

# Turkey's top publications in cardiovascular medicine in the past 25 years: evaluation of its impact

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## ABSTRACT

**Objective:** To identify “genuine” publications from Turkey’s institutions since 1992 that have cumulatively contributed the most to global cardiovascular medicine.

**Methods:** Based on data from the Web of Science, 146 publications from Turkey were identified having received  $\geq 50$  citations as of late July, 2017. Papers with more than a minor share by international authors were excluded.

**Results:** Hundred and ten primary authors generated 147 medical papers which received  $\geq 50$  (interquartile range, 54; 86) citations. These articles corresponded in quality to the top 12% global papers. Half of the articles were published from 2002 to late 2007, with a median exposure period of 12 years. Peak performance was reached in 2004–’07, with a mean of 15–20 papers annually, which then regressed to five papers in 2008–’13, representing an estimated 50% decline. Cardiology generated 105 articles (20 in collaboration with other branches), cardiovascular surgery generated 27 articles, and pediatric cardiology generated 5 articles. Publications arose from 26 medical faculties, Gülhane Military Academy, and 9 hospitals not which were not academically affiliated. The performance of many related Turkish institutions was disappointing.

**Conclusion:** Turkey’s contribution to cardiovascular medicine has further declined slightly in the current assessment, particularly since 2007. To prevent a further gap in Turkey’s contribution to the field, an undelayed return is needed by building an environment that allows focusing on research with a potential to contribute to medicine. (*Anatol J Cardiol* 2017; 18: 417-24)

**Keywords:** Contribution to cardiovascular medicine, history of medicine, medical research in Turkey

## Introduction

Economic growth of a country depends on added-value production as much or more than manpower and capital. The former when transposed to science or specifically, to medicine is congruent with research output. The impact of this output somewhat parallels the entire base, but is significantly driven by top publications.

Adoption of appropriate indicators of activity of scientific publication is required for appropriate assignment of national resources (1). In this connection, the number of publications with “top” citations rather than the overall number of citations is a better or the best indicator of contribution to science with respect to scientific institutions or countries (2). Currently, one-fifth of the 1 million scientific papers are coauthored by researchers collaborating internationally (3). Multiauthored international publications have substantially increased in recent years, such that less than one-fifth of scientific publications have a single author, >600 papers are published with >100 authors (4). Though one may agree that best results in science come from international collaboration (3,5), the advantage of this practice

favors the restricted growth potential of advanced economies, whereas the growth potential of domestic publications in emerging economies is still great. Hence, for communities emerging in medical research, increasing proportion of internationally “collaborative” papers and their acquired citations is a major confounder compared with research “genuinely” originating from native institutions. In Turkey, I have documented that an overwhelming proportion of Turkey’s contribution to medicine belonged to internationally “collaborative” papers, which does not reflect a sustainable capacity (6).

This article aims 1) to identify prominent publications (on the basis of citations as an indicator of contribution to cardiovascular medicine) in the past 25 years derived from native academic institutions and hospitals and their primary authors and 2) to evaluate the trend of such activity in Turkey in the period under study.

## Methods

Data from Thomson Reuters Web of Science (Core Collection) served to obtain current citations using “Turkey or Türkiye”

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**Table 1. 147 articles from Turkey with highest "genuine" contribution to cardiovascular medicine: information on field, institution and reference**

