Burden of Chronic Kidney Disease and Its Risk-Attributable Burden in 137 Low-and Middle-Income Countries, 1990-2019: Results From The Global Burden of Disease Study 2019

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Research Article

Keywords: Chronic kidney disease, Burden of disease, Disability-adjusted life years, Population attributable fraction, Risk factors

Posted Date: June 30th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-641196/v1>

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Version of Record: A version of this preprint was published at BMC Nephrology on January 5th, 2022. See the published version at <https://doi.org/10.1186/s12882-021-02597-3>.

Abstract

Background

Chronic kidney disease (CKD) is a global public health concern, but its disease burden and risk-attributable burden in CKD has been poorly studied in low - and middle-income countries (LMICs). This study aimed to estimate CKD burden and risk-attributable burden in LMICs from 1990 to 2019.

Methods

Data were collected from the Global Burden of Disease (GBD) Study 2019, which measure CKD burden using the years lived with disability (YLDs), years of life lost (YLLs), disability-adjusted life-years (DALYs) and estimate risk-attributable burden using population-attributable fraction (PAF) from 1990 to 2019. The 95% uncertainty intervals (UIs) were calculated and reported for YLDs, YLLs and DALYs.

Results

In 2019, the age-standardized YLL rate is much higher than the YLD rate in various income regions. LICs had the highest age-standardized DALY rate at 692.25 per 100,000 people (95%UI: 605.14 to 785.67), followed by Lower MICs. From 1990 to 2019, the age-standardized DALY rate showed a 13.70% reduction in LICs, 2.25% reduction Upper MICs but 3.72% rising in Lower MICs. Age-standardized YLD rate was higher in females than in males, whereas age-standardized rates of YLL and DALY of CKD were all higher in males than in females in globally and various income regions. Additionally, there were upward trends in the CKD-related age-specific YLD, YLL and DALY rates in various income regions. In 2019, kidney dysfunction, high systolic blood pressure, high fasting plasma glucose, and high body-mass index remained the major causes attributable age-standardized CKD DALYs. From 1990 to 2019, there were upward trends in the PAF contributions of high fasting plasma glucose, high systolic blood pressure, and high body-mass index. The greatest increase in the PAF was high body-mass index, especially in Lower MICs.

Conclusions

CKD burden remains high in various income regions, especially in MICs and Lower MICs. More effective and targeted preventive policies and interventions aimed at mitigating preventable CKD burden and addressing risk factors are urgently needed, particularly in geographies with high or increasing burden.

Introduction

Chronic kidney disease (CKD) is a global public health concern[1], and a risk factor for adverse outcomes in other diseases[2, 3]. The global burden of CKD is rapidly increasing and is projected to become the 5th most common cause of years of life lost worldwide by 2040[4, 5], with the burden of CKD increasing faster in low - and middle-income countries (LMICs)[6]. The burden of CKD is studied predominantly in high-income countries, with few studies in LMICs, and even fewer studies on attributable disease burden[2]. In this study, we aimed to analyzed and compared the trends of disease burden of CKD as well as its attributable disease burden in LMICs from 1990 to 2019, by using the data from the GBD 2019 study.

Methods

Data sources

Data for this study were obtained from the GBD 2019 study. The GBD 2019 provides estimates of years lived with disability (YLDs), years of life lost (YLLs), and disability-adjusted life-years (DALYs) disaggregated due to 369 diseases and injuries, and 87 risk factors and combinations of risk factors in 204 countries and territories from 1990 to 2019[7, 8]. Detailed methods of GBD 2019 have been published elsewhere[7, 8]. The GBD 2019 attributable burden estimates followed the general framework established for comparative risk assessment (CRA)[9, 10]. Compared with previous GBD studies[11–13], the GBD 2019 study developed new approaches to estimate risk exposure and risk-attributable burden by integrating all accessible data from multiple epidemiological studies in various countries[7]. These studies included high-quality systematic reviews, cohorts, trials, case-control studies and other observational studies[7].

