

# Chronic Kidney Disease and the Global Public Health Agenda: An International Consensus

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42

43 **Abstract**

44 Early detection is a key strategy to prevent kidney disease, its progression, and related  
45 complications, but numerous studies show that awareness of kidney disease at the  
46 population level is low. Therefore, increasing knowledge and implementing sustainable  
47 solutions for early detection of kidney disease are public health priorities. Economic and  
48 epidemiological data underscore why kidney disease should be placed on the global public  
49 health agenda — kidney disease prevalence is increasing worldwide, and it is now the 7<sup>th</sup>  
50 leading risk factor for mortality worldwide. Moreover, demographic trends, the obesity  
51 epidemic and the sequelae of climate change are all likely to increase kidney disease  
52 prevalence further, with serious implications for survival, quality-of-life, and healthcare  
53 spending worldwide. Importantly, the burden of kidney disease is highest among historically  
54 disadvantaged populations that often have limited access to optimal kidney disease  
55 therapies, greatly contributing to current socioeconomic disparities in health outcomes. This  
56 joint statement from the International Society of Nephrology (ISN), European Renal  
57 Association (ERA), and American Society of Nephrology (ASN), supported by three other  
58 regional nephrology societies, advocates for the inclusion of kidney disease in the current  
59 World Health Organisation (WHO) statement on major NCD drivers of premature mortality.

60

## 61 [H1] INTRODUCTION

62 In 2015, United Nations member states agreed on the ambitious Sustainable Development  
63 Goals (SDGs), with the aim to end poverty and inequality, protect the planet and ensure that  
64 all people enjoy health, justice and prosperity. An important health-related target is the  
65 reduction of non-communicable disease (NCD)-related mortality by one-third by 2030.<sup>1</sup> The  
66 World Health Organization (WHO) has listed heart disease, stroke, cancer, diabetes and  
67 chronic lung disease as the five major NCDs driving premature death and disability.<sup>2</sup> Notably  
68 absent from this list is kidney disease, either acute kidney injury (AKI) or chronic kidney  
69 disease (CKD); of note, AKI increases the risk of CKD and vice versa.<sup>3-6</sup> Additionally, kidney  
70 disease commonly occurs with and enhances the risks of major NCDs such as ischaemic  
71 heart disease, stroke and peripheral vascular disease, diabetes and cancer.<sup>7,8</sup>

72  
73 Approximately 850 million people worldwide are estimated to have kidney disease, most of  
74 whom live in low-income and lower-middle-income countries (LICs and LMICs), and a large  
75 proportion of these individuals lack access to kidney disease diagnosis, prevention or  
76 treatment.<sup>9</sup> As many as 9 out of 10 individuals with CKD in resource-poor settings with  
77 weak primary care infrastructure are unaware that they have this condition and therefore  
78 do not seek treatment.<sup>10-12</sup> Ageing populations and population growth will translate to large  
79 increases in the prevalence of CKD in LICs and LMICs in the coming decades. In contrast to  
80 cardiovascular disease, stroke, and respiratory disease, CKD mortality has been rising.  
81 Currently, kidney disease is the third fastest-growing cause of death globally and the only  
82 NCD to exhibit a continued rise in age-adjusted mortality.<sup>13</sup> By 2040, CKD is projected to be  
83 the 5th highest cause of years of life lost (YLL) globally.<sup>14</sup>

84  
85 Population growth, ageing and the increasing burden of diabetes, heart disease, and  
86 hypertension are the best-recognised drivers of CKD incidence, especially in regions with  
87 advanced economies. As many as 1 in 3 people with diabetes and 1 in 5 with hypertension  
88 in high-income countries (HICs) have CKD, which has led to the suggestion that focusing on  
89 the control of diabetes and cardiovascular disease will alleviate the growing burden of  
90 CKD.<sup>15</sup> This assumption is based on the premise that screening for CKD is part of the  
91 standard of care for these conditions and that no special interventions are required in those

92 with kidney diseases. However, CKD and AKI have diverse causes, mediators and risk factors  
93 beyond diabetes and cardiovascular disease (Figure 1), especially in LICs and LMICs, which  
94 account for two-thirds of the global burden of kidney disease.<sup>16</sup> For example, dehydration  
95 and infections are leading causes of AKI in LICs and LMICs.<sup>17</sup> Finally, the latest research  
96 shows that CKD and AKI require unique treatments and are not merely risk enhancers when  
97 they accompany other major NCDs.

98  
99 In this Consensus Statement, we discuss the unique environmental, social and medical  
100 drivers of kidney diseases, highlighting how tackling diabetes and heart disease alone will  
101 not target the core drivers of a large proportion of kidney diseases. We also discuss how  
102 such an approach worsens global inequities in access to the best attainable standards of  
103 health and hinders progress towards targets identified in the SDGs, making the absence of  
104 kidney disease from the global NCD health agenda morally indefensible and a substantial  
105 challenge to tackling the growing kidney disease burden.

## 106 107 **[H1] METHODS**

108 The International Society of Nephrology (ISN), European Renal Association (ERA) and the  
109 American Society of Nephrology (ASN) convened a diverse core group of 19 experts  
110 representing high and low-income countries in the Americas, Africa, Europe and Asia-Pacific,  
111 across adult and paediatric nephrology. Over several meetings, the authorship team  
112 discussed current and future challenges, as well as strategies for increasing global  
113 awareness of CKD and decreasing its global impact, to develop this Consensus Statement  
114 and recommendations. The manuscript was reviewed by various regional representative  
115 bodies (ISN Regional Boards), and consensus was attained. The ISN has established a  
116 Regional Board in each of its 10 regions — Africa, Eastern and Central Europe, Latin America  
117 and the Caribbean, Middle East, New Independent States and Russia, North America and the  
118 Caribbean, North and East Asia, Oceania and Southeast Asia, South Asia and Western  
119 Europe. The Regional Boards have representation from all affiliated societies within the  
120 region and are a major link between the ISN and National Societies of Nephrology.

122 Endorsement was also provided by other major global and regional societies, namely the  
123 Asian Pacific Society of Nephrology (APSN), African Association of Nephrology (AFRAN),  
124 Latin American Society of Nephrology and Hypertension (SLANH) and the World Heart  
125 Federation (WHF).

## 126 **[H1] KIDNEY DISEASE IS A GROWING GLOBAL PROBLEM**

127 Kidney disease is an increasing global problem that disproportionately affects poor,  
128 vulnerable and marginalised populations, and is associated with high individual, healthcare,  
129 and social costs. Approximately 700 million people are estimated to have CKD worldwide. To  
130 this must be added the global burden of AKI and kidney failure (including those receiving  
131 dialysis and kidney transplant recipients), increasing the global prevalence of kidney disease  
132 to around 850 million<sup>7,9</sup>, which translates to a global prevalence > 10%. Of note, this  
133 prevalence is probably an underestimate owing to the lack of early kidney disease detection  
134 and screening programs in many parts of the world, which results in large-scale  
135 unawareness of the burden and prevalence of earlier stages of CKD.<sup>11</sup>

136  
137 AKI affects 7–18% of hospitalized patients and 20–200 per million individuals annually in the  
138 community.<sup>18</sup> AKI is most common in LICs and LMICs, where 75% of cases are community-  
139 acquired owing to infections, toxins (for example, from animal bites, herbs and medications)  
140 and pregnancy complications.<sup>19,20</sup> According to a systematic review, an estimated 13.3  
141 million cases of AKI are recorded worldwide every year, with LICs and LMICs countries  
142 contributing 11.3 million.<sup>21</sup> Of the 1.7 million deaths per year from AKI globally, an  
143 estimated 1.4 million occur in LICs and LMICs.<sup>18</sup>

