Younger trend in acute myocardial infarction in China

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Abstract

There are more and more acute myocardial infarction (AMI). However, little is known about its age trend. Here, we report younger trend in AMI in China. To check literatures from PubMed according to keywords “AMI and Chin Med J (Engl)” and collect available data on ages from original research articles published in Chin Med J (Engl) from 1990 to 2019. Age groups were divided into 1990s, 1995s, 2000s, 2005s, 2010s, 2015s, and 2020s, respectively. Means of minimum ages of each group were about 55.0, 46.4, 48.2, 55.0, 47.1, 43.9, and 52.8 years old, respectively. The age curve showed younger trend in AMI due to unhealthy lifestyle related major risk factors. This novel classification of risk factors based “environment-sleep-emotion-exercise-diet” intervention [E(e)SEEDi] is beneficial to better control and prevent AMI in the globe.

Introduction

It is well known that more than 40% deaths each year are attributed to cardiovascular disease (CVD) in China. Acute myocardial infarction (AMI) is the leading cause of death in adults with CVD. It is also a major “killer” in younger adults. Mortality of AMI in both urban and rural population in China is more than 1.1‰¹. However, previous studies on trends in AMI focused mainly on its sex-specific or gender differences^{2,3}, risk factors and mortalities⁴⁻⁶, little is known about data of evidence-based age trend in AMI in China.

Results

Data on ages of patients with acute myocardial infarction were collected from original research articles published in *Chin Med J (Engl)* during 1990 to 2019 (Table 1). Means of minimum ages of each group are about 55.0 (1990s), 46.4 (1995s), 48.2 (2000s), 55.0 (2005s), 47.1 (2010s), 43.9 (2015s), and 52.8 (2020s) years old, respectively. According to the curve on means of minimum ages of each group, it's easy to find younger trend in AMI in China from 2003 to 2017 (Fig. 1). However, current data on ages of AMI in 2020s are incomplete.

Discussion

There were AMI patients aged 18 years enrolled in the VIRGO (Variation in Recovery: Role of Gender on Outcomes of Young AMI Patients) study^{7,8}. Of course, there is the geographical inequalities in incident AMI. Thus, there is arising need for control of AMI younger by more health coverage and essential health service since it is far from reality for poor and rural regions⁹, and modifying unhealthy lifestyle and reducing unhealthy “environment-sleep-emotion-exercise-diet” intervention [E(e)SEEDi] based major risk factors.

Currently, younger trend in AMI could be due to unhealthy lifestyle and evidence-based major risk factors are highly associated with AMI onset (Table 2). First, abnormal external environment¹⁰. There is increased

risk of AMI due to exposure to cold temperatures¹¹, radiation, traffic noises¹², dust¹³, and air pollution (such as particulate matter exposure)¹⁴⁻¹⁷; And abnormal internal environment, for example, inflammation & infection^{18,19}, acute infection including influenza epidemics²⁰. Previous studies showed that acute respiratory-tract infections are associated with an increased risk of first-time AMI²¹, HIV infection also increases the risk of AMI²². Serum triglyceride levels, familial-combined hyperlipidaemia²³, and type 2 diabetes (T2D) are traditional risk factors highly linked to AMI²⁴.

Second, bad sleep can induce AMI. Many young and middle-aged adults often stay up late, some work in shifts, and many adults suffer from insomnia or severe obstructive sleep apnea (OSA). Third, bad emotion, anxiety and depression. Physical exertion and anger or emotional upset are triggers associated with first AMI in all regions of the world, in men and women, and in all age groups²⁵. Screening for depression is necessary because patients with untreated depression are associated with increased long-term mortality of AMI²⁶. Self-reported symptoms of depression and anxiety, especially if recurrent, were also moderately associated with the risk of incident AMI²⁷. HIV-infected individuals with depression have a 30% increased risk for AMI than without depression²⁸. However, antipsychotic use is associated with a transient increase in risk for AMI.

Fourth, physical inactivity and long-term sitting linked to obesity and T2D may induce AMI due to popularization of cars, urban buses, subways, and elevators as well as lasting watching TV at home and mobile-phone entertainment. Lastly, there are unbalance of diet and nutrition including higher “salt, fat, and sugar” and inadequate water and fresh fruits intake²⁹, heavy alcohol consumption. But there is a protective role of Mg and low Ca:Mg ratio against coronary heart disease (CHD)³⁰. Tobacco use is one of the most important causes of AMI globally, especially in men³¹. In contrast, smoking ban was associated with a reduction in AMI incidence³².

