCI) (%) TIMI (Pre-PCI) If ACS Is This Culprit Lesion Stenosis (Post) (%) TIMI (Post) Bifurcation Lesion Thrombus If 100% Chronic Total Occlusion If 40-70 % IVUS Previous Treated Lesion Graft Detail Lesion Complications Devices characteristics	Re-observing and re-interpreting films

N-PROVE: national persian registry of cardiovascular disease; PCI: percutaneous coronary intervention; LVEF: left ventricle ejection fraction; TIMI: Thrombolysis in myocardial infarction; ACS: acute coronary syndrome; IVUS: intravascular ultrasound

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