Cites	Authors	Field	Inst.	Topic	Journal	Year & reference
392	Abacı A, Oğuzhan A, Kahraman S &	Card	Erc	Coronary collaterals	Circulation	1999; 99: 2239-42
233	Kalay N, Başar E, Özdoğru İ &	Card-Onc	Erc	Carvedilol-cardiomyopathy	J Am Coll Cardiol	2006; 48: 2258-62
223	Onat A, Ceyhan K, Başar Ö &	Card	CPŞ	Metabolic syndrome	Atherosclerosis	2002; 165: 285-92
188	Onat A	Card	CPŞ	Cardiovascular disease	Atherosclerosis	2001; 156: 1-10
176	Tokgözoğlu SL, BaturMK, Topcuog MA &	Card	HT	Stroke localization	Stroke	1999; 30: 1307-1
174	Tarkun İ, Çetinarslan B, Cantürk Z &	End-Card	Kocaeli	PCOS: inflammation	J Clin Endo Metab	2004; 89: 5592-6
158	Onat A, Şurdum-Avcı G, Barlan MM &	Card	CPŞ	Visceral adiposity	Int J Obes	2004; 28: 1018-25
150	Eren M, Görgülü Ş, Uslu N &	Card	Ersek	Aortic stiffness in HT, DM	Heart	2004; 90: 37-43
150	Aytemir K, Ozer N, Atalar E &	Card	HT	P-wave dispersion	PACE	2000; 23: 1109-12
145	Kosecik M, Erel O, Sevinc E. et al.	Ped. C	Harran	Children & passive smoking	Int J Cardiology	2005; 100: 61-4
133	Onat A, Uyarel H, Hergenç G &	Card	CPŞ	Üric acid & metab synd	Am J Hypertens	2006; 19: 1055-62
130	Sezgin AT, Sığircı A, Barutçu İ &	Card	Başkt	Slow coronary flow	Coron Artery Dis	2003; 14: 155-61
122	Tüzün H, Beşirli K, Sayın A &	CVS	CPŞ	Aneurysm in Behçet's	Surgery	1997; 121: 150-6
118	Eroğlu S, Sade LE, Yıldırım A &	Card	Ht/Bk	Epicardial fat-CAD	Nutr Met Cardio Dis	2009; 19: 211-7
115	Yaralı H, Yıldırım A, Aybar F &	Gyn-C	HT	Polycystic ovary syndr.	Fertil Steril	2001; 76: 511-6
114	Çelik T, İyisoy A, Kursaklıoğlu H &	Card	GATA	Effect on oxidat. stress	J Hypertension	2006; 24: 591-6
113	Yazici S, Yazici M, Erer B. et al.	PhM-C	Düzce	Platelet indices in rheumatoid arthr.	Platelets	2010; 21: 122-25
113	Özkan M, Kaymaz C, Kıрма C &	Card	Koşuy	Valvular thrombosis	J Am Coll Cardiol	2000; 35: 1881-9
109	Aras D, Tüfekçioğ, Kumral E &	Card	TYİH	Ventric. noncompaction	J Card Fail	2006; 12: 726-33
109	Güvener M, Paşaoğlu İ, Demircin M	CVS	HT	Postop hyperglycemia	Endocrine J	2002; 49: 531-7
109	Taşdemir O, Vural KM, Karagöz H &	CVS	TYİH	Cardiac surgery without bypass	J Thor Cardio Surg	1998; 116: 68-73
108	Özcan EE, Güneri S, Akdeniz B &	Card	9Eyl	Radiocontrast nephropathy	Am Heart J	2007; 154: 539-44
103	Tavil Y, Şen N, Yazıcı HU. et al.	Card	Gazi	Mean platelet vol. MetS.CAD	Thromb Res	2007; 120: 245-50
103	Okutan H, Özçelik N, Yılmaz HR. et al.	CVS	Demirel	Caffeic acid & lipid peroxidation	Clin Biochem	2005; 38: 191-96
102	Erdoğan D, Güllü H, Yıldırım E &	Card	Demir	Low bilirubin; carotid IMT	Atherosclerosis	2006; 184: 431-7
101	Onat A, Uyarel H, Hergenç G &	Card	CPŞ	Abdominal obesity	Atherosclerosis	2007; 191: 182-90
101	Demirkılıç U, Kuralay E, Yenicesu M &	CVS	GATA	Postop renal failure	J Cardiac Surg	2004; 19: 17-20
95	Farsak B, Yıldırım A, Akyön Y &	CVS	HT	Bacterial DNA in plaques	J Clin Microbiol	2000; 38: 4408-11
93	Özaydın M, Varol E, Aslan SM &	Card	Demirel	Statin- atr.fibrillation	Am J Cardiol	2006; 97: 1490-3
93	Özer N, Yavuz B, Can İ &	Card	HT	Doppler; T-wave dispersion	J Am Soc Echocardi	2005; 18: 945-8
92	Durdu S, Akar AR, Arat M. et al.	CVS	Ank U	Thrombangiit. oblit. Cell transplant.	J Vasc Surg	2006; 44: 732-9
91	Erdoğan D, Güllü H, Çalıřkan M &	Card	Demir	Uric acid; endothel functn	Int J Clin Pract	2005; 59: 1276-82
90	Şenaran H, İleri M, Altınbaş A&	Hem-Card	Fatih	Platelet vol.-CAD	Clin Cardiol	2001; 24:405-8
89	Akpek M, Kaya MG, Lam YY &	Card	Erciye	Neut/Lympho-coron. flow	Am J Cardiol	2012; 110: 621-7
89	Bilge AK, Ozben B, Demircan S. et al.	Card	Çapa	Depression & defibrillator	PACE	2006; 29: 619-26
86	Uyarel H, Ergelen M, Çiçek G, &	Card	B'esir	Redcell distr width, prognosis	Coron Artery Dis	2011; 22: 138-44
86	Ak K, Isbir CS, Tetik S. et al.	CVS.	Marmara	Algorithm blood product use after CABG:	J Cardiac Surg	2009: 24404-10
86	Dursunoğlu D, Evrengül H, Polat B, &	Card	Pamukk.	Lp(a) and lipids in rheumatoid arthritis	Rheumatol Int	2005; 25: 241-5
86	Kayıkçıoğl M, Tumuklu M, Özkahya M &	Card-Neph	Ege	Salt restrict.-End-st. renal dis.	Nephrol Dial Transpl	2009; 24: 956-62
84	Onat A, Hergenç G, Sansoy V &	Card	CPŞ	ApoC-III & coronary risk	Atherosclerosis	2003; 168: 81-9
84	Onat A, Avcı GŞ, Şenocak M &	Card	CPŞ	Lipids in Turkey	J Epid Commun Hlth	1992; 46: 470-6
82	Zorlu A, Bektaşoğlu G, Güven FM &	Card.	Cumh.	Red cell distrib.width. pulm.embolism	Am J Cardiol	2012; 109: 128-34