In addition, the rates of awareness, treatment, and control of hypertension are still lower. Some drugs, e.g. cocaine abuse, oral contraceptive use, and post menopausal hormone replacement therapy may increase the risk of AMI³³. Incidence of AMI also associated with stopping evidence-based pharmacotherapy, e.g., statin, beta-blockers and clopidogrel³⁴. Early initiation of statin treatment and beta-blockers are underused for primary and secondary prevention of CHD before the first AMI.

So far, a number of risk factors have been identified to link with AMI and higher risk factor levels at younger ages link to the earlier age of AMI^{35,36}. The unhealthy E(e)SEEDi lifestyle results in not only CHD and C-type hypertension³⁷, but also AMI younger. Thus, a new program is indeed necessary for prevention and management of AMI. Without doubt, the published standardized comprehensive iRT-ABCDEF program for AMI is worthy of conduction in the globe³⁸. As a magic and novel “polypill”³⁹, healthy E(e)SEEDi lifestyle can help to halt AMI younger and reduce its morbidity and mortality due to better self-management of major risk factors.

Because the famous SPRINT (Systolic Blood Pressure Intervention Trial) found that a lower systolic blood-pressure is better for less AMI and other cardiovascular events, “clinical trial will change practice”⁴⁰, it helps us to understand and support not only more aggressive treatment of hypertension but also the renewed AHA Guideline on a more strict definition of hypertension (130/80 mmHg). It can be said that more coverage by healthy E(e)SEEDi lifestyle and application of the iRT-ABCDEF program, more effectiveness in prevention of AMI younger.

Positive cardiovascular prevention will help reducing the first AMI among high risk individuals, new targets and treatments help to develop novel cardioprotective strategies⁴¹⁻⁴⁴ and better biomarkers for screening, diagnosis or prognosis for patients with AMI. Since the China Acute Myocardial Infarction (CAMI) Registry is a good platform for evaluation, healthcare, investigation and prevention, it will help to improve quality of care (QOL) and better prevent AMI⁴⁵⁻⁴⁶. For example, invasive coronary angiography should be used rationally according to patients’ clinical presentation so as to get better diagnosis and care. With further understanding of cellular and molecular mechanisms on CVD (such as atherosclerosis, hypertension, heart failure, and stroke) and analysis of human atlases on cardiac cell and the adult heart⁴⁷⁻⁴⁸, new therapeutic targets and strategies will be developed for better control and prevention of AMI.

At the same time, to choose safer agents for anticoagulation therapy so as to improve AMI patients’ outcomes and QOL⁴⁹. In addition, smoking ban linked to reduced hospitalization rates for AMI⁵⁰. The iRT-ABCDEF program for management or self-management of AMI can help to control and prevent AMI so as to halt its younger trend, and improve QOL in patients with history of AMI. Herein, both the iRT-ABCDEF program and healthy E(e)SEEDi lifestyle^{38,39} are worthy of conduction in the globe, especially during the pandemic and post-COVID-19 era.

Data on ages of patients with AMI in this study were collected just only from original research articles published in *Chin Med J (Engl)* during 1990 to 2019, which is highly authority and has a history of over a hundred and thirty years, and these papers were also finished by multi-centre clinical units in China. However, these data didn’t cover literatures published in other international journals. The curve on means of minimum ages of each group just showed younger trend in AMI in China from 2003 to 2017. they are still incomplete in 2020s. In addition, this study didn’t involve in data on patients’ gender, treatment and mortality.

In conclusion, there is indeed younger trend in AMI in China due to modern unhealthy E(e)SEEDi lifestyle and major risk factors. This novel classification of risk factors can help to prevent younger trend in AMI and improve QOL. Hence, it is worthy of conduction in the globe.