This study adherence to the Guidelines for Accurate and Transparent Health Estimates Reporting (GATHER) recommendations[14]. All data used in this study were obtained from the Institute for Health Metrics and Evaluation (IHME) website[15].

In the GBD study, chronic kidney disease was recognized as a disease as well as a metabolic risk factor[16]. In this analysis, we treated chronic kidney disease as a disease. CKD was defined as eGFR(estimated glomerular filtration rate) of < 60 mL/min per 1.73 m²[16].

Definitions

We used years lived with disability (YLDs), years of life lost (YLLs) and disability-adjusted life-years (DALYs) to measure the burden caused by CKD. YLDs measures the amount of time people lose to diseases and injuries that degrade their level of health but do not cause death. YLLs is a measure of premature death within a group of people. DALYS is a comprehensive index to evaluate the disease burden of disability and premature death, it is calculated by adding the YLLs and the YLDs[17, 18].

Due to the potential effects of climate change on human health, two new risk factors (high and low non-optimal temperatures) have been added in GBD 2019. 8 risk factors, i.e. high temperature, low temperature, Lead exposure, diet high in sodium, high systolic blood pressure, high fasting plasma glucose, high body mass index, impaired kidney function, were considered to be associated with CKD In GBD 2019.

In our analyses we classified countries according to World Bank Income Levels in 2019, a total of 137 low-and middle-income countries (LMICs) were categorized into three groups: 31 low-income countries (LICs), 47 lower-middle income countries (Lower MICs) and 59 upper-middle income countries (Upper MICs).

Statistical analyses

We computed counts, and age-standardized rates (per 100 000) to quantify the burden of CKD. YLDs, YLLs and DALYs were metrics used to measure the burden of CKD and reported by specific region, year, sex, age. Age-standardized rates (per 100 000) were standardized by the global age-standard population. The percentage contributions of risk factors to age-standardized CKD DALYs were calculated by the population attributable fraction (PAF).

Uncertainty interval

For each estimated rate and number of YLDs, YLLs, DALYs, and PAF of risk-attributable CKD DALYs, we reported its 95% uncertainty interval (UI). 95% UI was calculated by taking 1000 draws from the posterior distribution of each quantity and using the 25th and 975th-ordered draw of the uncertainty distribution[19].

Results

There were upward trends in the CKD-related YLDs, YLLs and DALYs in various income regions from 1990 to 2019 (Table 1). In 2019, the age-standardized YLL rate is much higher than the YLD rate at the global level and in various income regions. LICs had the highest age-standardized DALY rate at 692.25 per 100,000 people (95%UI: 605.14 to 785.67) in 2019, followed by Lower MICs, while Upper MICs had the lowest rate. From 1990 to 2019, the age-standardized YLD rate all showed an upward trend in various income regions, while YLL rate decreased in LICs, Upper MICs and demonstrated a minor increase trend in Lower MICs. The age-standardized DALY rate showed a 13.70% reduction in LICs, 2.25% reduction in Upper MICs, whereas increased 3.72% from 660.14 (95%UI: 601.55 to 723.28) in 1990 to 684.72(95%UI: 623.56 to 746.12) in 2019 in Lower MICs. (Table 2).

Table 1
Number of YLDs, YLLs, DALYs of CKD with percent change in specific region, 1990–2019

