

Original Article

Household's Catastrophic Health Expenditure in Patients With Type 2 Diabetes: A Study From Iran

Shahryar Sadr Manouchehri¹ , Sayed Saeed Kassaeian², Navid Danaei³, Farid Gharibi⁴ ¹School of Medicine, Semnan University of Medical Sciences, Semnan, Iran²Department of Community Medicine, School of Medicine, Semnan University of Medical Sciences, Semnan, Iran³Department of Pediatrics, School of Medicine, Semnan University of Medical Sciences, Semnan, Iran⁴Social Determinants of Health Research Center, Semnan University of Medical Sciences, Semnan, Iran*Corresponding author: Farid Gharibi, Email: gharibihsa@gmail.com

Abstract

Introduction: Type 2 diabetes (T2D) is a chronic condition that substantially threatens public health due to its prevalence and severe adverse effects. Beyond its health consequences, T2D is associated with considerable financial burden. Accordingly, this study aimed to investigate the magnitude and determinants of catastrophic health expenditure (CHE) incurred by patients with T2D.

Methods: Overall, 400 participants with T2D participated in this cross-sectional study in 2022, and a researcher-made questionnaire was used for data collection. The allocation of at least 40% of non-food expenditures to healthcare (during the last year) was the basis for CHE calculation. The chi-square test was utilized to determine the statistical association between demographic and background variables and CHE occurrence.

Results: It was found that patients incur a mean annual cost of \$1138, including 15.5%, 8.5%, and 76% spent on diagnostic expenses, medical visits, and treatment expenditures, respectively. Laboratory services, internist and endocrinologist visits, and medication accounted for the most considerable proportion of diagnostic, physician visits, and treatment costs. About 19.95% of direct medical costs were attributable to non-food costs, while 13.5% of patients experienced CHE. Educational status, employment status, indigenouness, residency in urban and rural areas, supplementary health insurance, disease treatment, the location of getting care, and the statistically significant link between the side effects and occurrence of CHE were among the demographic and background variables.

Conclusion: Although the rate of CHE provided care to diabetic patients is reasonable, health policymakers still need to take steps to resolve the situation through promotion measures.

Keywords: Direct medical costs, Catastrophic health expenditure, Type 2 diabetes

Received: February 25, 2026, Revised: April 17, 2026, Accepted: April 30, 2026, ePublished: June 30, 2026

Introduction

As health systems have been globally designed to preserve and improve the health of communities, they are required to offer each of their residents high-quality and accessible care. One aspect of this commitment is to ensure that individuals have equitable financial access to necessary care (1). It should be noted that patients' inability to pay health costs disrupt the treatment process, leads to undesirable health outcomes, and jeopardize public health (2). Catastrophic health expenditure (CHE) occurs when the costs imposed on patients due to illness exceed their financial means and those of their families. In such circumstances, the patient is deprived of receiving appropriate care, and the family's level of well-being also declines sharply (3).

Annually, almost 44 million households with a population of 150 million people in the world are faced with CHE, of which 25 million households with a population of more than 100 million are impoverished (4). Various studies estimate the total vulnerability of Iranian

families to CHE to be between 8.3% and 22.2% (5). Even though Iranian officials intended to cut out-of-pocket expenditures to less than 30% and the entire exposure of households to CHE to less than 1%, these objectives were never even partially met (6). In Iran, the cost of healthcare per capita climbed by 200% between 2004 and 2008. In 2006, nearly 50% of these expenses were borne by people (6). In addition, the exposure of Iranian households to CHE grew from 2.57% in 2008 to 3.25% in 2015 (7).

Chronic diseases hinder the capacity of patients and their families to work and earn a living and involve them for many years with severe and occasionally escalating problems associated with the disease (8). In China, for example, the estimated percentage of CHE borne by families with chronically ill members was 34%. However, the corresponding figure for households without such a patient was only 13% (9). Diabetes, one of the most prevalent chronic diseases in the world and the third leading cause of death in Iran, is proliferating (10). According to estimates, the global prevalence of diabetes



will rise from 7% of the population in 2012 to 8.3% in 2030 (11), and the number of diabetics will rise from 366 million in 2011 to 522 million in 2030 if the illness is not controlled (12).