Materials And Methods

Literatures on AMI were checked from PubMed according to key words “AMI and *Chin Med J (Engl)*” and to collect data on ages from original research articles on AMI published in *Chin Med J (Engl)*. Data on

ages of patients with AMI were divided into seven groups: 1990s (1988-1992), 1995s (1993-1997), 2000s (1998-2002), 2005s (2003-2007), 2010s (2008-2012), 2015s (2013-2017), and 2020s (2018-2022), respectively, and recorded them in a table. The trend of ages in AMI was expressed with a curve on means of minimum ages of each group.

Statistical analysis

The results of original records were used. Data were statistically analyzed using the Statistical Package for the Social Sciences (SPSS version 17.0, SPSS Inc., Chicago, IL, USA) with t-test for comparisons between two groups. A *P*-value of <0.05 was considered statistically significant.

Ethics statement

The study was approved by Human Research Ethics Committee of the Nanchang University, Hospital of Nanchang University, Jiangxi Academy of Medical Science (approval 20120312). Data collection was followed by a study protocol that was approved by the local ethics committee. It was conducted in accordance with the Helsinki Declaration of 1975, as revised in 2000, and all enrolled patients gave written informed consent. No potential sources of bias.

Role of the funding source

No funding for this study was received. All authors had full access to all study data, and the corresponding author had final responsibility for the decision to submit for publication.

Reporting Summary. Further information on research design is available in the Nature Research Reporting Summary linked to this article.

Data availability

The data that support the findings of this study are not publicly available but are available upon reasonable request from the corresponding author.

Declarations

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Contributions

CH drafted the manuscript and contributed to the critical revisions of the manuscript. CH is the corresponding author. All authors read and approved the final manuscript.

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Ethics declarations

Competing interests

The author declares no competing interests.

References

1. Chen WW, Gao RL, Liu LS, [Zhu ML](#), [Wang W](#), [Wang YJ](#), et al. [China cardiovascular diseases report 2015: a summary](#). *J Geriatr Cardiol*. 2017;14(1):1-10.
2. Nielsen S, Björck L, Berg J, Giang KW, Zverkova Sandström T, et al. [Sex-specific trends in 4-year survival in 37 276](#) men and women with acute myocardial infarction before the age of 55 years in Sweden, 1987-2006: a register-based cohort study. *BMJ Open*. 2014;4(5):e004598.
3. Dreyer RP, Wang Y, Strait KM, Lorenze NP, D'Onofrio G, Bueno H, et al. [Gender differences in the trajectory of](#) recovery in health status among young patients with acute myocardial infarction: results from the variation in recovery: role of gender on outcomes of young AMI patients (VIRGO) study. *Circulation*. 2015;131(22):1971-80.
4. [Cao CF](#), [Ren JY](#), [Zhou XH](#), [Li SF](#), [Chen H](#). Twenty-year trends in major cardiovascular risk factors in hospitalized patients with acute myocardial infarction in Beijing. *Chin Med J (Engl)*. 2013;126(22):4210-5.
5. [Chang J](#), [Liu X](#) and [Sun Y](#). Mortality due to acute myocardial infarction in China from 1987 to 2014: Secular trends and age-period-cohort effects. *Int J Cardiol*. 2017;227:229-38.
6. [Zhao Q](#), [Yang Y](#), [Chen Z](#), [Yu H](#), [Xu H](#). Changes in characteristics, risk factors, and in-hospital mortality among patients with acute myocardial infarction in the capital of China over 40 years. *Int J Cardiol*. 2018;265:30-4.
7. Leifheit-Limson EC, D'Onofrio G, Daneshvar M, Geda M, Bueno H, Spertus JA, et al. [Sex Differences in Cardiac](#) Risk Factors, Perceived Risk, and Health Care Provider Discussion of Risk and Risk Modification Among Young Patients With Acute Myocardial Infarction: The VIRGO Study. *J Am Coll Cardiol*. 2015;66(19):1949-57.
8. Lichtman JH, Leifheit EC, Safdar B, Bao H, Krumholz HM, Lorenze NP, et al. [Sex Differences in the Presentation and](#) Perception of Symptoms Among Young Patients With Myocardial Infarction: Evidence from the VIRGO Study (Variation in Recovery: Role of Gender on Outcomes of Young AMI Patients). *Circulation*. 2018;137(8):781-90.
9. [Wright S](#), [Mabejane R](#). The 2019 UN high-level meeting on universal health coverage. *Lancet*. 2019;393(10184):1931.