region	YLDs (in thousands)			YLLs (in thousands)			DALYs (in thousands)	
	1990	2019	% change	1990	2019	% change	1990	2019
Global								
Male	1741.00(1257.88 to 2303.57)	4021.93(2903.65 to 5335.61)	131.01	9459.51(8850.56 to 10238.32)	17958.18(16654.70 to 19565.50)	89.84	11200.51(10402.02 to 12151.42)	21980.11(20395.10 to 23965.10)
Female	2136.55(1543.68 to 2754.34)	4724.57(3429.29 to 6179.89)	121.13	8167.50(7550.21 to 8778.44)	14833.90(13467.77 to 16117.36)	81.62	10304.06(9457.91 to 11216.13)	19558.48(17647.98 to 21467.98)
Both	3877.55(2790.33 to 5063.93)	8746.51(6320.23 to 11508.24)	125.57	17627.02(16596.25 to 18589.76)	32792.08(30450.91 to 35049.54)	86.03	21504.57(20039.12 to 23065.78)	41538.59(38542.86 to 45037.86)
LICs								
Male	64.78(45.86 to 86.48)	183.03(128.83 to 243.54)	182.56	812.62(705.35 to 915.27)	1374.18(1155.57 to 1633.83)	69.11	877.40(771.03 to 981.89)	1557.22(1324.18 to 1816.35)
Female	86.82(62.37 to 114.16)	236.24(170.14 to 308.59)	172.11	725.37(579.46 to 886.26)	1123.96(956.11 to 1317.79)	54.95	812.19(666.47 to 978.52)	1360.20(1164.74 to 1567.74)
Both	151.60(108.49 to 199.48)	419.28(301.72 to 551.00)	176.58	1537.99(1323.56 to 1736.06)	2498.14(2131.37 to 2923.69)	62.43	1689.59(1467.73 to 1895.09)	2917.41(2517.37 to 3337.37)
Lower MICs								
Male	582.07(412.90 to 764.46)	1435.35(1022.53 to 1884.88)	146.59	4102.25(3652.28 to 4877.33)	8296.79(7396.62 to 9441.35)	102.25	4684.32(4232.22 to 5461.27)	9732.14(8724.10 to 10944.03)
Female	679.46(485.04 to 888.82)	1716.13(1227.10 to 2237.84)	152.57	3402.13(2905.25 to 3892.33)	6549.77(5624.24 to 7307.56)	92.52	4081.59(3548.37 to 4611.32)	8265.90(7264.41 to 9217.41)
Both	1261.53(894.56 to 1645.02)	3151.48(2258.15 to 4109.39)	149.81	7504.37(6712.65 to 8256.48)	14846.56(13448.78 to 16241.31)	97.84	8765.91(7935.09 to 9641.47)	17998.04(16488.51 to 19659.97)
Upper MICs								
Male	682.27(491.68 to 914.77)	1586.01(1117.03 to 2119.58)	132.46	3368.40(3075.84 to 3669.85)	5897.67(5272.58 to 6534.90)	75.09	4050.67(3687.01 to 4402.69)	7483.69(6754.16 to 8336.16)
Female	871.74(631.51 to 1141.58)	1884.09(1367.00 to 2491.20)	116.13	2941.26(2679.18 to 3217.92)	4983.55(4468.38 to 5549.00)	69.44	3813.00(3424.11 to 4186.28)	6867.63(6114.74 to 7687.36)
Both	1554.01(1120.48 to 2050.69)	3470.10(2493.95 to 4600.83)	123.30	6309.66(5880.61 to 6755.34)	10881.22(9964.84 to 11836.99)	72.45	7863.67(7212.38 to 8502.03)	14351.32(13068.90 to 15772.42)

Table 2
Age-standardized YLD, YLL and DALY rates of CKD with percent change in specific region, 1990–2019