Diabetes affects 11.4% of Iran's adult population. According to the rising trend of the disease due to the proliferation of its risk factors, it is estimated that around 9 million Iranians will have diabetes by 2030 (13). It is noteworthy that diabetes develops unnoticeably. Hence, around 10% of patients have difficulties at the initial diagnosis, and these consequences advance fast if the condition is not controlled (14). Moreover, diabetes caused almost 109,000 fatalities, 1,157,000 lost life years, and 2,263,000 disability-adjusted life years in India only in 2004 (15), and the cost of patient treatment rose from \$4.66 billion in 2000 to \$8.14 billion in 2016 (16). Despite the undeniable significance of accurate calculation of CHE in chronic diseases, most studies conducted in Iran have focused on chronic diseases but rather on the general health costs imposed on households (17). These studies typically suffer from methodological errors, particularly in terms of approach, the incompleteness of the evaluation tool, and even recall bias (18). Likewise, this phenomenon is also visible in other international investigations (19). Therefore, the present study aims to investigate the prevalence and causes of CHE among patients with type 2 diabetes (T2D) and their households in Semnan.

Materials and Methods

Participants and Type of Study

This cross-sectional study involving 400 individuals with T2D was conducted in Semnan, Iran, in 2022. The required data were collected from patients referring to diabetes clinics in the public sector, as well as private offices that were frequently owned by internal medicine and endocrinology specialists. An inclusion criterion was a minimum of one year since treatment initiation. Patients diagnosed with T1D or gestational diabetes were excluded from the study.

Sample Size

Although the required sample study included 384 patients using the following formula, considering 5% of the population, the final participants were calculated to be 400 patients. In this formula, n and z represent the sample size used to determine the community's mean exposure to CHE and the Z-score value at a specified degree of confidence, respectively. In addition, s and d denote the projected changes in responses and the margin of error, respectively. Based on the prediction changes of 0.5, the margin of error of 0.05, and the 95% confidence level, the sample size was calculated to be 384 individuals.

$$n = \left(\frac{zs}{d} \right)^2 = \left(\frac{1.96 * 0.5}{0.05} \right)^2 = \left(\frac{0.9604}{0.0025} \right) = 384.16$$

Instruments

A researcher-made questionnaire was used to acquire the necessary data. To create the questionnaire, the

components of diabetes-related health costs were determined and categorized through interviews with internists, endocrinologists, health management professionals, and patients and a review of their care files. New demographic and background factors that may influence CHE and income components were found through additional research and in-depth interviews with specialists. They were added to the initial survey instrument. Then, the form and content validities of the questionnaire were assessed based on the opinions of ten experts. To this end, all questions were evaluated based on the four indices of necessity, relevance, transparency, and simplicity within a quadruple spectrum. Additionally, the content validity rate (CVR) and content validity index (CVI) indices were utilized to determine the questions' content validity.

Further, the questionnaire's face validity was established by gathering experts' qualitative feedback on the formulation (20). The content validity of each question was determined through the estimation of the CVR by calculating the points scored in the essential criterion. Then, the CVI was determined by utilizing the points earned in the remaining three evaluation criteria. To identify these parameters, the number of experts who voted for two positive spectrum options was divided by the total number of experts that participated:

$$CVR / CVI = \frac{nE - \frac{N}{2}}{\frac{N}{2}}$$

nE represents the number of experts who chose two positive spectrum alternatives. Furthermore, N denotes the total number of experts. Due to the participation of 10 experts at this stage, the acceptance rate of 62% was used to validate the questionnaire items (20). The final questionnaire consisted of 74 questions, with 27 and 37 questions about demographic and background information and disease cost information, respectively. The remaining questions were related to income status ($n=4$) and elicitation of patients' perspectives on the adverse effects of disease costs on them ($n=6$). The instrument was validated with scores of 0.90 and 0.87 for CVR and CVI indicators, respectively.