10. Gibson J. [Air pollution, climate change, and health](#). *Lancet Oncol*. 2015;16(6):e269.
11. Claeys MJ, Rajagopalan S, Nawrot TS, Brook RD. [Climate and environmental triggers of acute myocardial infarction](#). *Eur Heart J*. 2017;38(13):955-60.
12. Tonne C, Melly S, Mittleman M, Coull B, Goldberg R, Schwartz J. A case-control analysis of exposure to traffic and acute myocardial infarction. [Environ Health Perspect](#). 2007;115(1):53-7.
13. Kojima S, Michikawa T, Ueda K, Sakamoto T, Matsui K, Kojima T, et al. [Asian dust exposure triggers acute myocardial infarction](#). *Eur Heart J*. 2017;38(43):3202-8.
14. Wang X, Kindzierski W, Kaul P. [Comparison of transient associations of air pollution and AMI hospitalisation in two cities of Alberta, Canada, using a case-crossover design](#). *BMJ Open*. 2015;5(11):e009169.
15. Brüske I, Hampel R, Baumgärtner Z, Rückerl R, Greven S, Koenig W, et al. Ambient air pollution and lipoprotein-associated phospholipase A₂ in survivors of myocardial infarction. [Environ Health Perspect](#). 2011;119(7):921-6.
16. Madrigano J, Kloog I, Goldberg R, Coull BA, Mittleman MA, Schwartz J. Long-term exposure to PM_{2.5} and incidence of acute myocardial infarction. [Environ Health Perspect](#). 2013;121(2):192-6.
17. Chen H, Burnett RT, Copes R, Kwong JC, Villeneuve PJ, Goldberg MS, et al. Ambient Fine Particulate Matter and Mortality among Survivors of Myocardial Infarction: Population-Based Cohort Study. [Environ Health Perspect](#). 2016;124(9): 1421-8.
18. Meier CR, Derby LE, Jick SS, Vasilakis C, Jick H. [Antibiotics and risk of subsequent first-time acute myocardial infarction](#). *JAMA*. 1999;281(5):427-31.
19. Musher DM, Abers MS, Corrales-Medina VF. Acute Infection and Myocardial Infarction. *N Engl J Med*. 2019;380(2):171-6.
20. Ogbebor O, Odugbemi B, Maheswaran R, Patel K. [Seasonal variation in mortality secondary to acute myocardial infarction in England and Wales: a secondary data analysis](#). *BMJ Open*. 2018;8(7):e019242.
21. Meier CR, Jick SS, Derby LE, Vasilakis C, Jick H. Acute respiratory-tract infections and risk of first-time acute myocardial infarction. [Lancet](#). 1998;351(9114):1467-71.
22. Freiberg MS, Chang CC, Kuller LH, Skanderson M, Lowy E, Kraemer KL, et al. [HIV infection and the risk of acute myocardial infarction](#). *JAMA Intern Med*. 2013;173(8):614-22.
23. Wiesbauer F, Blessberger H, Azar D, Goliasch G, Wagner O, Gerhold L, et al. [Familial-combined hyperlipidaemia in very young myocardial infarction survivors \(< or =40 years of age\)](#). *Eur Heart J*. 2009;30(9):1073-9.