region	Age-standardized YLD rate per 100 000 persons			Age-standardized YLL rate per 100 000 persons			Age-standardized DALY rate per 100 000 persons		
	1990	2019	% change	1990	2019	% change	1990	2019	% change
Global									
Male	83.06(60.14 to 108.94)	104.03(75.56 to 137.05)	25.25	454.55(426.04 to 488.90)	470.20(435.54 to 510.93)	3.44	537.61(499.52 to 580.01)	574.23(527.52 to 625.27)	6.81
Female	91.65(66.14 to 118.85)	113.13(81.95 to 147.68)	23.44	352.04(328.69 to 377.34)	350.49(318.55 to 380.64)	-0.44	443.69(409.36 to 481.56)	463.61(419.34 to 509.95)	4.49
Both	87.22(63.28 to 113.54)	108.40(78.51 to 142.56)	24.29	397.25(375.73 to 417.52)	406.46(377.87 to 434.14)	2.32	484.46(452.28 to 518.67)	514.86(474.91 to 558.86)	6.27
LMCs									
Male	61.50(44.10 to 80.97)	81.40(58.54 to 108.12)	32.35	834.31(734.05 to 920.96)	701.47(607.71 to 807.96)	-15.92	895.81(795.47 to 989.35)	782.87(682.59 to 899.47)	-12.61
Female	77.61(56.39 to 101.50)	97.51(71.57 to 126.69)	25.65	641.19(540.91 to 773.77)	518.89(450.09 to 600.83)	-19.07	718.80(614.24 to 852.54)	616.40(538.21 to 704.61)	-14.25
Both	69.97(50.87 to 91.78)	89.95(65.58 to 117.75)	28.56	732.18(651.61 to 822.89)	602.30(523.74 to 689.61)	-17.74	802.15(716.50 to 893.68)	692.25(605.14 to 785.67)	-13.70
Lower MICs									
Male	86.95(62.24 to 113.19)	108.85(78.37 to 142.55)	25.20	630.85(565.26 to 744.67)	651.12(579.51 to 739.73)	3.21	717.80(650.34 to 835.60)	759.97(681.95 to 856.46)	5.88
Female	97.80(70.30 to 127.70)	123.26(88.95 to 160.66)	26.04	508.15(441.45 to 572.10)	491.88(423.51 to 548.00)	-3.20	605.95(531.23 to 677.46)	615.15(541.46 to 684.47)	1.52
Both	92.29(66.32 to 120.32)	116.05(83.44 to 151.12)	25.75	567.85(514.72 to 621.02)	568.67(515.93 to 621.51)	0.14	660.14(601.55 to 723.28)	684.72(623.56 to 746.12)	3.72
Upper MICs									
Male	82.65(59.61 to 109.30)	104.87(74.89 to 140.33)	26.89	417.83(381.07 to 456.87)	391.98(351.77 to 433.27)	-6.19	500.48(456.39 to 545.26)	496.86(449.34 to 551.52)	-0.72
Female	95.10(68.56 to 124.85)	116.28(83.74 to 153.68)	22.28	332.04(302.90 to 362.72)	291.19(261.08 to 324.08)	-12.30	427.14(385.04 to 470.83)	407.47(361.69 to 454.97)	-4.61
Both	88.69(64.44 to 116.99)	110.37(79.29 to 146.64)	24.45	369.16(344.16 to 395.66)	337.18(308.47 to 366.80)	-8.66	457.84(419.92 to 494.42)	447.55(405.38 to 493.01)	-2.25

In terms of gender, age-standardized YLD rate was higher in females than in males, whereas age-standardized rates of YLL and DALY of CKD were all higher in males than in females in globally and various income regions, (Table 2). Additionally, there were upward trends in the CKD-related age-specific YLD, YLL and DALY rates in various income regions, which were higher in aged ≥ 70 years (Fig. 1).

Among all 137 LMICs, the highest age-standardized YLD, YLL and DALY rates of CKD in 2019 were seen in Mexico 296.40 per 100 000 people (95% UI: 206.99 to 394.46), Micronesia (Federated States of) 1895.00 per 100 000 people (95% UI: 1313.85 to 2478.01) and Micronesia (Federated States of) 2162.73 per 100 000 people (95% UI: 1584.61 to 2761.55), respectively. Whereas the lowest age-standardized YLD, YLL and DALY rates were seen in Ukraine 56.53 per 100 000 people (95% UI: 39.81 to 75.38), Belarus 69.79 per 100 000 people (95% UI: 55.13 to 89.34) and Belarus 128.92 per 100 000 people (95% UI: 104.56 to 156.45), respectively. From 1990 to 2019, the growth of age-standardized DALY rate varied from – 46.83% in Mongolia to 182.92% in El Salvador. The variations in other CKD burden metrics (YLDs, YLLs and DALYs) by country in 2019 can be found in Fig. 2 and Additional file.