Sampling Method and Data Collection

Systematic random sampling was utilized for the research. In addition, face-to-face and telephone interviews with patients were employed to collect data on direct medical expenses and demographic and background variables. Each questionnaire item was orally posed to the patients, and their desired responses were recorded in the questionnaires. Finally, the accuracy of the care and cost information was verified to the greatest degree possible using the medical records of patients at healthcare facilities.

Statistical Analysis

The direct medical costs incurred by patients in the

form of out-of-pocket payments at the time of receiving healthcare were the primary bases of occurring CHE. As with most studies relating to CHE in chronic diseases, the period selected to collect information from patients was the preceding year. Due to the lack of a comprehensive health record for patients, the amount and type of expenses stated were acquired via self-report. Additionally, the likelihood of recall bias was reduced owing to the recurring nature of health expenses in chronic diseases and the confirmation of patients' stated expenses through their care records. The criterion for CHE was spending at least 40% of a household's non-food expenses on healthcare (21). Considering the qualitative nature of the data, the chi-square test was utilized to study the statistical link between demographic and background variables and the CHE imposed on patients and their families.

Ethical Considerations

Each patient was allowed to accept or decline participation in the trial, and their informed consent was acquired before the study. All patients were treated with care and informed that their information would merely be utilized for the study's aims. Necessary data were collected in a manner that did not interfere with the treatment of patients, and the required permits were received from the university's ethical committee.

Results

According to the patients' demographics, the majority of them were above the age of 40, with a mean age of 51.93 (± 15.84) years and a range of 10–77 years. Both genders were equally represented among the patients under examination, most of whom were married. Moreover, most patients were literate but lacked a college education; homemakers and retired patients had the highest proportions, respectively. In addition, most patients were urban residents and inhabitants of the provincial center (Table 1).

Examining patient demographics revealed that the vast majority had social security-style basic health insurance, but only about two-thirds had supplemental health insurance. Most patients were immediately followed up and treated after receiving a disease diagnosis. Additionally, most of them were between 10 and 20 years after the disease's onset. In nearly three-quarters of patients receiving continuous care, endocrinologists were responsible for providing care and supervising the treatment process; likewise, most patients received care in private healthcare centers or private and public facilities (Table 2).

The most prominent side effects were neuropathy, amyloidopathy, and acute visual loss, affecting about 19% of patients. Moreover, the mean period of exposure to neuropathy, retinopathy, and nephropathy for these individuals was 5.76 (± 3.45), 3.75 (± 2.32), and 5 (± 2.60) years (Table 3).

The mean annual cost imposed on patients and their families was approximately \$1138, of which \$178 was

Table 1. Demographic Characteristics of Patients

Demographic Variables	Category	Frequency	Percentage
Age	1–20 years old	25	6.25
	21–40 years old	62	15.5
	41–60 years old	159	39.75
	61–80 years old	154	38.5
Gender	Male	204	51
	Female	196	49
Marital status	Single	53	13.25
	Married	347	86.75
Educational status	Illiterate	8	2
	Below high school diploma	113	28.25
	High school diploma	182	45.5
	Associate's and bachelor's degrees	87	21.75
	Master's degree	10	2.5
Occupational status	Office employee	53	13.5
	Worker	8	2
	Self-employed	11	2.75
	Housekeeper	118	29.5
	Retired	197	49.25
Nativity	Unemployed	12	3
	Center of province	389	97.25
	Other places of province	11	2.75
Living place	Urban dwellers	386	96.5
	Rural dwellers	14	3.5

spent on diagnostic charges, \$98 on visit fees, and \$862 on medical expenses. In addition to laboratory services, an internist/endocrinologist visit and medication accounted for the majority of diagnostic, visit, and treatment costs, respectively (Table 4).

The mean yearly income of patients and their families was nearly 23,571 dollars, of which over 30% was spent on non-food expenses. In this status, the mean proportion of direct medical costs attributable to non-food expenses was 19.50% (36.85), and 13.5% of patients and their families had experienced CHE.