24. [The Lancet](#). Modernizing the NHS: leading the way with diabetes. [Lancet](#). 2019; 393(10168):200.
25. Smyth A, O'Donnell M, Lamelas P, Teo K, Rangarajan S, Yusuf S. INTERHEART Investigators. [Physical Activity and Anger or Emotional Upset as Triggers of Acute Myocardial Infarction: The INTERHEART Study](#). [Circulation](#). 2016;134(15):1059-67.
26. Smolderen KG, Buchanan DM, Gosch K, Whooley M, Chan PS, Vaccarino V, et al. [Depression Treatment and 1-Year Mortality After Acute Myocardial Infarction: Insights From the TRIUMPH Registry \(Translational Research Investigating Underlying Disparities in Acute Myocardial Infarction Patients' Health Status\)](#). [Circulation](#). 2017;135(18):1681-9.
27. Gustad LT, Laugsand LE, Janszky I, Dalen H, Bjerkeset O. [Symptoms of anxiety and depression and risk of acute myocardial infarction: the HUNT 2 study](#). [Eur Heart J](#). 2014;35(21):1394-403.
28. Khambaty T, Stewart JC, Gupta SK, Chang CH, Bedimo RJ, Budoff MJ, et al. [Association Between Depressive Disorders and Incident Acute Myocardial Infarction in Human Immunodeficiency Virus-Infected Adults: Veterans Aging Cohort Study](#). [JAMA Cardiol](#). 2016;1(8):929-37.
29. Du H, Li L, Bennett D, Guo Y, Key TJ, Bian Z, et al. [China Kadoorie Biobank Study](#). [China Kadoorie Biobank Study. Fresh Fruit Consumption and Major Cardiovascular Disease in China](#). [N Engl J Med](#). 2016;374(14):1332-43.
30. Kousa A, Havulinna AS, Moltchanova E, Taskinen O, Nikkarinen M, Eriksson J, et al. [Calcium:magnesium ratio in local groundwater and incidence of acute myocardial infarction among males in rural Finland](#). [Environ Health Perspect](#). 2006;114(5):730-4.
31. Teo KK, Ounpuu S, Hawken S, Pandey MR, Valentin V, Hunt D, et al. [INTERHEART Study Investigators](#). Tobacco use and risk of myocardial infarction in 52 countries in the INTERHEART study: a case-control study. [Lancet](#). 2006;368(9536):647-58.
32. Sipilä JO, Gunn JM, Kauko T, Rautava P, Kytö V. [Association of restaurant smoking ban and the incidence of acute myocardial infarction in Finland](#). [BMJ Open](#). 2016;6(1):e009320.
33. Chilvers CE, Knibb RC, Armstrong SJ, Woods KL, Logan RF. [Post menopausal hormone replacement therapy and risk of acute myocardial infarction—a case control study of women in the East Midlands, UK](#). [Eur Heart J](#). 2003;24(24): 2197-205.
34. Ho PM, Peterson ED, Wang L, Magid DJ, Fihn SD, Larsen GC, et al. [Incidence of death and acute myocardial infarction associated with stopping clopidogrel after acute coronary syndrome](#). [JAMA](#). 2008;299(5):532-9.
35. Wang Y, Li J, Zheng X, Jiang Z, Hu S, Wadhera RK, et al. [Risk Factors Associated With Major Cardiovascular Events 1 Year After Acute Myocardial Infarction](#). [JAMA Netw Open](#). 2018;1(4):e181079.

36. Bradley SM, Borgerding JA, Wood GB, Maynard C, Fihn SD. [Incidence, Risk Factors, and Outcomes Associated With In-Hospital Acute Myocardial Infarction](#). *JAMA Netw Open*. 2019;2(1):e187348.
37. Hu C. C-type hypertension. *Eur Heart J*. 2019;40(9):715.
38. Hu C, Tkebuchava T, Hu D. Managing acute myocardial infarction in China. *Eur Heart J*. 2019;40(15):1179-81.
39. Hu C. Grants supporting research in China. *Eur Heart J*. 2018;39(25):2342-4.
40. Drazen JM, Morrissey S, Campion EW, Jarcho JA. A SPRINT to the Finish. *N Engl J Med*. 2015;373(22):2174-5.
41. Tang J, Wang J, Huang K, Ye Y, Su T, Qiao L, et al. [Cardiac cell-integrated microneedle patch for treating myocardial infarction](#). *Sci Adv*. 2018;4(11):eaat9365.
42. Zhang YY, Fu ZY, Wei J, Qi W, Baituola G, Luo J, et al. [ALIMA1 variant promotes low plasma LDL cholesterol and decreases intestinal cholesterol absorption](#). *Science*. 2018;360(6393):1087-92.
43. Andreadou I, Cabrera-Fuentes HA, Devaux Y, Frangogiannis NG, Frantz S, Guzik T, et al. [Immune cells as targets for cardioprotection: new players and novel therapeutic opportunities](#). *Cardiovasc Res*. 2019;115(7):1117-30.
44. Yang CF, Chen YY, Singh JP, Hsu SF, Liu YW, Yang CY, et al. [Targeting Protein Tyrosine Phosphatase PTP-PEST for Therapeutic Intervention in Acute Myocardial Infarction](#). *Cardiovasc Res*. 2020;116(5):1032-46.
45. Zhang H, Masoudi FA, Li J, Wang Q, Li X, Spertus JA, et al. China PEACE Collaborative Group. [National assessment of early \$\beta\$ -blocker therapy in patients with acute myocardial infarction in China, 2001-2011: The China Patient-centered Evaluative Assessment of Cardiac Events \(PEACE\)-Retrospective AMI Study](#). *Am Heart J*. 2015;170(3):506-15.e1.
46. Xu H, Li W, Yang J, Wiviott SD, Sabatine MS, Peterson ED, et al. CAMI Registry study group. [The China Acute Myocardial Infarction \(CAMI\) Registry: A national long-term registry-research-education integrated platform for exploring acute myocardial infarction in China](#). *Am Heart J*. 2016;175:193-201.e3.
47. M. Orecchioni *et al.*, [Olfactory receptor 2 in vascular macrophages drives atherosclerosis by NLRP3-dependent IL-1 production](#). *Science* **375**, 214-221 (2022).
48. M. Litviňuková *et al.*, [Cells of the adult human heart](#). *Nature* **588**, 466-472 (2020).
49. Zhao X, Yang XX, Ji SZ, Wang XZ, Wang L, Gu CH, et al. [Efficacy and safety of fondaparinux versus enoxaparin in patients undergoing percutaneous coronary intervention treated with the glycoprotein IIb/IIIa inhibitor tirofiban](#). *Mil Med Res*. 2016;3:13.