There was much consistency in the PAF of CKD-related age-standardized DALYs for these risk factors in various income regions. In 2019, CKD-related risk factors with the top four PAF were kidney dysfunction, high systolic blood pressure, high fasting plasma glucose and high body-mass index, which all are metabolic risks (Fig. 3). The PAF of CKD-related age-standardized DALYs for risk factors in 2019 at the global level and by LMICs were presented in Table 3.

Table 3
PAF (%) of age-standardized DALYs for CKD risk factors in specific region, 1990–2019

region	1990PAF	2019PAF	Percentage change in PAF, 1990–2019
Global			
High temperature	-0.07(-4.44 to 2.70)	0.53(-1.52 to 2.05)	-903.97(-1125.73 to 1395.84)
Low temperature	4.55(2.60 to 6.43)	3.97(2.15 to 5.60)	-12.71(-25.62 to 1.70)
Lead exposure	3.16(1.90 to 4.63)	2.92(1.70 to 4.33)	-7.60(-13.74 to -3.33)
Diet high in sodium	6.65(2.12 to 13.92)	6.11(1.50 to 13.95)	-8.20(-34.98 to 1.56)
High fasting plasma glucose	29.15(24.92 to 33.18)	30.89(26.49 to 34.95)	5.99(1.48 to 9.25)
High systolic blood pressure	47.48(42.63 to 52.14)	51.36(45.96 to 56.42)	8.17(4.17 to 11.30)
High body-mass index	15.80(8.35 to 25.53)	26.46(16.69 to 37.46)	67.48(42.97 to 105.85)
Kidney dysfunction	100.00	100.00	0.00
LICs			
High temperature	-0.02(-7.62 to 4.55)	0.63(-3.67 to 2.40)	-3026.12(-877.52 to 676.46)
Low temperature	3.71(1.90 to 5.38)	3.24(1.46 to 4.93)	-12.62(-26.55 to 5.47)
Lead exposure	3.66(2.29 to 5.20)	3.73(2.34 to 5.24)	1.73(-6.07 to 8.71)
Diet high in sodium	5.71(0.86 to 15.00)	4.92(0.48 to 14.20)	-13.83(-51.75 to -1.40)
High fasting plasma glucose	28.49(23.32 to 33.25)	29.15(24.25 to 33.42)	2.31(-2.66 to 6.55)
High systolic blood pressure	48.85(43.66 to 54.11)	52.62(47.37 to 57.61)	7.72(0.82 to 11.89)
High body-mass index	10.94(4.62 to 20.08)	18.64(10.40 to 28.84)	70.37(40.14 to 133.32)
Kidney dysfunction	100.00	100.00	0.00
Lower MICs			
High temperature	-0.14(-8.82 to 5.31)	0.90(-2.38 to 3.56)	-729.61(-1321.80 to 1093.38)
Low temperature	2.59(0.50 to 4.49)	2.56(0.23 to 4.52)	-1.32(-50.39 to 36.88)
Lead exposure	4.20(2.79 to 5.79)	3.97(2.60 to 5.50)	-5.35(-11.02 to -0.82)
Diet high in sodium	5.15(0.98 to 12.41)	4.97(0.62 to 12.68)	-3.53(-39.12 to 4.48)
High fasting plasma glucose	30.02(25.17 to 34.53)	32.52(27.66 to 37.00)	8.33(3.62 to 12.33)
High systolic blood pressure	48.13(43.14 to 53.29)	51.82(46.08 to 57.17)	7.66(2.87 to 11.00)
High body-mass index	11.18(5.19 to 19.70)	23.68(14.51 to 34.14)	111.83(66.28 to 196.48)
Kidney dysfunction	100.00	100.00	0.00
Upper MICs			
High temperature	-0.03(-1.47 to 0.82)	0.21(-0.67 to 0.77)	-858.03(-1391.68 to 1289.47)
Low temperature	5.83(3.17 to 8.40)	4.79(2.78 to 6.75)	-17.73(-26.50 to -3.66)
Lead exposure	3.07(1.82 to 4.52)	2.90(1.67 to 4.37)	-5.67(-11.73 to -0.70)
Diet high in sodium	9.49(3.90 to 17.23)	8.74(3.05 to 17.12)	-7.83(-30.95 to 5.14)
High fasting plasma glucose	31.37(27.18 to 35.03)	31.79(27.68 to 35.63)	1.35(-2.72 to 5.80)
High systolic blood pressure	45.87(40.97 to 50.79)	53.64(48.10 to 59.04)	16.94(12.55 to 22.01)
High body-mass index	16.71(8.67 to 27.05)	29.01(18.14 to 41.21)	73.58(48.84 to 113.01)
Kidney dysfunction	100.00	100.00	0.00