There was a statistically significant relationship between CHE and the demographic and background variables of education level, employment status, indigenous status, urban versus rural residence, secondary health insurance coverage, disease management, location of care, and side effect presence ($P < 0.05$). CHE was more prevalent among the illiterate than those with a high school diploma or less and those with a high school diploma or less than those with a university education. This rate was also lower among indigenous residents of the urban core of the province than among non-indigenous residents of the same area, among urban residents as opposed to rural ones, and among those with supplemental health insurance as opposed to those without such health insurance. Similarly, it was lower among those undergoing observation as opposed to those who were not and among those receiving care from private centers as opposed to public ones. In addition, the

Table 2. Background Characteristics of Patients

Underlying Variables	Category	Frequency	Percentage
Benefiting basic insurance	Yes	388	97
	No	12	3
Type of basic insurance	Social security	302	75.5
	Treatment services	41	10.25
	Armed forced	30	7.5
	Other (petroleum, banks, and the like)	27	6.75
Benefiting supplementary insurance	Yes	272	68
	No	128	32
Elapsed time since diagnosis	Less than 5 years	89	22.25
	5–9 years	106	26.5
	10–19 years	164	41
	20 years and more	21	10.25
The distance between disease diagnosis and the start of care	Immediately	370	92.5
	Less than 1 year	8	2
	1–4 years	14	3.5
	5–9 years	8	2
Controlling of the diabetes	Continuous	310	77.5
	Periodic	35	8.75
	In the event of an acute problem	45	11.25
	Not under care	10	2.5
The doctor in charge of the treatment	Family physician	5	1.25
	General practitioner	70	17.5
	Internal specialist	49	12.25
	Endocrinologist	176	69
Place of receiving care	Governmental center	114	28.5
	Private center	132	33
	Integration of private and public centers	154	38.5

incidence of CHE was substantially higher among people exposed to disease complications (especially neuropathy, retinopathy, and impaired vision) than among those who had not been exposed (Table 5).

Discussion

In this research, the mean annual cost imposed on patients and their families was approximately \$1138, with diagnostic, medical visit, and treatment expenditures accounting for 15.5%, 8.5%, and 76% of the total cost, respectively. Laboratory services, visits to internists and endocrinologists, and medications account for the most considerable proportion of diagnostic, visit, and treatment expenses. Nonetheless, the impact of significant expenditures on patients can be mitigated by lowering the expenses of laboratory tests and medications via comprehensive and adequate insurance coverage. In addition, incorporating internists and endocrinologists into the health maintenance organization, encouraging knowledge enterprises to produce high-quality pharmaceutical products, and working to lift medical supply embargoes will help diminish the impacts of healthcare costs.

Table 3. The Occurrence of Side Effects of the Disease

Underlying Variables	Category	Frequency	Percentage
Occurring serious side effects	Yes	76	19
	No	324	81
Type of side effects	Neuropathy	34	8.5
	Retinopathy	32	8
	Nephropathy	11	2.75
	Amputation	10	2.5
	Renal failure	8	2
	Kidney transplant	0	0
	Severe visual impairment	28	7
	Blindness	0	0

The mean yearly income of patients and their families was \$23,571, and nearly 30% of this amount was spent on non-food expenses. Considering the proportion of non-food healthcare costs, 13.5% of patients faced CHE. This rate was around 13.8% (22) and 11.1% (23), according to research conducted in China, and approximately 25% was observed in a study performed in South Africa (20). Comparing these statistics revealed a substantial correlation between Iran and China regarding the incidence of CHE among diabetic patients. Iran's status is superior to South Africa, another industrialized nation.

Based on the analysis results of demographic and background variables influencing the incidence of CHE, illiterate patients had a higher rate than those with a high school diploma or less, and those with a high school diploma or less had a higher rate than those with a university education. Additionally, this rate was lower for native patients living in the province's center than for non-native patients, for urban residents than for rural residents, and for patients with supplementary insurance than for those without. Further, the corresponding rate was lower for patients under medical supervision than for other patients and for patients receiving care at private centers than those receiving care at public health centers. In addition, CHE was extremely higher among those exposed to disease consequences (particularly neuropathy, amyloidopathy, and impaired vision) than among those not exposed to such consequences ($P < 0.05$).