50. Carrión-Valero F, Quiles-Izquierdo J, González-Monte C, Taberner-Alberola F, Lluch-Rodrigo JA, Chorro FJ, et al. Association between a comprehensive smoking ban and hospitalization for acute myocardial infarction: An observational study in the Autonomous Community of Valencia, Spain. *Rev Port Cardiol*. 2020;39(2):77-84.

Tables

Table 1. Ages of patients with AMI in China during 1990-2019.

Time	Literatures on ages of patients with AMI	Ages (yrs)	Mean of mini ages (yrs)
2020s	...		
	Chin Med J (Engl) . 2019;132(9):1037-1044.	56- 74	≈52.8
	Chin Med J (Engl). 2019;132(5):519-524.	62.02±12.47	
2015s	Chin Med J (Engl) . 2017;130(13):1534-1539.	44.4 ± 4.1	
	Chin Med J (Engl). 2017;130(5):542-548.	62.86 ± 14.98	
	Chin Med J (Engl). 2017;130(1):77-82.	38.68 ±4.44	
	Chin Med J (Engl). 2017;130(1):51-56.	58 ±12	
	Chin Med J (Engl) . 2016;129(5):518-22.	61.5 ± 11.1	
	Chin Med J (Engl). 2015;128(18):2415-9.	53.78 ±11.02	≈43.9
	Chin Med J (Engl). 2014;127(6):1008-11.	62.1±7.3	
	Chin Med J (Engl). 2013;126(21):4105-8.	68.1 ±8.5	
	Chin Med J (Engl). 2013;126(18):3481-5.	58.2 ±11.2	
	Chin Med J (Engl). 2013;126(16):3079-86.	62.8 ±12.3	
2010s	Chin Med J (Engl). 2013;126(12):2281-5.	61.8 ±9.6	
	Chin Med J (Engl). 2013;126(3):464-70.	60.1 ±14.4	
	Chin Med J (Engl). 2012;125(8):1405-9.	56 ±12	
	Chin Med J (Engl). 2011;124(20):3275-80.	60.5 ±10.1	
	Chin Med J (Engl). 2011;124(14):2083-8.	62.1 ±11.7	
	Chin Med J (Engl). 2011;124(6):825-30.	59 ±11.7	
	Chin Med J (Engl). 2010;123(20):2807-11.	56.61 ±11.44	
	Chin Med J (Engl). 2010;123(14):1840-5.	59 ±12	
	Chin Med J (Engl). 2010;123(14):1833-9.	57.8 ±2.5	≈47.1
	Chin Med J (Engl). 2009;122(22):2718-23.	52 ±11	
	Chin Med J (Engl) . 2009;122(14):1610-4.	40-79	
	Chin Med J (Engl). 2009;122(6):665-9.	36–82	
	Chin Med J (Engl). 2009;122(6):636-42.	68.0 ±10.6	
	Chin Med J (Engl). 2008;121(23):2384-7.	60 ±10	
	Chin Med J (Engl). 2008;121(9):771-5.	60.1 ±12.1	
	Chin Med J (Engl). 2007;120(14):1226-31.	62.3 ±9.3	