144  
145 Furthermore, the burden of kidney disease is rising worldwide. According to the Global  
146 Burden of Disease (GBD) study, the global prevalence of CKD increased by 33% between  
147 1990 and 2017<sup>7</sup>. Crucially, the greatest growth in the burden of CKD (prevalence and  
148 mortality) is concentrated outside of HICs, with almost one-third of all patients with CKD  
149 living in India and China alone.<sup>7</sup> Beyond population dynamics, numerous other social,  
150 environmental and economic threats increase the global risk of kidney disease. (Figure 1)

151

152 Given its increasing prevalence, if CKD remains largely undetected and is consequently not  
153 treated, the numbers of people developing kidney failure and requiring expensive kidney  
154 replacement therapy (KRT) will naturally increase. In 2010, ~2.6 million people received KRT,  
155 and this number is estimated to increase to 5.4 million by 2030.<sup>22</sup> Even in HICs, 15–20% of  
156 patients die within 12 months of starting dialysis.<sup>23</sup> Millions more develop kidney failure  
157 and require KRT but lack access to therapy and die prematurely.<sup>24,25</sup> Almost all of these  
158 people live in LICs and LMICs, which have only 7% of the global KRT population despite  
159 comprising 48% of the world population.<sup>24</sup> AKI and progressive CKD are also associated with  
160 high mortality even before the development of kidney failure, primarily owing to an  
161 increased risk of other major co-morbidities.<sup>7,18</sup> A greater number of people die of  
162 cardiovascular disease directly attributable to reduced kidney function than of kidney  
163 failure-related deaths<sup>26</sup>, with the GBD study attributing ~3.1 million deaths in 2019 to  
164 kidney dysfunction.

## 166 **[H2] Population dynamics will increase the burden of kidney disease**

167 Population dynamics are increasing the numbers of people at high risk of kidney disease but  
168 with limited access to kidney care. This effect is driven both by population growth and an  
169 ageing population. Population growth is booming in LICs and LMICs (especially in Africa and  
170 India) — Central and Southern Asia, Eastern and South-Eastern Asia, and sub-Saharan Africa  
171 are expected to hold 70% of the world's population by 2030.<sup>27,28</sup> The age-standardized rate  
172 of CKD has already increased by 3–5% between 1990 and 2017 in countries in the lowest  
173 three sociodemographic index quintiles.<sup>7</sup> The highest growth in the number of people  
174 requiring KRT is projected for Africa, where 23 of the 28 poorest countries in the world are  
175 located.<sup>22</sup> Policies aimed at decreasing the burden of other NCDs that do not target CKD in  
176 these countries will generate an additional CKD burden. The reasons for the increased risk  
177 of CKD in LICs and LMICs are explored further below.

178  
179 An ageing population faces an inherently increased risk of kidney disease. Current  
180 predictions estimate that by 2035, 1.1 billion people will be over 65 years of age, an increase  
181 of 60% from 2020<sup>27</sup>, with the largest number of older individuals expected to be in China  
182 and India. The controversies with regard to age-adjusted definition of CKD notwithstanding,

183 the rising prevalence of CKD translates to an increased risk of adverse outcomes in  
184 individuals in all age groups.<sup>29-31</sup> The loss of kidney reserve with ageing also exacerbates the  
185 bidirectional interplay between AKI and progressive CKD risk.<sup>32</sup> Moreover, CKD is associated  
186 with inflammation and accelerated whole-body ageing, particularly of the cardiovascular  
187 system, thereby increasing the burden of ageing-associated health decline even in younger  
188 patients.<sup>33 22</sup>

189

## 190 **[H2] Environmental and social threats to kidney health continue to rise**

191 The burden of CKD risk factors that traditionally drive disease in HICs, such as diabetes,  
192 hypertension and obesity, is growing most rapidly in LICs and LMICs. Moreover, LICs and  
193 LMICs face a constellation of additional risks that translate to a greater kidney disease  
194 burden than that seen in HICs.<sup>16</sup> Risks related to environmental change, including global  
195 warming, environmental toxins, air pollution and declining biodiversity are global. However,  
196 the lack of capacity and resources for mitigation and adaptation makes LIC and LMIC  
197 populations particularly vulnerable to such risks. These populations also continue to have  
198 high rates of infectious diseases, many of which affect the kidneys.<sup>19,34,35</sup> The lack of  
199 resources in these countries means that the contribution of local CKD risk factors is not as  
200 well-studied as those related to diabetes or cardiovascular disease that were first  
201 recognised in HICs, which leads to their continued under-recognition. Superimposed on this  
202 background, limited public health architecture and high poverty levels create life-course  
203 threats to kidney health, with a particular impact on pregnancy and childhood.

204

205 Fragile and underfunded health systems struggle to cope with the burden of kidney disease,  
206 leading to high and increasing mortality. Regional variations in the distribution of risk factors  
207 and the ability to implement adaptation measures mean that, in some places, CKD is an  
208 even bigger threat than that observed at a global level. For example, in Central America,  
209 CKD is the second most common cause of death.<sup>7</sup> Even in HICs, social determinants of  
210 health and factors such as gender, race or ethnicity influence the risk of kidney disease and  
211 underscore many health outcome disparities.<sup>36-39</sup> Race, for example, is increasingly  
212 recognized as a social construct, highlighting that its impact on kidney health is potentially  
213 modifiable.<sup>40</sup>



214

215 Environmental factors and climate instability contribute to the increased risk of kidney  
216 disease globally.<sup>41</sup> The GBD team estimated that in 2019, as many as 8% of deaths due to  
217 CKD were attributable to non-optimal (high or low) ambient temperatures.<sup>42</sup> For example,  
218 persistent exposure to high temperatures, particularly for agricultural and outdoor workers  
219 in LICs and LMICs who lack access to adaptation interventions, increase heat stress, which  
220 exacerbates the risk of kidney disease<sup>43-46</sup>. Heat stress is a potential contributor to CKD of  
221 unknown cause (CKDu) in agricultural communities, which is increasingly recognized as a  
222 major global cause of CKD. This condition is characterized by the presence of a benign  
223 urinary sediment and tubulointerstitial changes on biopsy.<sup>47</sup> Proposed mechanisms include  
224 recurrent heat stress with repeated episodes of AKI and exposure to environmental toxins,  
225 including pesticides and heavy metals.<sup>48-51</sup> Also known as CKD of non-traditional cause (CKD-  
226 NT), chronic interstitial nephritis in agricultural communities (CINAC), Mesoamerican  
227 nephropathy and Uddanam Nephropathy, CKDu has been seen largely in the Global South,  
228 including India, Sri Lanka, parts of Africa and Central and South America.<sup>49,51,52</sup> One study of  
229 people with CKDu in India found worsening of metabolic acidosis and hypertension in  
230 Summer compared with Winter, supporting the hypothesis that a warming planet also  
231 threatens kidney health.<sup>50</sup> Increasing salinity of drinking water in coastal areas of  
232 Bangladesh affected by rising sea levels has also been linked to increased rates of  
233 preeclampsia and gestational hypertension, in addition to hypertension and albuminuria in  
234 the general population, all of which are risk factors for subsequent kidney disease.<sup>53-55</sup>  
235 Furthermore, large population studies suggest rises in fine particulate matter in the air are  
236 associated with an increased risk of AKI, as well as CKD prevalence and progression.<sup>56-58</sup>

237

238 Climate change will also affect water availability. Since 2000, the global frequency and  
239 duration of drought have increased by nearly 30%.<sup>59</sup> In the context of profound drought,  
240 current haemodialysis options are not environmentally sustainable, as the average  
241 haemodialysis treatment uses >500 litres of water.<sup>60</sup> Emergencies such as extreme climate  
242 events (drought, snowstorms, floods and fires), natural disasters such as the earthquakes in  
243 Turkey and Syria, and floods in Pakistan, and man-made disasters like wars and conflicts all  
244 impact the ability of patients with kidney disease to access and receive lifesaving treatment

245 such as haemodialysis or kidney transplantation, thereby endangering lives.<sup>61-63</sup> Notably,  
246 extreme events can also directly cause kidney injury, such as mass rhabdomyolysis from  
247 crush injuries caused by earthquakes.<sup>64</sup>