The lower incidence of CHE among patients with a higher level of education can be attributed to their improved health awareness and self-care (and the incidence of disease complications with less frequency and severity), their employment status, and, consequently, their higher income. Furthermore, the reduced frequency of CHE in urban patients or those living in the center of the province may be attributable to their better access to a wide variety of care, especially with the state tariff, as well as their improved standard of living and income. Moreover, people with supplemental health insurance may have access to more specialized and high-quality care providers and facilities in the private sector, with less financial concern and better coverage of medical expenses, especially medications (as a source of the lower incidence

Table 4. Direct Medical Expenses

Domain	Type of Costs	Minimum		Maximum		Mean (Standard Deviation)	
		IRR	USD	IRR	USD	IRR	USD
Diagnosing services	Laboratory services	0	0	50000000	1190.47	6777600 (± 10052360)	161.37 (± 239.34)
	Sonography	0	0	9000000	214.28	225000 (± 1307830)	5.36 (± 31.14)
	CT scan	0	0	1500000	35.71	15000 (± 149620)	0.36 (± 3.56)
	MRI	0	0	4500000	107.14	45000 (± 448860)	1.07 (± 10.69)
	Other diagnosing costs	0	0	15000000	357.14	410500 (± 1995880)	9.77 (± 47.52)
	Sum of diagnosing expenditures	0	0	59000000	1404.76	7473100 (± 11211890)	177.93 (± 266.95)
Visiting	General physician	0	0	4000000	95.24	176200 (± 603030)	4.20 (± 14.36)
	Internist and endocrinologist	0	0	20000000	476.19	2729300 (± 2942290)	64.98 (± 70.05)
	Ophthalmologist	0	0	3600000	85.71	772100 (± 780370)	18.38 (± 18.58)
	Urologist and nephrologist	0	0	4800000	114.28	307500 (± 907410)	7.32 (± 21.60)
	Orthopedic and general surgeon	0	0	4400000	104.76	77000 (± 545940)	1.83 (± 12.99)
	Psychiatrist and psychologist	0	0	5000000	119.05	50000 (± 497840)	1.19 (± 11.85)
	Sum of visiting expenditures	0	0	20000000	476.19	4112100 (± 3485010)	97.91 (± 82.98)
Treatment services	Surgery	0	0	300000000	7142.86	6155000 (± 36209620)	146.55 (± 862.13)
	Hospitalization services	0	0	40000000	592.38	610400 (± 4874110)	14.53 (± 116.05)
	Medication	0	0	600000000	14285.71	28405000 (± 62325370)	676.31 (± 1483.94)
	Physiotherapy	0	0	70000000	1666.66	982000 (± 7501290)	23.38 (± 178.60)
	Occupational therapy	0	0	4000000	95.24	60000 (± 487420)	1.43 (± 1.60)
	Sum of treatment services (apart from visits)	0	0	600000000	14284.71	36212400 (± 82412640)	862.2 (± 1962.21)
Sum of expenditures		0	0	633000000	15071.43	47797600 (± 8847014)	1138.04 (± 210.64)

Note. CT: Computed tomography; MRI: Magnetic resonance imaging.

of CHE). Most of these patients' costs are related. The lower incidence of CHE in the patients under observation can be linked to the improved control of the disease and, consequently, the reduced frequency and severity of the disease's complications. Additionally, the lower incidence of CHE among private center patients can be related to their higher income level. Regarding the higher incidence of CHE in patients with severe disease complications, it can be argued that this is due to their need for specialized and complex care (which is generally more expensive) and their diminished ability to engage in economically productive activities.

In a study by Jing et al in China, household income, the severity of disease development and its complications, and the number and type of services received by patients impacted the incidence of CHE (22). In a similar study conducted by Sun et al in China, employment status, household income, and place of residence influenced CHE (23). In addition, the findings of a study by Mutyambizi et al in South Africa demonstrated the association between gender and household financial position and the incidence

of CHE (20). Comparing the results of prior studies with those of the present study revealed that factors influencing CHE are highly consistent.