From 1990 to 2019, there were upward trends in the PAF contributions of high fasting plasma glucose, high systolic blood pressure, and high body-mass index to age-standardized CKD DALYs in various income regions (Table 3). Notably, the greatest increase in the PAF attributed to high body-mass in various income regions, especially in Lower MICs (111.83% (95% UI: 66.28 to 196.48)), followed by Upper MICs (73.58% (95% UI: 48.84 to 113.01)) and LICs (70.37% (95% UI: 40.14 to 133.32)). In addition, the PAF of age-standardized DALYs for high systolic blood pressure increased significantly in Upper MICs than in LICs and Lower MICs (Fig. 4).

Discussion

Chronic kidney disease (CKD) is a significant global health problem and one of the top 20 causes of death worldwide. It is a serious threat to people's life and health[20, 21]. CKD DALYs is calculated by adding the YLLs and the YLDs, we found that the age-standardized YLL rate is much higher than the YLD rate at the global level and in various income regions, suggesting that premature death is the main cause of CKD burden. The age-standardized YLD rates all showed an upward trend in LICs, Lower MICs and Upper MICs, the age-standardized YLL rates decreased in LICs, Upper MICs and demonstrated a minor increase trend in Lower MICs, suggesting that future CKD treatment strategies should focus on improving the quality of life of CKD patients.

Our results show disparities in CKD burden were also observed in geographical regions and countries. LICs had the highest age-standardized DALY rate, followed by Lower MICs, which may be related to different exposures to risk factors, weak health systems, inadequate health care funding, access to effective health care interventions[22]. These findings call for increased planning and interventions, and developed novel and more appropriate solutions to address the burden of CKD in these areas[23]. The greatest decline in age-standardized DALY rates of CKD were all seen in LICs. This may be related to the improvement of medical technology and effective health care reform. However, the age-standardized DALY rate showed an upward trend in Lower MICs in 2019. If these trends continue, the disparities that exist in CKD burden between Lower MICs and LICs and Upper MICs will be further increased.

Furthermore, our results showed that The CKD burden showed homogeneity by gender among global and LMICs: age-standardized YLD rate was higher in females than in males, whereas age-standardized rates of YLL and DALY of CKD were all higher in males than in females. The disease burden of CKD is mainly due to premature death in males and disability in females. This difference may be related to physiological differences, estrogen levels and lifestyle between males and females[24]. This gender difference should also be taken into account by policy makers when planning future strategies and implementing preventive and control measures. Additionally, there were upward trends in the CKD-related age-specific YLD, YLL and DALY rates in various income regions, which were higher in aged ≥ 70 years, speculated this change is largely related to the aging population and the increase of the elderly population. More attention should be paid to the elderly in the prevention and treatment of CKD.