248

249 Threats to kidney health vary across the lifespan. In low-resource and underprivileged  
250 settings, maternal factors such as malnutrition, poor health literacy and comorbidity burden  
251 contribute to an adverse uterine environment.<sup>65</sup> Mothers in low-resource settings are more  
252 likely to give birth to children who are small for gestational age (SGA), have low birth weight  
253 (LBW) and or are born prematurely than those in high-resource settings.<sup>66</sup> Importantly,  
254 numerous large population studies show that SGA, LBW and prematurity increase the risk  
255 for the infant developing proteinuria, hypertension, CKD and kidney failure in later life.<sup>67-73</sup>  
256 This risk seems to be mediated through multiple mechanisms, with low nephron  
257 endowment owing to suboptimal growth in utero increasing susceptibility to kidney injury  
258 later in life.<sup>74</sup> Poor maternal nutrition, which despite improvements remains substantially  
259 prevalent in large parts of the world, also increases the risk of gestational diabetes and  
260 hypertension, both of which are known risk factors for CKD.<sup>65</sup> Poor infant and childhood  
261 nutrition, as well as childhood AKI events related to infections, superimpose additional  
262 layers of risk to kidney health across the lifespan.<sup>65</sup>

263

264 Although kidney diseases are commonly grouped with other NCDs, infections are also  
265 important causes of AKI in LICs and LMICs, either through direct kidney involvement (for  
266 example in cases of leptospirosis or HIV infection) or indirectly through haemodynamic  
267 mechanisms, systemic inflammatory responses or infection-related glomerulonephritis.  
268 <sup>19,35,75</sup> The adverse kidney effects of infections in LICs and LMICs are exacerbated by  
269 decreased access to specialized care, especially in areas endemic for diseases such as  
270 malaria, leptospirosis, scrub typhus, hemorrhagic fevers, or dengue, and for children or  
271 adults with severe gastrointestinal fluid loss.<sup>76,77</sup> AKI is associated with increased morbidity  
272 and mortality and affects all age groups, from neonates to older individuals. Continued high  
273 mortality due to childhood AKI in the absence of dialysis prompted the ISN to introduce the

274 Saving Young Lives Program in collaboration with the International Society of Peritoneal  
275 Dialysis (ISPD), European Peritoneal Dialysis (EuroPD), and the International Pediatric  
276 Nephrology Association (IPNA) to promote peritoneal dialysis in Africa, later expanded to  
277 Asia and Latin America <sup>78</sup> However, this program is just scratching the surface with regard to  
278 addressing the KRT needs of people with AKI in these regions.

279

280 Climate change and loss of global biodiversity are also increasing the risk of infectious  
281 diseases that predispose to AKI and CKD outside of current tropical areas as the climate  
282 becomes more conducive to the survival of parasites (for example, those causing malaria or  
283 schistosomiasis) and/or their vectors (for example, mosquitoes or ticks).<sup>41</sup> Of note, although  
284 the association between certain infections and AKI is well known, the role of infections in  
285 the development and/or progression of CKD is not well studied. However, emerging data  
286 suggest that leptospirosis might contribute to the development of CKDu or increase  
287 susceptibility to triggers such as heat stress.<sup>79-81</sup>

288

289 Globally, multifactorial social determinants of health influence kidney health profoundly.  
290 Indigenous populations, people living in rural areas, migrants, older individuals or those  
291 affected by poverty, homelessness and food insecurity are more likely to be affected by  
292 kidney disease and develop its worst manifestations <sup>36-38,82,83</sup>. For example, underprivileged  
293 people with CKD are more likely to experience rapid progression of disease.<sup>84</sup> Importantly,  
294 progressive CKD can also exacerbate poverty (see later discussion). Sex and gender also  
295 influence the causes of CKD, the profile of comorbidities and disease evolution over time.<sup>39</sup>  
296 These differences are probably driven by complex biological, social and system-level factors.  
297 For example, women are 29% more likely to have CKD than men, but men are more likely to  
298 die from CKD than women.<sup>7,85</sup> Notably, despite the increased competing risk of death, men  
299 are 47% more likely than women to access dialysis or to have a kidney transplant.<sup>7</sup> In older  
300 general population cohorts, women had a lower baseline glomerular filtration rate (GFR),  
301 although men had a steeper rate of GFR decline over time.<sup>86,87</sup> This complex interplay of  
302 age, and sex or gender needs to be better understood to allow the development of  
303 appropriate health system-level responses.

304

## 305 [H2] Lack of health system response to kidney disease and global health

306 Despite being the third fastest-growing cause of death,<sup>13</sup> kidney disease has not received  
307 the attention it deserves from governments, multilateral organizations such as the WHO,  
308 the lay press, or health systems. Failure to diagnose CKD rests on the silent nature of the  
309 disease, lack of awareness of the devastating consequences of opportunities missed owing  
310 to lack of timely detection (including through coordinated screening programs), referral to  
311 nephrologists, and management. Even when treatment is sought, the quality of care might  
312 be poor. Information asymmetry is evident in the lay press for kidney disease. In an analysis  
313 of US newspapers, kidney disease was 11-fold underrepresented in the media as a discussed  
314 versus actual cause of death.<sup>88</sup> Diagnosis is further hampered by the limited availability or  
315 lack of tests needed to assess kidney function in many LICs or LMICs.<sup>89</sup>

316  
317 Globally, health systems and governments have failed to create robust systems for  
318 generating data on the burden of kidney disease and its drivers. Data registries are vital for  
319 understanding disease epidemiology, tracking progress and developing cost-effective  
320 intervention targets. Kidney disease registries are sparse in LICs and LMICs, which is where  
321 they are most needed.<sup>90</sup> A 2022 review of dialysis registries found none in large Asian  
322 countries.<sup>91</sup> The AFRAN registry has been established in Africa, but so far only involves seven  
323 countries (Botswana, Burundi, Ghana, Kenya, Nigeria, South Africa and Zambia.)<sup>92</sup> Latin  
324 America is served by the Latin America Dialysis and Transplant Registry.<sup>93</sup> Of note, CKD  
325 registries are rare in both HICs and LICs.

326  
327 Data from the 2023 Global Kidney Health Atlas revealed that the availability of national  
328 strategies to address CKD correlates positively with income level — LIC 11%, LMIC 23%,  
329 UMIC 22% and HIC 33%.<sup>94</sup> Despite the immense healthcare costs, only 48% of national  
330 governments recognise CKD and/or its treatment and prevention as a health priority.<sup>94</sup> In  
331 2016, 50% of countries had no national health system oversight of kidney care.<sup>95</sup> Even in  
332 HICs, coordinated multi-agency approaches are lacking.<sup>96</sup> For example, the 2022–2027  
333 European Commission “Healthier Together – European Union Non-Communicable Diseases  
334 Initiative” does not address CKD.<sup>97 98</sup>

336 **[H2] Targeting current WHO major NCDs will not solve the growing global kidney disease**  
337 **problem**

338 CKD is often caused by pre-existing major NCDs that have been acknowledged by the WHO  
339 as priority conditions, such as diabetes, or by risk factors common to heart disease and  
340 stroke, such as hypertension. The WHO further reports that one-third of kidney mortality is  
341 caused by diabetic kidney disease.<sup>99</sup> However, glomerulonephritis, infection, malnutrition,  
342 environmental stressors and other toxins, pollution, climate change and obstetric  
343 catastrophes are all major causes of AKI and CKD, which are not addressed in the current list  
344 of major NCDs. CKD due to causes other than diabetes and hypertension already accounts  
345 for the highest global age-standardised rate of disability-adjusted life years (DALYs)<sup>7</sup>.  
346 Crucially, a common cause of kidney failure, even in HICs, is ‘kidney failure where the cause  
347 cannot be ascertained’. In a recent report of the European Renal Association, the cause of  
348 kidney failure was unknown in 28% of participants.<sup>100</sup> This finding emphasizes the need for  
349 research that can advance understanding of underlying causes of kidney disease and enable  
350 the development of cause-specific therapies. Failing to address kidney disease risk factors  
351 and mediators will fail to curb its devastating health, economic and psychosocial  
352 consequences.

