

# Earthquakes and Cardiovascular Diseases

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A catastrophic earthquake could affect the population at all levels. Following an earthquake, as well as human and economic losses, the public health and the rate of cardiovascular diseases (CVDs) can be negatively affected. In the 21<sup>st</sup> century, there have been more than 20 earthquakes ranging in intensity from 6 to 9.3.<sup>[1]</sup> After the Christchurch, New Zealand, the 2011 earthquake a significant increase in overall cardiovascular events ( $P = 0.003$ ), ST elevation myocardial infarctions ( $P = 0.016$ ) and stress cardiomyopathy admissions have been reported.<sup>[2]</sup> In the first year, people living in the damaged areas had approximately 10% more cardiovascular hospitalizations.<sup>[3]</sup>

Previous studies have showed that the prevalence of acute coronary syndrome, hypertension, heart failure and arrhythmias increase in areas after a high-impact earthquake.<sup>[4-6]</sup> The post-traumatic mental stress is the central reason for increasing the risk of CVDs, especially (25% more) in the older population.<sup>[7-9]</sup> The onset of acute cardiovascular events following earthquakes has been variable from the first day of the event to weeks and months [Figure 1]. Leor *et al.*<sup>[10]</sup> have reported that there was an increase in sudden cardiac deaths on the day of the Northridge earthquake 1994, compared with the week before and after the earthquake. The 15 minutes after Noto Peninsula earthquake 2007, in Japan, an acute coronary syndrome and 72 h after the event the first case of stroke was reported by Tsuchida *et al.*<sup>[11]</sup>

The pathophysiology of earthquake-related cardiovascular events is suggested to be triggered by the activation of the sympathetic nervous system (SNS), Hypothalamic-pituitary-adrenal (HPA) axis, endothelial dysfunction, abnormal circadian rhythms, increased platelet activation, and vascular thrombosis.<sup>[12]</sup> The activation of the SNS and HPA axis cause releasing of catecholamines, corticotrophin hormone and,

cortisol. Stress-induced mechanisms and excess hormones releasing lead to the progression of atherosclerosis, most etiology of the mortality.<sup>[13]</sup> Stress can also activate the renin-angiotensin system and increase the production of circulating angiotensin II [Figure 2].<sup>[14]</sup>

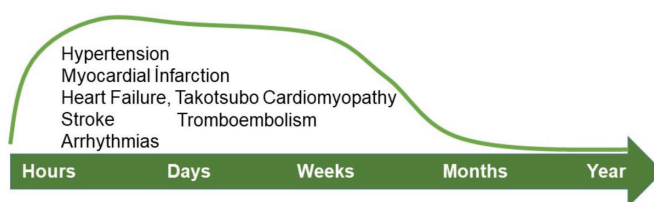


Figure 1: Time period of earthquake-related cardiovascular events

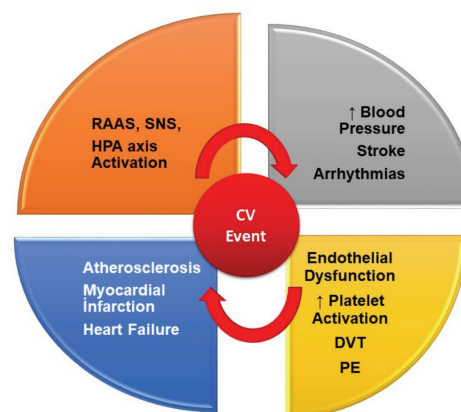


Figure 2: Pathophysiology and cardiovascular effects of an earthquake

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In conclusion, earthquake-induced CVDs are attributed to the abnormalities in the SNS, HPA axis, and neuroendocrine pathways triggered by mental and physical stresses. The rate and duration of the increases in cardiovascular events depend on the levels of earthquake damage, stress and, socio-economic stability.

## REFERENCES

1. ISC (2022), ISC-GEM Global Instrumental Earthquake Catalogue (1904-2018), Version 9.1, International Seismological Centre.
2. Chan C, Elliott J, Troughton R, Frampton C, Smyth D, Crozier I, *et al.* Acute myocardial infarction and stress cardiomyopathy following the Christchurch earthquakes. *PLoS One* 2013;8:e68504.
3. Teng AM, Blakely T, Ivory V, Kingham S, Cameron V. Living in areas with different levels of earthquake damage and association with risk of cardiovascular disease: a cohort-linkage study. *Lancet Planetary Health* 2017;1:e242-53.
4. Fukuma S, Ahmed S, Goto R, Inui TS, Atun R, Fukuhara S. Fukushima after the Great East Japan Earthquake: lessons for developing responsive and resilient health systems. *J Glob Health* 2017;7:010501.
5. Dobson AJ, Alexander HM, Malcolm JA, Steele PL, Miles TA. Heart attacks and the Newcastle earthquake. *Med J Aust* 1991;155:757-61.
6. Teng AM, Blakely T, Ivory V, Kingham S, Cameron V. Living in areas with different levels of earthquake damage and association with risk of cardiovascular disease: a cohort-linkage study. *Lancet Planetary Health* 2017;1:e242-53.
7. Sanoh T, Eguchi E, Ohira T, Hayashi F, Maeda M, Yasumura S, *et al.* Association between psychological factors and evacuation status and the incidence of cardiovascular diseases after the Great East Japan Earthquake: a prospective study of the Fukushima health management survey. *Int J Environ Res Public Health* 2020;17:7832.
8. Suzuki S, Sakamoto S, Koide M, Fujita H, Sakuramoto H, Kuroda T, *et al.* Hanshin-Awaji earthquake as a trigger for acute myocardial infarction. *Am Heart J* 1997;134:974-7.
9. Teng AM, Blakely T, Ivory V, Kingham S, Cameron V. Living in areas with different levels of earthquake damage and association with risk of cardiovascular disease: a cohort-linkage study. *Lancet Planet Health* 2017;1:e242-53.
10. Leor J, Poole WK, Kloner RA. Sudden cardiac death triggered by an earthquake. *N Engl J Med* 1996;334:1174-80.
11. Tsuchida M, Kawashiri MA, Teramoto R, Takata M, Sakata K, Omi W, *et al.* Impact of severe earthquake on the occurrence of acute coronary syndrome and stroke in a rural area of Japan. *Circ J* 2009;73:1243-7.
12. Kario K, McEwen BS, Pickering TG. Disasters and the heart: a review of the effects of earthquake-induced stress on cardiovascular disease. *Hypertens Res* 2003;26:355-67.
13. Trichopoulos D, Katsouyanni K, Zavitsanos X, Tzonou A, Dalla-Vorgia P. Psychological stress and fatal heart attack: the Athens (1981) earthquake natural experiment. *Lancet* 1983;1:441-4.
14. Chung IM. Stress-Induced Atherosclerosis: Clinical Evidence and Possible Underlying Mechanism. *Korean Circulation J* 2005;35:101-5.