2005s	Chin Med J (Engl). 2006;119(1):26-31.	62.3 ±11.3	≈55.0
	Chin Med J (Engl). 2004;117(10):1443-8.	58±7	
2000s	Chin Med J (Engl). 2002;115(2):163-5.	69 ±11	≈48.2
	Chin Med J (Engl). 2001;114(7):698-702.	55 ±8.6	
	Chin Med J (Engl). 2000;113(8):733-6.	61.7 ±10.2	
	Chin Med J (Engl). 2000;113(8):702-5.	27-86	
	Chin Med J (Engl). 1999;112(1):18-21.	65 ±7	
1995s	Chin Med J (Engl). 1997;110(11):839-42.	60 ±10.2	≈46.4
	Chin Med J (Engl). 1997;110(11):834-8.	61.2 ±10.6	
	Chin Med J (Engl). 1997;110(3):184-6.	36-78	
	Chin Med J (Engl). 1997;110(1):56-8.	40-74	
	Chin Med J (Engl). 1997;110(1):50-2.	61.0 ±9.4	
	Chin Med J (Engl). 1995;108(7):501-5.	58 ±12	
	Chin Med J (Engl). 1993;106(6):410-4.	42	
1990s	Chin Med J (Engl). 1990;103(7):541-5.	55	=55.0

Notes: Data of ages from original research articles published in *Chin Med J (Engl)*.

Table 2. E(e)SEED related major risk factors of acute myocardial infarction

E(e)SEED	AMI related risk factors	Notes
External environment	<p>Abnormal climate and environment,^{10,11} e.g.,</p> <p>cold temperatures¹¹</p> <p>traffic noise¹²</p> <p>dust¹³</p> <p>air pollution¹⁴⁻¹⁷</p> <p>radiation</p> <p>socioeconomic factors</p>	
Internal environment	<p>Inflammation & infection^{18,19}, e.g.,</p> <p>influenza epidemics²⁰</p> <p>acute respiratory-tract infections²¹</p> <p>COPD/asthma</p> <p>HIV infection²²</p> <p>Coronary thrombosis</p> <p>Dyslipidemia, e.g.,</p> <p>elevated apolipoprotein B/apolipoprotein A ratio</p> <p>serum triglyceride levels</p> <p>serum LDL-C levels</p> <p>familial-combined hyperlipidaemia²³</p> <p>Hypercoagulable state</p> <p>Diabetes²⁴</p> <p>Dypertension</p> <p>History of coronary heart disease (angina)</p> <p>Central obesity</p> <p>Family hereditary</p>	<p>Chronic obstructive pulmonary disease</p> <p>Human immunodeficiency virus</p>
Sleep	<p>Stay up late or work in shifts</p> <p>Insomnia</p> <p>OSA</p>	Obstructive sleep apnea

Emotion	Physical exertion, anger or emotional upset ²⁵ Stress at work or home Anxiety and depression ²⁶⁻²⁸	
Exercise	Physical inactivity	
Diet	Inadequate daily intake of fresh fruits and vegetables ²⁹ Low Mg and high Ca:Mg ratio ³⁰ Se deficiency Tobacco smoking ³¹ Heavy alcohol consumption Drugs, e.g. cocaine abuse OC use post menopausal hormone replacement therapy ³³ Underuse or stopping evidence-based pharmacotherapy, e.g. statin clopidogrel ³⁴ beta-blockers ⁴⁵	Oral contraceptive and oral corticosteroid

Figures

Figure 1

Curve on ages of patients with acute myocardial infarction (AMI) in China during 1990 to 2019 (1990s-2020s). It's easy to find that ages of AMI decreased from 2005s to 2015s (2003 to 2017). Of course, data of 2020s (2018-2022) is not complete. This means that AMI patients are younger and younger since 2003.