354 **[H1] KIDNEY DISEASES HAVE MULTIPLE ADVERSE CONSEQUENCES**

355 Kidney disease causes premature mortality, disability, reduced quality of life and other  
356 psychosocial harms, and incurs high costs to governments, healthcare systems, and patients  
357 and their families. (Box 1) The burden of this harm disproportionately affects those living in  
358 LICs and LMICs. Progressive CKD is a systemic disease and contributes to the evolution and  
359 progression of other major NCDs, most notably cardiovascular disease.<sup>101</sup>

361 **[H2] Kidney disease carries high morbidity and mortality**

362 The overall global age-standardised DALY rate declined sharply from 1990 to 2019.<sup>102</sup> In  
363 particular, the age-standardised DALY rate for WHO-recognised major NCDs such as  
364 ischaemic heart disease and stroke decreased by 28% and 35%, respectively.<sup>102</sup> By contrast,  
365 the age-standardised DALY rate for CKD increased by 6% (with an absolute increase of 62%)

366 over the last 30 years, causing CKD to rise from the 29<sup>th</sup> to the 18<sup>th</sup> leading cause of global  
367 disability.<sup>102,103</sup> In 2017 alone, CKD resulted in 36 million DALYs.<sup>7</sup> Nearly 75% of DALYs  
368 occurred in countries within the lowest three sociodemographic index quintiles.<sup>7</sup> Current  
369 population demographic trajectories and the increase in kidney disease risk factors mean  
370 that, without urgent action, CKD will continue to rise through the league table of global  
371 causes of death and disability.

372

373 The symptom burden of CKD is profound, and patients with kidney failure experience a  
374 similar or greater symptom burden (including fatigue, itch and pain) than those with  
375 terminal malignancies.<sup>104</sup> Kidney disease has multiple adverse psychosocial consequences,  
376 including reduced quality of life, poor life participation and mental illness. A 2022 meta-  
377 analysis of nearly 200,000 patients demonstrated that CKD reduced quality of life, especially  
378 for those on dialysis, for whom the pooled 36-item Short Form Health Survey (SF-36)  
379 physical component summary score was 36 out of 100.<sup>105</sup> Even among patients who were  
380 not on KRT (that is, dialysis or transplantation), many reported high symptom burden. At  
381 least 45% reported fatigue, poor mobility, bone and/or joint pain, drowsiness, insomnia  
382 and/or poor sleep, anxiety, pain, sexual dysfunction, muscle cramps, gastrointestinal  
383 distress, dyspnoea, itching, heartburn or oedema.<sup>105</sup> Children with CKD also have worse  
384 quality of life reported than those with type 1 diabetes or survivors of childhood cancer.<sup>106</sup>  
385 In older individuals, who typically have lower access to KRT than the younger adults, quality  
386 of life decreases and symptom burden increases for years before starting KRT and, in those  
387 starting KRT, symptom burden might stabilize but does not improve.<sup>107-109</sup> Of note, in  
388 advanced CKD, quality of life is worse in women than in men.<sup>107</sup> Moreover, having a person  
389 with CKD in the family adversely impacts the mental health of caregivers, 30–50% of whom  
390 report symptoms of anxiety or depression.<sup>110-113</sup>

391

392 The burden from kidney disease naturally extends to mortality. The global mortality from all  
393 kidney diseases likely ranges between 5–11 million per year<sup>114</sup> and kidney dysfunction is  
394 currently the 7<sup>th</sup> leading risk factor for death.<sup>99</sup> AKI contributes to an estimated additional  
395 1.7 million deaths per year.<sup>21</sup> Deaths due to kidney disease increased by 50% from 2000 to  
396 2019, and even mild CKD increases the risk of morbidity and mortality.<sup>115,116</sup> In 2019, CKD in

397 LICs led to ~600 YLL per age-standardised 100,000 population and around ~560 YLL per  
398 100,000 in LMICs, compared with 200 YLL per 100,000 in HICs.<sup>102</sup> Increasing prevalence and  
399 the relatively young age at death mean that overall deaths and YLL due to kidney disease  
400 are predicted to escalate dramatically at a global level (Figure 2 and 3). In 2040, kidney  
401 disease is predicted to cause 52 million YLL, moving from the 16<sup>th</sup> most common cause of  
402 YLL (in 2016) to the 5<sup>th</sup>, surpassing other major NCD drivers of early mortality listed by the  
403 WHO such as diabetes (Figure 3).<sup>14</sup> In 2040, CKD is expected to account for 5% of YLL .<sup>14</sup>  
404 (Figure 4) <sup>18</sup>

405

406 CKD also increases the risk of developing severe acute and chronic infections (such as  
407 COVID-19 and tuberculosis), which are major causes of death in LICs and LMICs. <sup>117,118</sup>

408 Hence, decreasing the incidence and severity of CKD will have beneficial effects on other  
409 NCDs and communicable diseases.

410

## 411 **[H2] Kidney disease increases the risk of other major NCDs**

412 Beyond the directly attributable toll of kidney disease, CKD contributes to and exacerbates  
413 other major NCDs. Uraemic toxins and systemic inflammation have profound effects on  
414 other organ systems, and extensive kidney–heart, kidney–brain, and kidney–lung  
415 interactions underscore the high co-morbidity burden of CKD.<sup>119-121</sup> In 2017, the GBD study  
416 estimated that 1.4 million cardiovascular disease-related deaths and 25 million  
417 cardiovascular DALYs were lost owing to kidney disease. <sup>7</sup> Accordingly, the 2021 European  
418 Society of Cardiology cardiovascular disease prevention guidelines suggest screening people  
419 with CKD for atherosclerotic cardiovascular disease <sup>122</sup>. These guidelines also advocate for  
420 albuminuria screening in those with high cholesterol or diabetes, acknowledging the  
421 importance of CKD as risk factor for cardiovascular disease.<sup>123</sup> Recognition of the role of CKD  
422 in increasing the risk of other major NCDs is essential to reducing overall NCD burden.

423

## 424 **[H2] Kidney disease imposes unacceptably high costs on economies, healthcare systems 425 and individuals**

426 The direct healthcare costs of kidney disease are relevant at the global, country, health  
427 system and individual levels. Patients with CKD are complex to manage and account for a  
428 disproportionately large amount of national economic expenditure.

429

430 Most countries use a mix of public and private funding to provide kidney care. In 2016, only  
431 19% of countries had completely publicly funded kidney care.<sup>95</sup> In the USA, kidney failure  
432 qualifies adults for Medicare benefits regardless of age. Of note, although <1% of Medicare  
433 beneficiaries have kidney failure, expenditures for kidney failure accounted for over 6% of  
434 Medicare spending in 2020, exceeding \$50 billion.<sup>23</sup> US federal costs for people with CKD  
435 are > \$85.4 billion annually, representing 23.5% of Medicare fee-for-service spending.<sup>23</sup>  
436 Similarly, in the UK, half of the National Health Service (NHS) budget spent on CKD care  
437 went to those with kidney failure, who comprise only 2% of patients with CKD stage 3–5.<sup>124</sup>  
438 In a range of other HICs and MICs, 2–4% of the healthcare budget is spent on the 0.1–0.2%  
439 of the population with kidney failure.<sup>125,126</sup> Moreover, the costs of CKD care are rising given  
440 the increased prevalence of CKD and the complexity of patients with CKD. Inflation-adjusted  
441 spending in the USA on people with kidney failure in 2021 had increased 20% over the  
442 preceding decade.<sup>23</sup> Notably, US expenditure on people with CKD rose faster than that for  
443 the general population or even patients with diabetes or heart failure.<sup>23</sup> A large Canadian  
444 general population study also found that patients with kidney disease had the highest  
445 comorbidity burden, number of medications, death rate and need for placement in long-  
446 term care facilities.<sup>127</sup> In Europe, aggregated annual healthcare costs of CKD are estimated  
447 to be higher than those of cancer or diabetes mellitus.<sup>128</sup> The average length of hospital stay  
448 in the UK is 35% longer for people with CKD compared to people without CKD.<sup>124</sup> Higher  
449 healthcare costs are also incurred from the increased rates of diseases such as  
450 cardiovascular disease in people with CKD. In the UK in 2010, a cost of £174 million was  
451 incurred from excess stroke and myocardial infarction in people with CKD.<sup>124</sup>