Several recommendations can be proposed based on our findings:

- Providing all diabetic patients, especially those in need and facing severe complications, with the necessary therapy and covering the cost of these services through basic health insurance
- Providing assistance to less privileged areas to acquire supplemental insurance services based on advance payment
- Integrating internal medicine and endocrinology professionals into the public sector and health maintenance organization
- Promoting knowledge businesses to produce high-quality laboratory equipment and medications for diabetic patients and increasing community health literacy and self-care, particularly among individuals with a family history of diabetes
- Expanding diagnostic and treatment facilities in the

Table 5. Statistical Relationship Between Demographic/Background Variable and Occurring CHE

Variable	Category	Incidence (%)	Significance (P-Value)
Educational status	Illiterate	50	0.037
	Below high school diploma	19.64	
	High school diploma	13.18	
	Associate's and bachelor's degrees	4.5	
	Master's degree	0	
Occupational status	Office employee	0	0.001
	Worker	0	
	Self-employed	0	
	Housekeeper	13.13	
	Retired	16.95	
	Unemployed	66.66	
Nativity	Center of province	12.31	0.018
	Other places of province	60	
Living place	Urban dwellers	12.43	0.046
	Rural dwellers	42.85	
Controlling of the diabetes	Continuous	16.13	0.001
	Periodic	0	
	In the event of an acute problem	0	
	Not under care	60	
Benefiting supplementary insurance	Yes	5.46	0.032
	No	19.21	
Place of receiving care	Governmental center	19.30	0.010
	Private center	3	
	Integration of private and public centers	18.8	
Occurring serious side effects	Yes	44.73	<0.001
	No	6.01	
Occurring Neuropathy	Yes	52.94	<0.001
	No	9.83	
Occurring Retinopathy	Yes	37.5	0.010
	No	11.41	
Occurring severe visual impairment	Yes	57.14	<0.001
	No	10.21	

Note. CHE: Catastrophic health expenditure.

non-central regions of the province, and even in rural areas, to improve justice and accountability

- Providing consistent and effective patient follow-up care (by the healthcare system) to prevent or mitigate the financial burden of illness.

To gain a deeper understanding of the national pattern of CHE associated with this condition, the research team suggests conducting similar studies in the other regions of the country and repeating the survey at specified intervals to follow both existing and emerging trends.

One of the limitations of the study was the absence of a comprehensive health information system in which all care delivered to patients with diabetes and its expenditures are recorded and preserved, as in the absence of such a system, researchers occasionally rely entirely on claims

and patients' memories. However, some of the merits of this study were the comprehensiveness of the research instrument, the adequate sample size, and the absence of similar research in Iran (and the limited number of similar studies worldwide).

Conclusion

Overall, although patients with T2D were found to have a relatively low rate of CHE, policymakers in the field need to implement promotional interventions to improve the current situation, mainly by providing specialized insurance and care support for people with severe complications of the disease in order to address the current financial and geographic inequities. By describing the scale and type of societally imposed CHE, factors determining the incidence of such costs, and practical recommendations, the researchers seeks to inform decision-making institutions and guide them toward the most appropriate and efficient solutions.

Acknowledgements

We would like to express our gratitude to the mothers who participated in the study and demonstrated remarkable patience in answering the questions, as well as the specialists who helped develop the questionnaire and the Research and Technology Vice-Chancellor at Semnan University of Medical Sciences for providing financial support.

Authors' Contribution

Conceptualization: Farid Gharibi, Shahryar Sadr Manouchehri, Sayed Saeed Kassaeian, and Navid Danaei

Data Curation: Farid Gharibi, Shahryar Sadr Manouchehri, Sayed Saeed Kassaeian, and Navid Danaei

Formal Analysis: Farid Gharibi, Shahryar Sadr Manouchehri, Sayed Saeed Kassaeian, and Navid Danaei

Software: Farid Gharibi, Sayed Saeed Kassaeian, and Navid Danaei
Writing–Original Draft: Farid Gharibi and Shahryar Sadr Manouchehri

Writing–Review and Editing: Sayed Saeed Kassaeian and Navid Danaei

Competing Interests

The authors declare that they have no competing interests.

Consent for Publication

Not applicable.

Data Availability Statement

Qualitative data in Persian language are stored and archived at the university where the study was conducted. Interested researchers, for valid reasons, may contact the first author (Farid Gharibi).