**Table 1. Cont.**

Cites	Authors	Field	Inst.	Topic	Journal	Year & reference
82	Özkan Y, Özkan E, Şimşek B &	Ecz-Card	Gazi	Homocystein and cysteine CHD RF	Int J Cardiol	2002; 82: 269-77
82	Hür E, Usta M, Toz H. et al.	Nphr-Card	Ege	Cardiovsoc parameters in hemodialysis	Am J Kidneu Dis	2013; 61:957-65
81	Kiziltepe U, Turan NN, Han U. et al.	CVS	AnkAcil	Resveratrol, spinal cord ischemia	J Vasc Surg	2004; 40:138-45
80	Sönmez B, Demirsoy E, Yağan N &	CVS	Nighting	Ablation: atrio-esophageal fistula	Ann Thorac Surg	2003; 76:81-3
79	Özaydın M, Peker O, Erdoğan D &	Card	Demir	Postop. Atrial fibrill. Rx	Eur Heart J	2008; 29:625-31
77	Kılıçkap S, Barista I, Akgül E. et al.	Onc.Card	HT	cTnT. anthracycline cardiotoxicity	Ann Oncol	2005; 16:798-804
76	Kucur M, Isman FK, Karadag B. et al.	Biochem	CPŞ	Serum YKL-40 levels in CAD	Coron Artery Dis	2007; 18:391-6
75	Dede DŞ, Yavuz B, Yavuz BB &	Card	HT	Alzheimer endothel. function	J Am Geriatr Soc	2007; 55:1613-7
74	Onat A, Hergenç G, Yüksel H &	Card	CPŞ	Neck circ. Sleep apnea	Clin Nutr	2009; 28:46-
74	Altun A, Uğur-Altun B.	Card-Endo.	Trakya	Melatonin: therapeutic utilization	Int J Clinl Pract	2007; 61:835-45
74	Erdoğan D, Yıldırım E, Çiftçi Ö &	Card	Demir	PreHT; cor. microvascular	Circulation	2007; 115:593-9
73	Diker E, Aydoğdu S, Özdemir M &	Card	TYİH	Atrial fibrillation	Am J Cardiol	1996; 77:96-8
72	Kaya MG, Yarıoğlu M, Günbakmaz Ö &	Card	Erciy	Platel. activ; hypertension	Atherosclerosis	2010; 209:278-82
72	Sezer M, Oflaz H, Gören T. et al.	Card	Çapa	Intracoron.streptokinase p. primary PCI	N Engl J Med	2007; 356:1823-34
71	Kaya MG, Özkan Mt, Günebakmaz O &	Card	Erciy	Nebivolol; anthrac.cardiomyopathy	Int J Cardiol	2013; 167:2306-10
71	Demirkol S, Balta Ş, Ünlü M &	Card	GATA	Mean platelet vol. Syndr. X	Clinics	2012; 67:1019-22
71	Doğancı S, Demirkılıç U	CVS	GATA	Laser & fibre Rx: saphen.varices	Eur J Vasc Surg	2010; 40:254-9
70	Sade LE, Eroğlu S, Bozbaş H &	Card	HT	Epicardial fat-coron.reserve	Atherosclerosis	2009; 204:580-5
70	Yılmaz MI, Sönmez A, Çağlar K &	Card	GATA	Antihyp. Rx- adiponectin	Nephrology	2007; 12:147-53
67	Güray U, Erbay AR, Güray Y &	Card	TYİH	Adhesion molecules	Int J Cardiol	2004; 96:235-40
67	Tükek T, Akkaya V, Demirel S. et al.	Card.	Çapa	Valsalva. P-dispersion in parox. AFib	Am J Cardiol	2000; 85:896-9
65	Turhan H, Saydam GS, Erbay AR, &	Card	İnönü-	Adhesion mol.-slow cor flow	Int J Cardiol	2006; 108:2024-30
65	Pekdemir H, Cin VG, Çiçek D. et al.	Card.	Mersin	Slow coronary flow.FFR & IVUS	Acta Cardiol	2004; 59:127-33
65	Kayıkçioğ M, Payzın S, Yavuzgil O &	Card	Ege	Statin in syndrome X	Eur Heart J	2003; 24:1999-2005
65	Onat A, Can G, Kaya H &	Card	CPŞ	Atherogenic index, vasc. events	J Clin Lipidol	2010; 4:89-98
64	Acar G, Akcay A, Sokmen A. et al.	Card	K.'maraş	Diast. function in diabetes	J Am Soc Echocard	2009; 22:732-8
64	Karabulut H, Toraman F, Evrenkaya S &	CVS	Acıbd	Clopidogrel in CABG	Eur J Cardiothor Surg	2004; 25:419-23
64	Çamsarı A, Pekdemir H, Çiçek D. et al.	Card.	Mersin	Endothelin-1, NO & slow coron. flow	Circ J	2003; 67:1022-8
64	Cin VG, Pekdemir H, Camsar A. et al.	Card.	Mersin	Coron. intimal thickening in slow cor. flow	Jap Heart J	2003; 44:907-19
64	Bahar I, Akgül A, Ozatik MA. et al.	CVS	TYİH	Renal failure. open heart surgery	Perfusion-Uk	2005; 20:317-22
63	Erbil Y, Ademoğlu E, Ozbey N &	Surg	Çapa	CV risk in Cushing - surgery	World J Surg	2006;30:1665-7
62	Özkan M, Gündüz S, Biteker M &	Card	Koşuy	Thrombolysis.Valve thrombosis	JACC CV İmag	2013; 6:206-16
62	Onat A, Özhan H, Esen AM &	Card	CPŞ	Smoking – diabetes/MetS	Atherosclerosis	2007; 193:330-8
62	Toraman F, Karabulut EH, Alhan HC &	CVS	Acb/Ersk	Post CABG atr fibrillation	Ann Thor Surg	2001; 72:1256-61
61	Çalışkan M, Erdoğan D, Güllü H &	Card	Demir	LV function-Ankyl.spodylitis	Atherosclerosis	2008; 195:306-12
61	Özaydın M, Doğan A, Varol E, &	Card	Demirel	Postop. atr.fibrillation	Cardiology	2007; 107:117-21
61	Mercanoğlu F, Oflaz H, Öz O, &	Card.	Çapa	Endothelial dysfunction & perodontitis	J Periodontol	2004; 75:1694-700
61	Yıldırım A, Kabakçı G, Akgül E &	Card	Ht/Bk	Menses–heart rate variab.	Ann Noninv Electroc.	2002; 7:60-3
61	Özer N, Aytemir K, Atalar E &	Card	HT	P-wave. disperson	PACE	2000; 23:1859-62
61	Saydam N, Kirb A, Demir O &	CVS	½9Eyl	Cancer tissue	Cancer Letters	1997; 119:13-9
60	Özhan H, Erden I, Ordu S. et al.	Card.	Düzce.	Atorvastatin. contrast-induc. nephropathy	Angiology	2010; 61:711-4
59	Yavuz B, Ertuğrul DT, Çil H &	Card	HT	Vitamin D Rosuvastatin	Cardiov DrugsTher	2009; 23:295-9