452

453 Health systems in LICs and LMICs will need increased funding to manage the rising burden of  
454 kidney disease. The prohibitive cost of dialysis likely explains the nearly 30-fold difference in  
455 the reported rates of kidney failure treated with dialysis between the country with highest  
456 rate (Taiwan) and the lowest (Bangladesh).<sup>125</sup> In 2016, 40% of LIC and 22% of LMIC reported



457 poor to extremely poor healthcare infrastructure for CKD care.<sup>95</sup> In Africa, where AKI is more  
458 common than in the rest of the world, 50% of countries reported poor to extremely poor  
459 AKI care infrastructure.<sup>95</sup> The negative impact of this lack of infrastructure is exacerbated by  
460 poor population coverage by nephrologists (0.2 nephrologists per million population in LICs,  
461 compared with 23 per million in HICs).<sup>129</sup> For children, the situation is even more dire. In the  
462 2018 Global Health Kidney Atlas, nearly 40% of LICs and LMICs reported absent or extremely  
463 limited access to a paediatric nephrologist.<sup>130</sup>

464  
465 At the individual level, the costs of kidney care can be staggering. In LICs and LMICs the  
466 burden of meeting healthcare costs is largely placed on the individual. Only 13% of LICs and  
467 19% of LMICs cover the cost of KRT for adults.<sup>95</sup> A World Bank report highlighted that out of  
468 all the disease groups, CKD is responsible for the largest number of people (188 million  
469 annually in LICs and LMICs) suffering catastrophic healthcare expenditures worldwide.<sup>131</sup>  
470 Even in the USA, where Medicare covers people with kidney failure, younger adults with  
471 CKD are not covered unless they have private health insurance, leading to massive out-of-  
472 pocket costs.

473  
474 Kidney disease also has many indirect economic costs. The individual patient faces  
475 decreased earning potential, and educational and vocational outcomes are compromised in  
476 children with kidney disease.<sup>132,133</sup> In the USA, >75% of patients initiating dialysis were  
477 unemployed.<sup>134</sup> Caregivers face similar lost earning opportunities, and the state receives  
478 less taxation revenue.

479  
480 With increasing prevalence, the overall global cost of providing kidney care is likely to rise.  
481 Moreover, with an ageing global population, the global tax base to fund health care will  
482 shrink over the next 30 years, emphasizing the crucial need to prevent kidney failure and its  
483 associated high health care costs (such as KRT costs).<sup>135</sup> The recognition of kidney disease as  
484 a major global driver of mortality is, therefore, essential to focus efforts on improving  
485 kidney health and decreasing the massive healthcare costs associated with kidney disease.

486

## 487 **[H1] THE MORAL CASE FOR KIDNEY HEALTH PRIORITISATION**

488 It is unacceptable that the only NCD consistently witnessing an increase in the number of  
489 deaths year-on-year is not identified as a priority for policy action. Kidney diseases  
490 disproportionately affect the poor and disadvantaged, globally and within each country.

491 Moreover, kidney disease not only has a profound negative impact on patients owing to its  
492 debilitating symptom burden, but it also increases their risk of developing other major  
493 NCDs, restricts their ability to work and care for family members, and is crippling  
494 expensive for individuals, families, health systems, and governments.

495 The changing population dynamics predicted over the next 20 years will translate to an  
496 increase in the number of people with kidney disease in LICs and LMICs, who are the least  
497 able to access kidney care. Arguments have been made that prioritizing kidney disease is not  
498 necessary in health systems without the resources to pay for the care of people with kidney  
499 disease. This approach will perpetuate and exacerbate the current global inequities in the  
500 care of patients with kidney disease, represents a pressing moral quandary to the world and  
501 is contrary to the Sustainable Development Agenda of leaving no one behind. Acceptance of  
502 such a situation by using the framing of cost-effectiveness as the primary metric further  
503 deprioritizes these patients leading to the outright denial of care. The status quo  
504 perpetuates this injustice.

505

## 506 **[H2] When kidney healthcare costs cannot be met, people die**

507 Most people access care in community or secondary health care settings in LICs and LMICs.

508 However, less than a third of LIC or LMIC community health care settings can access

509 essential diagnostics such as those measuring kidney function (for example, estimated GFR  
510 and/or albuminuria testing).<sup>136</sup> Medicines that can decrease albuminuria, or treat

511 glomerulonephritis and the complications of CKD (such as anaemia or CKD–mineral and

512 bone disorder (CKD–MBD)) are crucial to slow disease progression and limit the burden of

513 its complications (for example, cardiovascular disease).<sup>137,138</sup> However, in a recent survey of

514 the nephrology workforce in LICs and LMICs, only a third of respondents reported that

515 essential kidney medicines (such as angiotensin-converting enzyme (ACE) inhibitors, anti-

516 hypertensives, medications to treat acid–base and electrolyte disturbances or for CKD–

517 MBD) were mostly available in community settings.<sup>139</sup> This finding highlights the avoidable

518 progress to kidney failure and death faced by many patients in low-resource settings.  
519 Newer, paradigm-shifting medications, such as sodium–glucose cotransporter 2 (SGLT2)  
520 inhibitors and mineralocorticoid receptor antagonists are even less accessible.

521

522 Globally, <50% of all people requiring KRT can access it, with vast discrepancies in access  
523 between HICs and LICs.<sup>24,140,141 22</sup> Up to 98% of people with kidney failure in LICs do not  
524 receive KRT, compared with up to 30% in HICs. Of those patients unable to access KRT, 88%  
525 reside in Africa or Asia. The great disparity in wealth and availability of nephrologists greatly  
526 impact KRT funding and outcomes.<sup>142</sup> Approximately 93% of the world population receiving  
527 KRT lives in HICs or upper-middle-income countries (UMICs), who comprise only 52% of the  
528 world population. Women, children, socially marginalized groups, migrants, and refugees  
529 are particularly disadvantaged.<sup>140,143</sup> Even those who access KRT often cease quickly owing  
530 to cost constraints. In sub-Saharan Africa, only ~10% of adults and 35% of children who  
531 managed to access KRT were still on therapy by three months.<sup>144</sup> In a report from India that  
532 evaluated a state-funded dialysis program, the number of patients accessing the service  
533 increased over time, but about two-thirds of patients discontinued dialysis in less than one  
534 year and likely died because they could not afford the substantial out-of-pocket payments  
535 needed to meet the indirect costs of care.<sup>126</sup>

536

537 Access to dialysis for AKI is similarly poor in LICs. Up to 85% of people with AKI live in the  
538 Global South.<sup>21</sup> In the ISN *Obv25* global snapshot of AKI, nearly 50% of people who required  
539 dialysis in LICs and LMICs were unable to receive it owing to resource constraints or inability  
540 to pay.<sup>17</sup> A systematic review of AKI outcomes in sub-Saharan Africa found that only 64% of  
541 children and 33% of adults could access dialysis when needed.<sup>19</sup> In those unable to access  
542 dialysis, mortality was ~80%.<sup>19</sup>

543

## 544 **[H1] EXPECTED IMPACT OF PLACING KIDNEY DISEASE IN THE WHO LIST OF** 545 **NCD DRIVERS OF EARLY DEATH**

546 The ISN, ASN and ERA and nephrology communities worldwide unite in calling for kidney  
547 health to become a core part of the global health agenda. A crucial first step is the official