Ethical Approval and Consent to Participate

The Ethics Committee of Semnan University of Medical Sciences granted ethical approval to this study (IR.SEMUMS.REC.1399.300). All methods were performed in accordance with relevant guidelines and regulations. In addition, the participants were provided with an information sheet and reassured about anonymity, freedom to withdraw, and confidentiality. Further, the purpose of the study was explained to the participants, and informed consent was obtained from all study participants and the legal guardians of illiterate participants. Furthermore, participants were assured of anonymity and data confidentiality. Finally, they were allowed to withdraw the study at any time and were informed that the research results would be made available to them upon request.

Funding

This study received financial support from Semnan University of Medical Sciences.

References

- Gheinali Z, Moshiri E, Ebrahimi Tavani M, Haghi M, Gharibi F. Catastrophic health expenditures in hospitalized patients with delta variant of COVID-19: a cross-sectional study. *Health Promot Perspect* 2023;13(1):68-76. doi:[10.34172/hpp.2023.09](https://doi.org/10.34172/hpp.2023.09)
- Meshkat SAM, Kassaieen SS, Danaei N, Gharibi F. Households catastrophic health expenditure among older people with noncommunicable diseases: a cross-sectional study from Iran. *Health Sci Rep* 2024;7(3):e1992. doi:[10.1002/hsr.1992](https://doi.org/10.1002/hsr.1992)
- Hsu J, Flores G, Evans D, Mills A, Hanson K. Measuring financial protection against catastrophic health expenditures: methodological challenges for global monitoring. *Int J Equity Health* 2018;17(1):69. doi:[10.1186/s12939-018-0749-5](https://doi.org/10.1186/s12939-018-0749-5)
- Xu K, Evans DB, Kawabata K, Zeramdini R, Klavus J, Murray CJ. Household catastrophic health expenditure: a multicountry analysis. *Lancet* 2003;362(9378):111-7. doi:[10.1016/s0140-6736\(03\)13861-5](https://doi.org/10.1016/s0140-6736(03)13861-5)
- Piroozi B, Moradi G, Nouri B, Mohamadi Bolbanabad A, Safari H. Catastrophic health expenditure after the implementation of health sector evolution plan: a case study in the west of Iran. *Int J Health Policy Manag* 2016;5(7):417-23. doi:[10.15171/ijhpm.2016.31](https://doi.org/10.15171/ijhpm.2016.31)
- Kavosi Z, Rashidian A, Pourreza A, Majdzadytueh R, Pourmalek F, Hosseinpour AR, et al. Inequality in household catastrophic health care expenditure in a low-income society of Iran. *Health Policy Plan* 2012;27(7):613-23. doi:[10.1093/heapol/czs001](https://doi.org/10.1093/heapol/czs001)
- Yazdi-Feyzabadi V, Bahrampour M, Rashidian A, Haghdooost AA, Akbari Javar M, Mehrolhassani MH. Prevalence and intensity of catastrophic health care expenditures in Iran from 2008 to 2015: a study on Iranian household income and expenditure survey. *Int J Equity Health* 2018;17(1):44. doi:[10.1186/s12939-018-0743-y](https://doi.org/10.1186/s12939-018-0743-y)
- Xin XX, Zhao L, Guan XD, Shi LW. Determinants and equity evaluation for health expenditure among patients with rare diseases in China. *Chin Med J (Engl)* 2016;129(12):1387-93. doi:[10.4103/0366-6999.183425](https://doi.org/10.4103/0366-6999.183425)
- Si Y, Zhou Z, Su M, Ma M, Xu Y, Heitner J. Catastrophic healthcare expenditure and its inequality for households with hypertension: evidence from the rural areas of Shaanxi province in China. *Int J Equity Health* 2017;16(1):27. doi:[10.1186/s12939-016-0506-6](https://doi.org/10.1186/s12939-016-0506-6)