Table 1. Cont.

Cites	Authors	Field	Inst.	Topic	Journal	Year & reference
59	Akdoğan A, Çalgüneri M, Yavuz B &	Card	HT+	FMF-Int-Med thickness	J Am Coll Cardiol	2006; 48:2351-3
59	Barutçu İ, Esen AM, Kaya D &	Card	Koşuy	Smoking- HR variability	Ann Noninv Electroc	2005; 10:324-9
59	Durmaz İ, Yağdı, T, Çalkavur T &	CVS	Ege	Prophyl. Dialysis at CABG	Ann Thorac Surg	2003; 75:859-64
59	Yavuzgil O, Altay B, Zoghi M &	Card	Ege	Endothel & erectile function	Int J Cardiol	2005; 103:19-26
58	Onat A, Can G	Card	CPş	Autoimmune active.-chron disea..	Curr Pharm Design	2014; 20:575-84
58	Gür M, Aslan M, Yıldız A. et al.	Card.	Harran	Paraoxonase & arylesterase in CAD	Eur J Clin Invest	2006; 36: 779-87
58	Turhan H, Erbay AR, Yaşar AS &	Card	İnönü-	Adhesion mol. -cor ectasia	Coron Artery Dis	2005; 16: 45-50
58	Evrengül H, Dursunoğlu D, Çobankara V &	Card.	Pamukk	Heart rate variabil. in rheumatoid arthr.	Rheumatol Int	2004; 24: 198-202
58	Güler M, Kırallı K, Toke ME &	CVS	Koşuy	CABG method in COPD	Ann Thor Surg	2001; 71: 152-7
58	Tokgözoğlu S, Alikasıfoğlu, Ünsal İ &	Card	HT	Genotype & CAD risk	Heart	1999; 81: 518-22
57	Tutar E, Ekici F, Atalay S. et al.	Ped C	Ankara	Preval. bicuspid aortic valve in newborns	Am Heart J	2005; 150:513-5
57	Turhan H, Erbay AR, Yaşar AS &	Card	İnönü-	CRP-cor. ectasia/CAD	Am J Cardiol	2004; 94:1303-6
57	Kurtoğlu N, Akçay A, Didar İ	Card	Koşu	Dipyridamol;slow cor. flow	Am J Cardiol	2001; 87:777-
56	Balta İ, Balta Ş, Demirkol S. et al.	Derm-Card	GATA	High endocan. psoriasis	Br J Dermatol	2013; 169:1066-70
56	Sade LE, Demir Ö, Atar İ, &	Card	HT	Resynchronization; LV	Am J Cardiol	2008; 101:1163-8
56	Çelik SK, Sağcan A, Altintiğ A &	CVS-Card.	Atakalp	Coron.dissections in atheroscler. pts	Eur J Cardio-Thor Surg	2001; 20:573-6
56	Ertürk S, Ertuğ AE, Ateş K &	Card-Neph	Ank	Ambulat. BP monitoring	Nephrol Dial Transpl	1996; 11:2050-4
56	Özkan M, Emel O, Özdemir M &	Card	Koşuy	Doppler echo in Behçet's	Eur Heart J	1992; 13:638-41
55	Yılmaz O, Eser M, Şahiner A. et al.	Card	19 May	Syncope due to honey poisoning	Resuscitation	2006; 68: 405-8
55	Demirbağ R, Yılmaz R, Koçyiğit A.	Card-Bioch.	Harran.	DNA damage, antioxidant capacity.CAD	Mutation Res	2005; 570: 197-203
55	Kalko Y, Basaran M, Aydın U. et al.	CVS	Vkf Gureba	Surgery for Behçet's aneurysms	J Vasc Surg	2005; 42: 673-677
55	Karagöz HY, Sönmez B, Bakkaloğlu B &	CVS	Güven	CABG without narcosis	Ann Thor Surg	2000; 70: 91-6
55	Başaran Y, Başaran MM, Babacan KF &	Card	Koşuy	TNFα in coronary HD	Angiology	1993; 44: 332-7
55	Akın A, Esmaoğlu A, Güler G, &	Ped C	Erci	Propofol in cardiac cath.	Pediatr Cardiol	2005; 26: 553-7
54	Şen N, Afşar B, Özcan F, &	Card	MKEmal	Neutrophil lymphocyte ratio in MI+OCI	Atherosclerosis	2013; 228: 203-10
54	Başaran Y, Tigen H, Karaahmet T	Card	Koşuy	Fragmented QRS compl	Echocardiography	2011; 28: 62-8
54	Sanisoğlu, Öktenli C, Haşimi A. et al.	PbH-Card.	GATA	Preval. MetS-related disorders	BMC Publ Health	2006; 6: 92
54	Pamukçu B, Ofıaz H, Öncül A&	Card	Çapa	Aspirin resist. & clopidogrel	J Throm Thrombolys	2006; 22: 103-10
54	Atar İ, Konas D, Açıkkel S, &	Card	Başk	Atrial fibril. İn dialysis pts	Int J Cardiol	2006; 106: 47-51
54	Dursunoğlu D, Dursunoglu N, Evrengül H &	Card.	Pamukk	Obstr.sleep apnoea & LV mass-function	Eur Respir J	2005; 26: 283-8
54	Pamukçu B, Ofıaz H, Nişancı Y	Card	Çapa	Platelet GpIIa polymorphism	Am Heart J	2005; 149: 675-80
54	Yalçın F, Kaftan A, Müderrisoğ	Card	Başk	Ventr. filling: Doppler	Heart	2002; 87: 336-9
54	Onat A, Can G, Hergenç G. et al.	Card.	CPş	Apo B. dyslipidemia, MetS & diabetes	Int J Obesity	2007; 31: 1119-25
53	Balta İ, Balta Ş, Koryürek ÖM. et al.	Derm-Card	GATA	High endocan. İn Behçet's	J Am Acad Dermat	2014; 70: 291-6
53	Onat A, Can G, Rezvani R &	Card	CPş	Complement C3-cardiomet risk	Clin Chim Acta	2011; 412: 1171-9
53	Kozan Ö, Oğuz A, Abacı A &	Card	Ege+	MetS prevalence	Eur J Clin Nutr	2007; 61: 548-53
53	Kılıç T, Ural D, Ural E &	Card	Kocaeli	Cytokine ratios prognosis after ACS	Heart	2006; 92: 1041-6
53	Koşar F, Aksoy Y, Ozguntekin G. et al.	Card.	İnönü U.	Cytokines. chronic heart failure	Eur J Heart Fail	2006; 8: 270-4
53	Tarkun İ, Çetinarslan B, Türemen E &	Endo-Card	Kocaeli	Rosiglitazone & polycystic ovary symdr.	Eur J Endocrinol	2005; 153: 115-21
53	Kılıçlı-Çamur N, Demirtunç R, Konuralp C &	Int Med	HpşNüm	Platelet vol.; predicting A,aMI	Med Sci Monit	2005; 11: CR387-92
53	Çıkım AS, Ofıaz H, Ozbey N. et al.	Endo-Card.	İnönü-Çapa	Endothel. funct.subcl. hypo- & hyperthyroid.	Thyroid	2004; 14: 605-9
53	Ömeroğlu SN, Kırallı K, Güler M. et al.	CVS	Koşuyol	Bypass grafting without bypass	Ann Thorac Surg	2000; 70: 844-9