548 recognition by the WHO that kidney disease is a major NCD driver of early mortality. The  
549 significance of prioritising CKD by an important multilateral organization such as the WHO in  
550 strengthening the fight against CKD cannot be overstated. Specifically, prioritization by the  
551 WHO will help to raise awareness and demand for care, develop and implement guidelines  
552 and standards, improve implementation of locally appropriate surveillance and monitoring  
553 mechanisms, coordinate international efforts, and allocate resources more efficiently. In  
554 addition to enhanced efforts to prevent the development and progression of kidney disease,  
555 prioritization will foster investment towards the development of sorely needed new  
556 therapies. (Box 2)

557

558 Firstly, placing kidney disease on the WHO list of major NCD causes of premature mortality  
559 will enable a cohesive and targeted global campaign to decrease the harm caused by kidney  
560 disease, especially in emerging economies. Failure to spotlight kidney disease will undo or  
561 substantially slow progress towards the 2015 United Nations Sustainable Development Goal  
562 3.4 of reducing premature mortality from NCDs by a third by 2030.<sup>145</sup> Combating kidney  
563 disease will also contribute to action on many other Sustainable Development Goals,  
564 including SDG 1 (no poverty), 2 (gender equity), 6 (water security), 8 (work and economic  
565 growth), 10 (inequalities), and 13 (climate action). Adding kidney disease to the WHO major  
566 NCD list will translate to better health outcomes across the world and enhance the ability to  
567 address pervasive inequities that place disadvantaged populations at increased risk of  
568 kidney disease.

569

570 Previous successful collaborations between Latin American Society of Nephrology and  
571 Hypertension (SLANH) and the Pan American Health Organization (PAHO), which is a  
572 specialized agency of the United Nations, exemplify the progress that can be made by  
573 multilateral organisational collaboration. This joint initiative has been pivotal in  
574 implementing and developing dialysis and transplantation registries, increasing knowledge  
575 of CKD and AKI among primary care health personnel, establishing a clinical and  
576 epidemiological definition of CKD of non-traditional causes, prioritising individuals with  
577 kidney disease for COVID vaccination, and establishing a direct line of action with local  
578 ministries of health.<sup>146</sup> The ongoing evolution of digital health technologies as a lever to

579 improve the detection and monitoring of kidney disease will accelerate these programs and  
580 improve their implementation. Recognition of kidney disease as a major NCD driver of  
581 mortality is crucial to translating these gains to a global stage.

582

583 Early disease detection and a life course approach are cornerstones for reducing CKD-  
584 related morbidity and mortality worldwide. CKD meets the WHO principles for screening as  
585 early stages are asymptomatic, and there are effective early interventions.<sup>98,147</sup> In 2021, the  
586 Kidney Disease Improving Global Outcomes (KDIGO) global multidisciplinary expert panel  
587 recommended screening high-risk groups (for example, individuals with diabetes or  
588 hypertension) for CKD.<sup>98</sup>

589

590 One of the main historical arguments against CKD screening has been the lack of effective  
591 therapies to slow disease progression, but this landscape has changed radically in the past 5  
592 years. The advent of new therapeutic agents such as SGLT2 inhibitors, glucagon-like  
593 peptide-1 (GLP-1) receptor agonists, endothelin receptor antagonists, selective  
594 mineralocorticoid receptor antagonists, and new glomerulonephritis-targeted therapies,  
595 means that early recognition of disease can translate to massive health improvements. For  
596 example, a 2021 meta-analysis revealed that SGLT2 inhibitor use decreased the risk of CKD  
597 progression by 37% in people with and without diabetes.<sup>128</sup> Consensus-based expert opinion  
598 recommends case detection in individuals with known risk factors such as diabetes,  
599 hypertension and cardiovascular disease.<sup>98</sup> As discussed above, the list of relevant risk  
600 factors is likely longer and poorly studied in LIC and LMICs.<sup>16,148</sup> Prioritization by the WHO  
601 will spur studies to more accurately document disease burden and risk factors in these  
602 geographic areas. Failure to identify people at high risk of kidney disease development  
603 and/or progression is a missed opportunity to intervene and prevent kidney failure and its  
604 stratospheric health, economic and psychosocial costs.<sup>138</sup>

605

606 Prioritising kidney disease will also facilitate the development and expansion of kidney  
607 disease registries. Accurate registry data are crucial to understanding trends and risk factors  
608 and to inform cost-effective and equitable resource delivery. The ISN, through its Share-RR  
609 program, is providing support for the setting up of registries but such initiatives are unlikely

610 to be sustainable without embedment in local health systems.<sup>149</sup> Registries are already  
611 highlighting global hotspots of kidney failure, enabling investigation of disease causes and  
612 improving the understanding of new disease entities such as CKDu.<sup>93,150</sup>

613

614 Greater attention to kidney health and disease will also translate to increased investment by  
615 governments, the private sector and research funders, which will spur innovation and new  
616 therapies. Despite spending disproportionate amounts of money on funding KRT,  
617 governments worldwide have not prioritised innovation in these areas. Professional  
618 societies have been trying to fill this gap, with exciting results. The Affordable Dialysis Prize  
619 co-funded by the ISN, the Asian Pacific Society of Nephrology, the Farrell Family Foundation  
620 and the George Institute for Global Health and has led to the development of a prototype of  
621 a low-cost dialysis machine. The KidneyX project in the USA is a public-private partnership  
622 that has raised tens of millions of dollars to foster innovations in dialysis care, including an  
623 artificial kidney prize .

624

625 New therapies that focus on the prevention of kidney disease development and progression  
626 will result in major health and socio-economic benefits. Finally, highlighting kidney disease  
627 will enable kidney health societies to expand advocacy for appropriate access to care for  
628 patients with kidney disease, increasing access to diagnosis and treatment and including  
629 medications needed to treat kidney disease in the WHO essential medicines list.

630

631 Shining a spotlight on kidney disease will not only result in decreased numbers of people  
632 needing resource-intensive kidney treatment but also empower programs to reduce waste  
633 in dialysis. More sustainable dialysis modalities and technologies are urgently needed.

634 Haemodialysis, the most common form of KRT, uses hundreds of litres of water per  
635 session.<sup>60</sup> In drought-affected areas, this demand poses a profound challenge. Decreasing  
636 the amount of people on dialysis by disease prevention will improve water security and  
637 reduce waste. Dialysis also produces >900,000 tonnes of plastic waste a year, rendering it  
638 one of the highest emitters of carbon emissions in healthcare.<sup>151</sup> In the USA, annual  
639 emissions per haemodialysis facility are estimated at nearly 770,000 kg of CO<sub>2</sub>  
640 equivalents.<sup>152</sup> Nearly 38,000,000 kg of recyclable plastic waste is generated annually from

641 peritoneal dialysis globally, but limited recycling options exist.<sup>153</sup> Encouragingly, programs to  
642 monitor electricity and water use in dialysis facilities have resulted in 30–50% savings  
643 despite increasing patient numbers in France.<sup>154</sup>  
644

## 645 **[H1] Grand challenges for kidney health**

646 Several major unmet policy, advocacy and implementation needs (Box 3) must be tackled to  
647 alleviate the global burden of kidney disease. We call for the global health community to  
648 address the following urgent public health needs to meet the needs of those at risk of, and  
649 with kidney diseases:

- 650 1. *Improved access to care:* Many people with CKD do not have access to adequate  
651 diagnostic and treatment (including preventive) services, particularly in LICs and LMICs.  
652 Similarly, >1 million people with potentially reversible AKI die yearly owing to lack of  
653 access to timely therapies, including dialysis. These gaps must be addressed by  
654 increasing the availability of affordable and accessible healthcare services.
- 655 2. *Better prevention:* More effective strategies are needed to prevent the development of  
656 CKD and AKI. Kidney disease risk factors need to be better understood, especially in LICs  
657 and LMICs, through appropriately designed studies using a multi-disciplinary approach,  
658 interpreting the results in the context of the study population and its limitations, and  
659 considering their implications for the community and public health. In a recent White  
660 Paper, an ISN Working Group suggested points that countries should consider before  
661 developing a CKD case finding and management program, and put forward an evidence-  
662 based, resource-sensitive framework that can be adjusted to suit the local contexts.  
663 (139)
- 664 3. *Developing, testing and scaling up novel balanced models of care:* Implementing  
665 affordable, scalable and sustainable models of care requires co-development with  
666 stakeholder communities. Balanced models should also outline a systematic but flexible  
667 approach to planning treatment and care within the overall context of strengthened  
668 primary health care services. In low-resource settings, this approach might include a  
669 combination of task-sharing between physicians and non-physician healthcare workers  
670 in a locally appropriate way for diagnosis and follow-up care (facilitated by digital mobile

671 technology and the use of clinical decision support systems with regional supervision),  
672 the use of online platforms to deliver competency training and facilitate supervision, and  
673 the use of peers for quality assurance. Potential risks of such approaches should be  
674 recognised and addressed by implementing policies that ensure the equitable delivery of  
675 safe, effective and high-quality care. In high-resource settings, care delivery needs to be  
676 refined across all levels of healthcare with the addition of an extended range of services  
677 in terms of coverage and degree of specialisation.

678 4. *Greater awareness and education:* Many people with CKD are not aware that they have  
679 the disease, and many more are not aware of the steps that they can take to slow its  
680 progression. Similarly, a large proportion of the primary care community does not fully  
681 appreciate the adverse consequences of early-stage CKD. Greater awareness and  
682 education campaigns are needed to help people understand the importance of early  
683 diagnosis and management of CKD.

684 5. *Addressing social determinants of kidney health:* As kidney diseases disproportionately  
685 affect impoverished and marginalized communities, addressing social determinants of  
686 health, such as poverty, poor housing and lack of access to healthy food and clean  
687 water, is essential to address the burden of kidney diseases.

688 6. *Increased funding for research and development:* More funding is needed to support the  
689 development of new treatments and therapies for kidney diseases, and to improve  
690 understanding of these diseases and their underlying causes in different parts of the  
691 world.

692 7. *International cooperation and coordination:* International cooperation and coordination  
693 are needed to promote the development and implementation of effective policies and  
694 programs for the prevention, early detection, and management of kidney diseases and  
695 to share knowledge and best practices.

696 8. *Greater engagement with patient communities:* The demand for meaningful  
697 participation by community members in shaping health policies and in planning,  
698 delivering, quality assurance, and evaluation of services has increased steadily. Greater  
699 engagement with patient communities is needed to ensure that policies and programs  
700 address the needs and priorities of people living with kidney diseases effectively.  
701 Community involvement can range from consultation and collaboration to leadership.



702

## 703 **CONCLUSION**

704 The 2015 United Nations Sustainable Development Goal 3.4 aims to reduce premature  
705 mortality from NCDs by a third by 2030.<sup>145</sup> To tackle this goal, the WHO has recognised  
706 cancer, heart disease, stroke, chronic lung disease and diabetes as the major NCD drivers of  
707 early mortality. Failure to include kidney disease in this initiative misses the opportunity to  
708 address a major contributor to premature and preventable mortality. Changing population  
709 dynamics and evolving risk accumulation mean that the global burden of kidney disease is  
710 increasing relentlessly to become the 5<sup>th</sup> most common NCD driver of mortality by 2040.  
711 Kidney disease increases the risk of mortality, morbidity, and disability, decreases quality of  
712 life and has profound individual and health system level economic consequences, as well as  
713 dire environmental impacts. Kidney disease is under-recognised and under-resourced.  
714 Recognising kidney disease as a major driver of NCD-related mortality will translate to  
715 coordinated global efforts to minimise the burden of kidney disease and will save lives.

716

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1203

## 1204 **Author contributions**

1205 A.F. and V.J. researched data for the article. A.C.MO., S.L.T., A.O., A.B.F., D.F., P.R.-C., M.F.,  
1206 M.N., C.W., C.M. L.S., I.U. and V.J. made substantial contributions to discussions of the  
1207 content. A.F., M.N.H., V.J. wrote the manuscript. A.H., D.A., S.B., A.C., L.S., I.U. and V.J.  
1208 reviewed or edited the manuscript before submission.

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1215 submitted work. The other authors declare no competing interests.

## 1216 **Peer review information**

1217 *TBC*

## 1218 **Related links**

1219 Prototype of a low-cost dialysis machine: <https://www.ellenmedical.com/>

1220 KidneyX project: [kidneyx.org](http://kidneyx.org)

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1223 **Figure Legends :**

1224

1225 **Figure 1. Many risk factors for chronic kidney disease will not be addressed by targeting**  
1226 **the current WHO recognised major non-communicable diseases.**

1227 A Venn diagram of risk factors for kidney disease and other major NCDs reveals separate  
1228 major risk factors for CKD which will not be addressed by targeting WHO-recognized major  
1229 NCDs.

1230

1231 **Figure 2. Predicted change in deaths due to chronic kidney disease from 1990 to 2040**

1232 Legend. Modelling of Global Burden of Disease data reveals an increase in predicted deaths  
1233 due to CKD each year from 1990 to 2040. Blue spectrum = less deaths, red spectrum= more  
1234 deaths

1235

1236 Source: Institute for Health Metrics and Evaluation, University of Washington; open access  
1237 under the Creative Commons Attribution, Non-Commercial, No Derivatives 4.0 International  
1238 License

1239

1240 **Figure 3. Predicted change in years of life lost to chronic kidney disease from 1990 to 2040**

1241 Legend. Modelling of Global Burden of Disease data reveals an increase in predicted years of  
1242 life lost due to CKD each year from 1990 to 2040. Blue spectrum = less years of life lost, red  
1243 spectrum= more years of life lost

1244

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1248

1249 **Figure 4. Predicted years of life lost from chronic kidney disease by 2040 is similar to other**  
1250 **WHO recognised major non-communicable diseases.**

1251

1252 Legend. By 2040, CKD is expected to surpass diabetes as a cause of years of life lost.

1253 Adapted from data from Foreman KJ et al. Forecasting life expectancy, years of life lost, and  
1254 all-cause and cause-specific mortality for 250 causes of death: reference and alternative

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1258

**Box 1: The burden of kidney disease**

- Premature mortality
- Disability
- Reduced quality of life
- Other psychosocial harms
- High costs to governments and health care systems
- High costs to individuals and families, in part due to lost productivity

1259

**Box 2: The impact of WHO recognition of CKD as a major driver of NCD-related early mortality**

- Rise in global awareness of CKD
- Further development of guidelines and standards for the care of people with CKD
- Improved implementation of locally appropriate surveillance and monitoring mechanisms
- Facilitated coordination of international efforts to understand disease burden and develop evidence-based prevention approaches
- Improved resource allocation
- Fostering of investment for new therapies

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**Box 3: A path to developing sustainable patient-centered kidney care services to achieve SDG targets**

- Improved access to care by integrating kidney care services into routine primary care and restructure care pathways away from hospitals and into community settings
- A staged approach to understanding and responding to kidney disease, with focus on region-specific risk factors, comorbidity and multimorbidity
- Task-sharing of integrated preventive, diagnostic and management interventions for kidney disease with non-specialised workers in the overall context of NCD care
- Adoption of technological solutions, such as digital platforms and point of care tests, to facilitate the delivery of interventions across the continuum of care
- Development of a continuum of care pathway by integrating primary preventive care with specialist care
- Commitment to involving patients and family members in planning and providing services
- Implementation of community-based interventions to enhance the demand for preventive care

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**Figure 1**

A Venn diagram of risk factors for kidney disease and other major NCDs reveals separate major risk factors for CKD which will not be addressed by targeting WHO recognized major NCD's