- Forouzanfar MH, Ghajarieh Sepanlou S, Shahrzaz S, Dicker D, Naghavi P, Pourmalek F, et al. Evaluating causes of death and morbidity in Iran, global burden of diseases, injuries, and risk factors study 2010. *Arch Iran Med* 2014;17(5):304-20.
- Shaw JE, Sicree RA, Zimmet PZ. Global estimates of the prevalence of diabetes for 2010 and 2030. *Diabetes Res Clin Pract* 2010;87(1):4-14. doi:[10.1016/j.diabres.2009.10.007](https://doi.org/10.1016/j.diabres.2009.10.007)
- Beiranvand S, Fayazi S, Asadizaker M, Latifi SM. Survey of the foot care status in type II diabetic patients: application of the theory of planned behavior. *J Clin Nurs Midwifery* 2014;3(2):57-66.
- Esteghamati A, Etemad K, Koohpayehzadeh J, Abbasi M, Meysamie A, Noshad S, et al. Trends in the prevalence of diabetes and impaired fasting glucose in association with obesity in Iran: 2005-2011. *Diabetes Res Clin Pract* 2014;103(2):319-27. doi:[10.1016/j.diabres.2013.12.034](https://doi.org/10.1016/j.diabres.2013.12.034)
- Ahmed SA, Badi S, Tahir H, Ahmed MH, Almobarak AO. Knowledge and practice of diabetic foot care in Sudan: a cross sectional survey. *Diabetes Metab Syndr* 2019;13(4):2431-5. doi:[10.1016/j.dsx.2019.06.016](https://doi.org/10.1016/j.dsx.2019.06.016)
- Venkataraman K, Kannan AT, Mohan V. Challenges in diabetes management with particular reference to India. *Int J Diabetes Dev Ctries* 2009;29(3):103-9. doi:[10.4103/0973-3930.54286](https://doi.org/10.4103/0973-3930.54286)
- Ohinmaa A, Jacobs P, Simpson S, Johnson JA. The projection of prevalence and cost of diabetes in Canada: 2000 to 2016. *Can J Diabetes* 2004;28(2):116-23.
- Ghorbanian A, Rashidian A, Bagheri Lankarani K, Kavosi Z. The prevalence and determinants of catastrophic health expenditures in Iran: a systematic review and meta-analysis. *Health Scope* 2017;8(1):e63210. doi:[10.5812/jhealthscope.63210](https://doi.org/10.5812/jhealthscope.63210)
- Lu C, Chin B, Li G, Murray CJ. Limitations of methods for measuring out-of-pocket and catastrophic private health expenditures. *Bull World Health Organ* 2009;87(3):238-44. doi:[10.2471/BLT.08.054379](https://doi.org/10.2471/BLT.08.054379)
- Wang Z, Li X, Chen M. Catastrophic health expenditures and its inequality in elderly households with chronic disease patients in China. *Int J Equity Health* 2015;14:8. doi:[10.1186/s12939-015-0134-6](https://doi.org/10.1186/s12939-015-0134-6)
- Mutyambizi C, Pavlova M, Hongoro C, Booysen F, Groot W. Incidence, socio-economic inequalities and determinants of catastrophic health expenditure and impoverishment for diabetes care in South Africa: a study at two public hospitals in Tshwane. *Int J Equity Health* 2019;18(1):73. doi:[10.1186/s12939-019-0977-3](https://doi.org/10.1186/s12939-019-0977-3)
- Nekoei Moghadam M, Banshi M, Akbari Javar M, Amiresmaili M, Ganjavi S. Iranian household financial protection against catastrophic health care expenditures. *Iran J Public Health* 2012;41(9):62-70.
- Jing Z, Chu J, Imam Syeda Z, Zhang X, Xu Q, Sun L, et al. Catastrophic health expenditure among type 2 diabetes mellitus patients: a province-wide study in Shandong, China. *J Diabetes Investig* 2019;10(2):283-9. doi:[10.1111/jdi.12901](https://doi.org/10.1111/jdi.12901)
- Sun X, Liabsuetrakul T, Xie X, Liu P. Catastrophic health expenditure and impoverishment for type 2 diabetes mellitus patients in a multiethnic province in China using a Blinder-Oaxaca decomposition: a cross-sectional study. *Medicine (Baltimore)* 2019;98(39):e17376. doi:[10.1097/md.00000000000017376](https://doi.org/10.1097/md.00000000000017376)