**Table 1. Cont.**

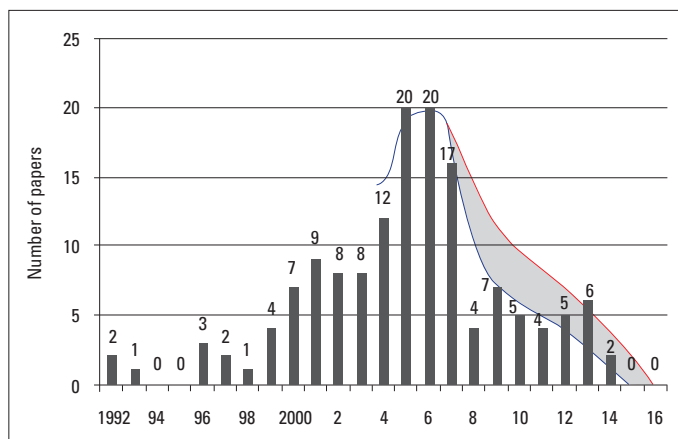
Cites	Authors	Field	Inst.	Topic	Journal	Year & reference
53	Vural KM, Şener E, Taşdemir O &	CVS	TYİH	Valsalva sinus aneurysm	Eur J Cardiothor Surg	2001; 20: 71-6
52	Yılmaz MB, Cihan G, Güray Y &	Card	TYİH	Platelet vol.-ACS	J Thromb Thrombolys	2008; 26: 49-54
52	Arslan U, Türkoğlu S, Balcıoğlu S, &	Card.	Gazi U.	Nonalcoholic fatty liver & CAD	Coron Artery Dis	2007; 18: 433-6
52	İltumur K, Yavavli A, Apak I. et al.	Card.	Dicle U.	N-T natriuretic peptide in stroke	Am Heart J	2006; 151: 1115-22
52	Ağırbaşı M	Card.	Marmara	Plasminogen-activ. Inhib.-1 in vasc.dis.	Int J Clinl Pract	2005; 59: 102-6
52	Gürgün C, Ercan E, Ceyhan C &	Card	Ege	CV involv. in Behçet's	Jap Heart J	2002; 43: 389-98
52	Gölbaşı Z, Uçar O, Keleş T &	Card	Nüm	CRP; rheum valve dis.	Eur J Heart Fail	2002; 4: 593-5
52	Özkutlu S, Ayabakan C, Çeliker A&	Ped C	HT	Myocard noncompaction	J Am Soc Echocard	2002; 15: 1523-8
52	Kaplan M, Demirtaş M, Çimen S&	CVS	Ersek	Cardiac hydatid cysts	Ann Thor Surg	2001; 71: 1587-90
52	Uysal S, Kalaycı AG, Baysal K. et al.	Ped C	19 May..	Cardiac function: rickets	Ped Cardiol	1999; 20: 283-6
51	Tümüklü MM, Etika İ, Kısacık B &	Card	GOP Tok	Obesity, LV structure	Echocardiography	2007; 24: 802-9
51	Tanrıverdi H, Evrengül H, Kuru O &	Card.	Pamukk	Smoking oxidative stress coron. flow	Circ J	2006; 70: 593-9
51	Yılmaz AT, Arslan M, Demirkılıç U &	CVS	GATA	Postop GI complications	Eur J Cardiothor Surg	1996; 10: 763-7
50	Balta Ş, Demirkol S, Çelik T. et al.	Derm-Card	GATA	High endocan. psoriasis	Angiology	2013; 64: 627-32
50	Kalay N, Dođdu O, Koç F. et al.	Card	Erciyes	Blood cell counts. Coron progression	Angiology	2012; 63: 213-7
50	Kaya MG, Uyarel H, Akpek M. et al.	Card	Erciyes	Uric acid. ST-MI. PCI	Am J Cardiol	2012; 109: 486-91
50	Onat A	Card	CPŞ	MetS natural history	Exp Opin Pharmacoth	2011; 12: 1887-
50	Yılmaz MB, Yalta K, Yontar C. et al.	Card.	Cumhur.	Levosimendan in acute heart failure:	Cardiov Drugs Ther	2007; 21: 431-5
50	Erdoğan HB, Kayalar N, Ardal H &	CVS	Koşu	Pacemaker P aortic valve replac.	J Card Surg	2006; 21: 211-5
50	Özal E, Kuralay E, Yıldırım V. et al.	CVS	GATA	Methylene blue for vasoplegic	Ann Thorac Surg	2005; 79: 1615-9
50	Yılmaz MB, Bıykoğlu SF, Akın Y &	Card	TYİH	Obesity-coron. collaterals	Int J Obes	2003; 27: 1541-5

11492; 147\*78

31+63 improved 18.9%, annually 9%.

AO 14\*98.6=1387 cites=12.1% improved 17%, annually 8.2%

as address. Publications in clinical medicine and cardiovascular medicine were targeted. When sorted by the highest to lowest