In 2019, except for age and other non-modifiable risk factors, kidney dysfunction, high systolic blood pressure, high fasting plasma glucose, and high body-mass index remained the major causes attributable age-standardized CKD DALYs in LMICs. Unfortunately, there was no remarkable decline in PAF of them since 1990. This may be related to the increased incidence and prevalence of hypertension, dyslipidemia, overweight and obesity and sedentary lifestyle in the population over the past 30 years[25]. Therefore, more efforts are needed to create healthy lifestyles. Moreover, there were upward trends in the PAF of DALYs contributions of high systolic blood pressure, high fasting plasma glucose, and high body-mass in LMICs from 1990 to 2019. Perhaps most concerning are high body mass index, especially in Lower MICs, so it is imperative that effective measures be taken to curb the rise of obesity. There is clear evidence that interventions to manage hypertension and promote weight loss are associated with reduced risks of developing CKD and better outcomes among those living with CKD[26–28]. Therefore, it is important to develop relevant strategies and targeted measures to prevent and manage hypertension, diabetes, and obesity.

Limitations

Our study has several limitations. First, since data for this study is part of GBD 2019 study, all limitations of the GBD 2019 methods outlined elsewhere also apply here[7, 8]. In the estimation of YLDs, the disability weight is derived from statistical data of multiple countries around the world, which is uncertainty in the estimation of disease in LMICs. In addition, a comprehensive assessment of the burden of disease should also include the economic, family and social aspects of the burden, so a multi-dimensional analysis can be considered to improve the accuracy of the results[29].

Conclusions

This study has evaluated the burden of CKD and its risk-attributable burden in 137 LMICs from 1990 to 2019. CKD burden remains high in various income regions, especially in MICs and Lower MICs. More effective and targeted preventive policies and interventions aimed at mitigating preventable CKD burden and addressing risk factors are urgently needed, particularly in geographies with high or increasing burden.

Abbreviations

- GBD**
Global Burden of Disease
- CKD**
Chronic kidney disease
- LMICs**
Low - and middle-income countries
- MICs**
Low-income countries
- Lower MICs**
Lower-middle income countries
- Upper MICs**
Upper-middle income countries
- YLD**
Years lived with disability
- YLL**
Years of life lost
- DALY**

Disability-adjusted life-years
PAF
Population-attributable fraction
UI
Uncertainty interval

Declarations

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Availability of data and materials

Data for this study were obtained from the GBD 2019 study. This study adherence to the Guidelines for Accurate and Transparent Health Estimates Reporting (GATHER) recommendations. All data used in this study were obtained from the Institute for Health Metrics and Evaluation (IHME) website(<http://ghdx.healthdata.org/gbd-results-tool>)[15]. And the public access to the database is open.

Competing interests

None of the authors have any conflicts of interests to declare.

Funding

This study was supported by the National Natural Science Foundation of China (81872721); National Key R&D Program of China (2017YFC1310902). The funding body of this research had no role in the design of the study and collection, analysis, and interpretation of data and in writing the manuscript.

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Authors' contributions

CK, SL and CW conceived the study. CK, JL and ML analyzed and interpreted data on the disease burden of CKD. CK, JL and ML wrote the paper. SL and CW guided the writing of the paper. All authors read and approved the final manuscript.

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Acknowledgements

The authors would like to thank all members of the Institute for Health Metrics and Evaluation (IHME), and all collaborators involved in GBD 2019 study.

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Figures

Figure 1

Age-specific numbers and rates of YLDs (A) YLLs (B) and DALYs (C) of CKD , 2019

Figure 2

Age-standardized YLD (A), YLL (B) and DALY (C) rates of CKD across 137 low-and middle-income countries, 2019.

Figure 3

Figure 4

Percentage change (%) in PAF contributions of major risk factors of CKD in specific region, 1990-2019

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