**Figure 1.** Distribution of the 147 publications in cardiovascular medicine achieving  $\geq 50$  citations by published year. Just over half of the papers had been published in the period from 2002 to 2007. A more rapid than anticipated decline is observed after 2006. The estimated average expectation of number of articles in the 8 years preceding the index date is diagrammatically represented, based on data from the Web of Science where citations to an item 3–4 years after publication are half those to an item 8 years after publication

citations, articles or reviews cited  $\geq 50$  were selected. “Genuine” contributions were defined when all first three authors of the paper worked in a Turkish university or hospital. All remaining “collaborative” articles were excluded. Following criteria were also need to be met to qualify: either the primary author had to be a cardiologist or the main topic was required to be on the field and publication was to be in a periodical confined to cardiovascular medicine. In total, 147 papers were identified.

In papers with coauthors from multiple institutions, the first author and his/her institution were credited and listed. With the purpose of precluding omission of some researchers in the address “Turkey,” some 50 primary authors known to me from a previous work (7) were also individually searched. For those authors who produced highly-cited papers (denoting a wider meaning than the same term used in the Web of Science) in two different institutions, citations received were assigned to the two institutions.

The closing index date in the current study for data retrieved from the Web of Science was late July, 2017. These data exclude intrinsically eligible citations to references incorrectly or inadequately provided and to periodicals not covered by the Web of Science. These excluded citations may be estimated to form a



**Table 2. Thirty-eight source institutions of the “highly” cited papers**

16	Hacettepe U. Med Fac., Ankara	2	Dokuz Eylül U. Med Fac., Izmir
16	İ.U. Cerrahpaşa Med. Fac., İstanbul	2	19 Mayıs U. Med Fac.
11	Gülhane Military Medical Academy, Ank.	2	Marmara U. Med Fac.
10	Kartal Koşuyolu Res. Hospital, İstanbul	2	Düzce U. Med Fac.
8	Turkey's YI Hosp., Ankara	1,5	Acıbadem Hosp., İstanbul
8	Sül. Demirel U. Med Fac., Isparta	1	Trakya U. Med Fac.
8	Erciyes U. Med Fac., Kayseri	1	Balıkesir U. Med Fac.
7,5	I.U. İstanbul Med. Fac.	1	Fatih U. Med Fac., Ankara
7	Ege U. Med Fac., Izmir	1	Flor. Nightingale Hosp., İstanbul
4,5	İnönü U. Med Fac., Malatya	1	Dicle U. Med Fac.
4	Pamukkale U Med Fac., Denizli	1	Acil &Traumat. Hosp, Ankara
4	Başkent U. Med Fac., Ankara	1	Nümune Hosp., Ankara
3	Harran U. Med Fac.	1	Vakıf Gureba Hosp., İst.
3	Mersin U. Med Fac.	1	Mustafa Kemal U, Hatay
3	Ankara U. Med Fac.	1	Atakalp Hosp., İzmir
3	Kocaeli U. Med Fac.	1	Haydarpaşa Nümune Hosp, İst.
2,5	S. Ersek Center for Cardiovasc. Surgery, İst.	1	Gaziosmanpş. U., Tokat
3	Gazi U. Med Fac., Ankara	1	Güven Hosp., Ankara
2	Cumhuriyet U. Med Fac.	1	Sütçü İmam U., Kahr'maraş
		147	

share of 5%–10% of the Web of Science citations.

Estimates of the expected distribution of “highly-cited” papers were based on the number of papers observed in 2005 and on the 10th percentile data provided by the Web of Science.

In assessing the rate of generation of such papers, the elapsed period from the index date of the median (25th and 75th percentiles) publication year was used and was compared with that of a work that preceded this study by 2 years (7).

## Results

The number of “genuine” papers in cardiovascular medicine published in the previous quarter century that received  $\geq 50$  citations was 147. Overall citations received by these papers were 11,492. Table 1 comprises source information of these “genuine” articles.

Temporal distribution of the number of these publications is graphically presented in Fig. 1. The graph reveals that the publication of the papers had a median year (25th and 75th percentiles) of 2005 (from 2002 to late 2007). Expressed otherwise, the exposure period consisted of a median of 12 (IQR 9.5–15) years. Only 33 papers (23%) have been published after 2007, i.e., in the latest 9 years.

Papers in the three fields of cardiovascular medicine were distributed as follows: an overwhelming proportion, namely, 105 papers belonged to cardiology, 27 belonged to cardiovascular

surgery, and 5 belonged to pediatric cardiology. In 20 shared articles, cardiologists collaborated with specialists in endocrinology, nephrology, biochemistry, dermatology, internal medicine gynecology, oncology, hematology, public health, physical medicine, and pharmacology.

### Front-running institutions

Only 33 medical institutions produced the 147 papers. Hacettepe Med Fac and Cerrahpaşa Med Fac were leading, each with 16 papers, and Gülhane Military Academy, Kartal Koşuyolu Res Hospital, Turkey's Yüksek İhtisas Hospital, Erciyes U. and S. Demirel U. Med. faculties were runners-up with 7–10 papers (Table 2). İstanbul U. İstanbul, Ege U. and İnönü U. Med. faculties followed. Further, 23 institutions generated the remaining 45 publications. Eight hospitals not affiliated with academia contributed to 26 publications (18% of the total).

Eighteen primary authors of multiple publications are listed in Table 3, together with the total number of their citations, affiliated institutions, and temporal period of their contributions. Collectively, they produced 38.0% of the articles and citations received.

The articles were published with a predilection in following periodicals: nearly two-fifths, i.e., 55 in the following nine journals: Atherosclerosis (10 papers); Am J Cardiol (9 papers); Ann Thorac Surg (8 papers); Int J Cardiol (7 papers); Coron Artery Dis (5 papers); and Eur J Cardiothor Surg, Heart, Am Heart J, and Angiology (each 4 papers).

**Table 3. List of 18 primary authors with multiple publications, their total citations, institutions and periods of contribution**

Pap	Cites	Investigator	Institution	Period	Pap	Cites	Investigator	Institution	Period
14	1387	Altan Onat	Cerrahpaşa	1992-'14	3	159	Şevket Balta	GATA	2013-'14
2	283	Nihat Kalay	Erciyes Ü	2006-'12	3	152	M Birhan Yılmaz	TYİH	2003-'08
3	263	Doğan Erdoğan	S Demirel	2006-'08	2	154	Necla Özer	Hacettepe	2000-'05
3	233	Mehmet Özyaydın	S Demirel	2006-'08	2	137	Dursun Dursunoğlu	Pamukkale	2005
3	231	Mehmet Özkan	Koşuyolu	1992-'13	2	126	L. Elif Sade	Hacettepe	2008-'09
2	227	İlknur Tarkun	Kocaeli U.	2004-'05	2	126	Meral Kayıkçıoğlu	Ege U.	2003-'09
2	205	Lale Tokgözoğlu	Hacettepe	1999	2	108	Burak Pamukçu	Çapa	2005-'06
3	193	Mehmet G. Kaya	Erciyes Ü	2002-'13	2	107	Yelda Başaran	Koşuyolu	1996-'11
3	180	Hakan Turhan	İnönü	2004-'06	2	100	Mehmet Kaplan	S. Ersek	2001-'02
					55	4371	38.0% of total		

## Discussion

What is the impact and its trend of “genuine” contribution of Turkey’s medical institutions to global knowledge on cardiovascular medicine in the past quarter century based on data retrieved from the Web of Science? This was assessed in this article. Publications representing internationally “collaborative” papers were excluded because it was recently shown that such papers, forming over two-thirds of our relatively highly-cited publications, diluted the actual performance capacity of the country (6).

The vast review by Adams (5) of publications from the Web of Science disclosed that domestic publications had flattened in the U.S. and Western Europe, and publication increases were due to international collaboration. In the U.S., papers with at least one author from another country in 2011 were found to be cited 1.36-fold more often than purely domestic research (5). Of note is that, while the proportion of domestic papers in the total papers have decreased in the past two decades to 30%–50% in Switzerland and the U.K., this has been stable at approximately 75% in emerging countries, such as China, South Korea, and Brazil (5).

Following main findings were elicited. A total of 147 papers achieved this level of citation, which indicates roughly the top 12% of global papers in cardiovascular medicine. The median exposure time was 12 years, longer than the 10.4 years determined 2 years previously. Only 33 articles published after 2007 attained this level of citations. Thirty-three institutions generated this research. Non-academic hospitals contributed to 18% of the papers. Younger researchers, though relatively few in number, have notably participated in generating these articles.

General agreement exists that the number of relatively highly-cited papers are the best indicator of contribution to science (1, 2), which is supported by the adoption of papers with > 10% citations as a criterion in the Leiden University Ranking (7).

### Overall performance compared with that 2 years previously

Data provided by Essential Science Indicators (9) inform us that in clinical medicine (which excludes biochemistry, molecu-

lar biology, and neuroscience from overall medicine), following mean annual data were recorded in the Web of Science in the 10-year period from 2007 to 2016: 245.000 papers and 1.41 million citations in the world and 7400 papers and 19,150 citations in Turkey. It may be inferred that papers cited herein represent 2% of those generated in Turkey in cardiovascular medicine and that citations received by these papers make up (6% of those in clinical medicine) approximately one-third of those received by genuine papers in cardiovascular medicine in Turkey.

The selection of 50 citations as a threshold in this evaluation is highly comparable with that of 40 citations considered 2 years previously (8) because overall citations covered by the Web of Science increased by just over 24% in that short period.

The median exposure period is an important parameter to be taken into account because cumulative citations are strongly time-dependent. The 6 years from 2002 through 2007 comprised slightly more than one-half of the total publications, namely 86 publications, revealing that an annual mean of 14 papers were generated of this quality in cardiovascular medicine in Turkey. In view of the availability of 80 medical faculties plus the research hospitals of the Health Ministry, this performance falls short of what might be anticipated.

Estimating that the average number of top 12% of papers in cardiovascular medicine in the past decade is approximately 2500 per year, the generation of a mean of 10–12 papers per year in Turkey (in the first decade of this century) reflects an approximately global share of 4–5 per mille. In view of a declining trend thereafter, the performance is unsatisfactory with respect to the potential of Turkey.

Cardiovascular surgery and particularly, pediatric cardiology, have not kept up with the expectations. Papers in these two broad fields generated only 21% of high-quality papers in this period. Separate reasons for this deserve to be detected.

### Institutions and researchers

It is to be noted that broadly, only one of the three medical faculties or major hospitals with cardiology departments suc-

ceeded in adding one publication to the current list in the 25 years. Hacettepe and Cerrahpaşa medical faculties, GATA and Kartal Koşuyolu Research Hospital, as well as Turkey's Yüksek İhtisas Hospital, Erciyes and Süleyman Demirel university medical faculties merit special acknowledgment for having collectively generated just over half the quality research articles.

In the meantime, 19 papers (dating from 1999 to 2006) included in our analysis 2 years previously failed to attain the added 10 citations and are, thus, not included herein. Conversely, 22 articles have succeeded to be newly selected for this evaluation.

Eight papers appearing as late as 2013 and 2014 succeeded in meeting the high threshold of this study. Şevket Balta and Sait Demirkol, along with the dermatologist İlknur Balta, produced three of the stated publications and thus, deserve tribute mention. M. Özkan, E. Hür, M.G. Kaya, N. Şen, and the current author were further actors of such a feat.

The exclusion of the period preceding 1992 precluded the inclusion of the following three scientists of the "old guard": the cardiovascular surgeons Aydın Aytaç and İlhan Paşaoğlu and the pediatric cardiologist late Teoman Onat, each of whom merits tribute mention in this study. The current list of scientists welcomes, in particular, Mehmet G. Kaya and Nihat Kalay from Erciyes U, Şevket Balta and Sait Demirkol from GATA, and Mehmet Kaplan of the S. Ersek center. Mehmet Özkan and Doğan Erdoğan have strengthened their previous scientific base as did Selma Yazıcı and Yusuf Tavail.

Cardiologists Birhan Yılmaz, Meral Kayıkçıoğlu, and Dursun Dursunoğlu and biochemist İlknur Tarkun merit special mention for their stimulating work.

### Periodicals mediating successful research

In particular, in this analysis, journals with relatively low impact factors, such as Coron Artery Dis, Angiology, or Eur J Cardiothorac Surg were also found to mediate in the success of 4–5 papers each. This implicates that well-designed and executed research may well be rewarded even when published in comparatively low-ranked journals.

### Widening of the international gap in cardiologic research

Assessments of higher quality research in (cardiovascular) medicine in Turkey (9-11) have indicated stagnation. Moving increasingly away from competency in scientific issues, lower support by the government to academic institutions, and func-

tional reorientation of state hospitals primarily as out-patient clinics seem to have reduced the attraction of thorough research. Joining consensus statements or international trials with few contributed cases, which attain high number of citations, do not conceal the lack of "highly-cited" genuine articles.

## Conclusion

This evaluation of the "genuine" contribution of Turkey's institutions to global knowledge in cardiovascular medicine resulted in the identification of 147 articles with 50–392 citations, received at a median of 12 years. I detected substantial attenuation in publications of this quality after 2007. Only 38 medical faculties and hospitals generated these papers, representing disappointing performance of a majority of related institutions.

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**Peer-review:** Externally peer-reviewed.

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