**RISK FACTORS FOR NCDs Recognized by WHO:**

Diabetes, Heart Disease, Stroke, Cancer

**RISK FACTORS FOR CKD**

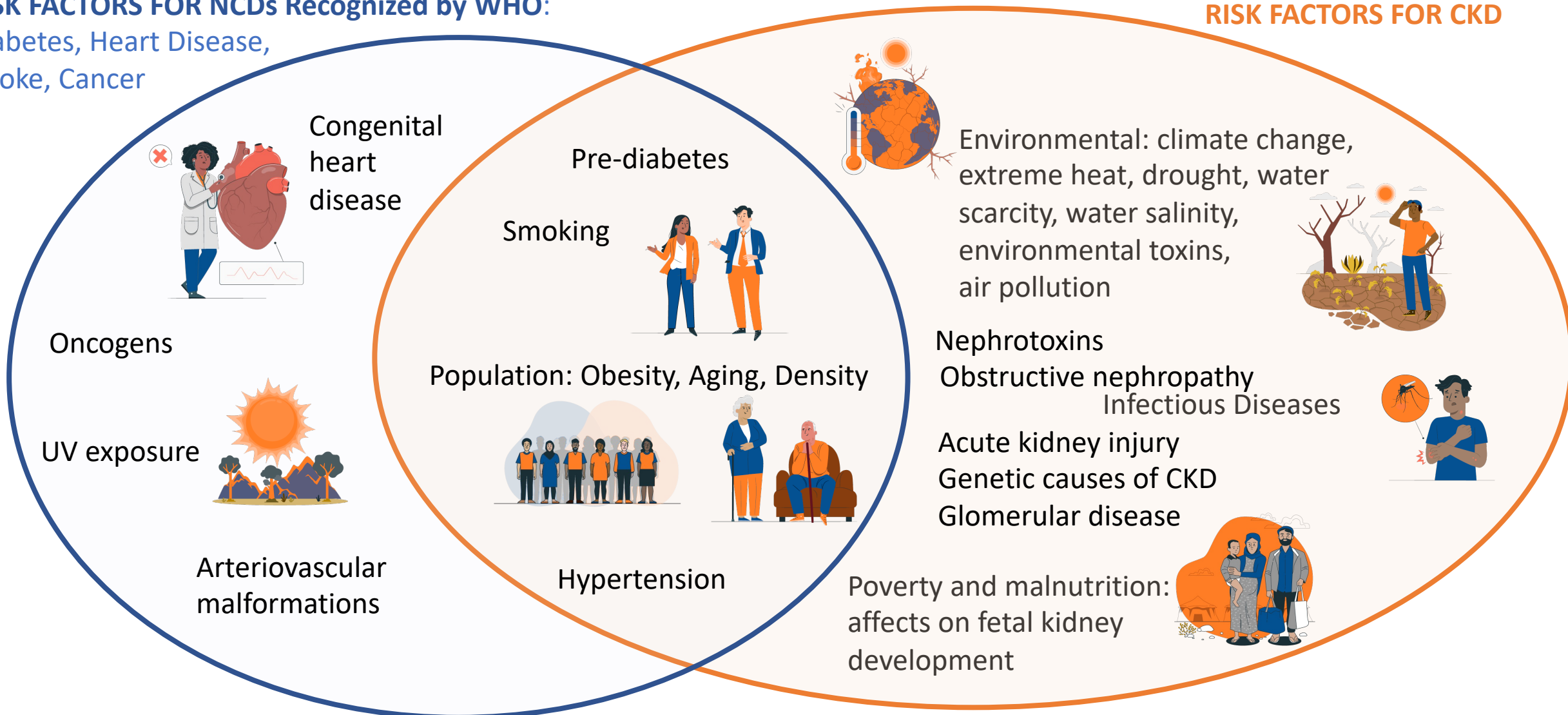


Figure 2a. Predicted change in deaths due to CKD 1990 to 2040

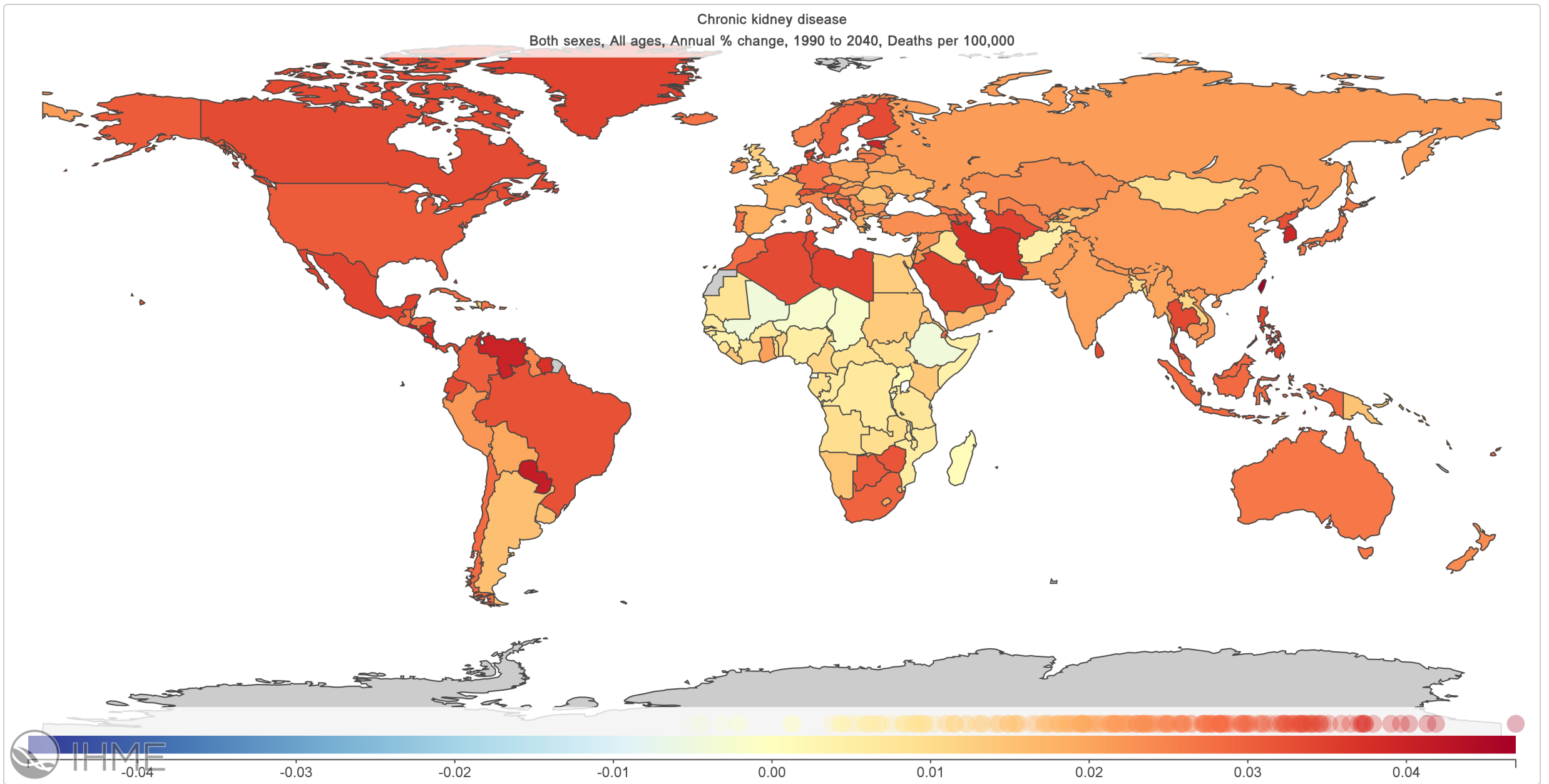


Figure 2b. Predicted change in years of life lost due to CKD 1990 to 2040

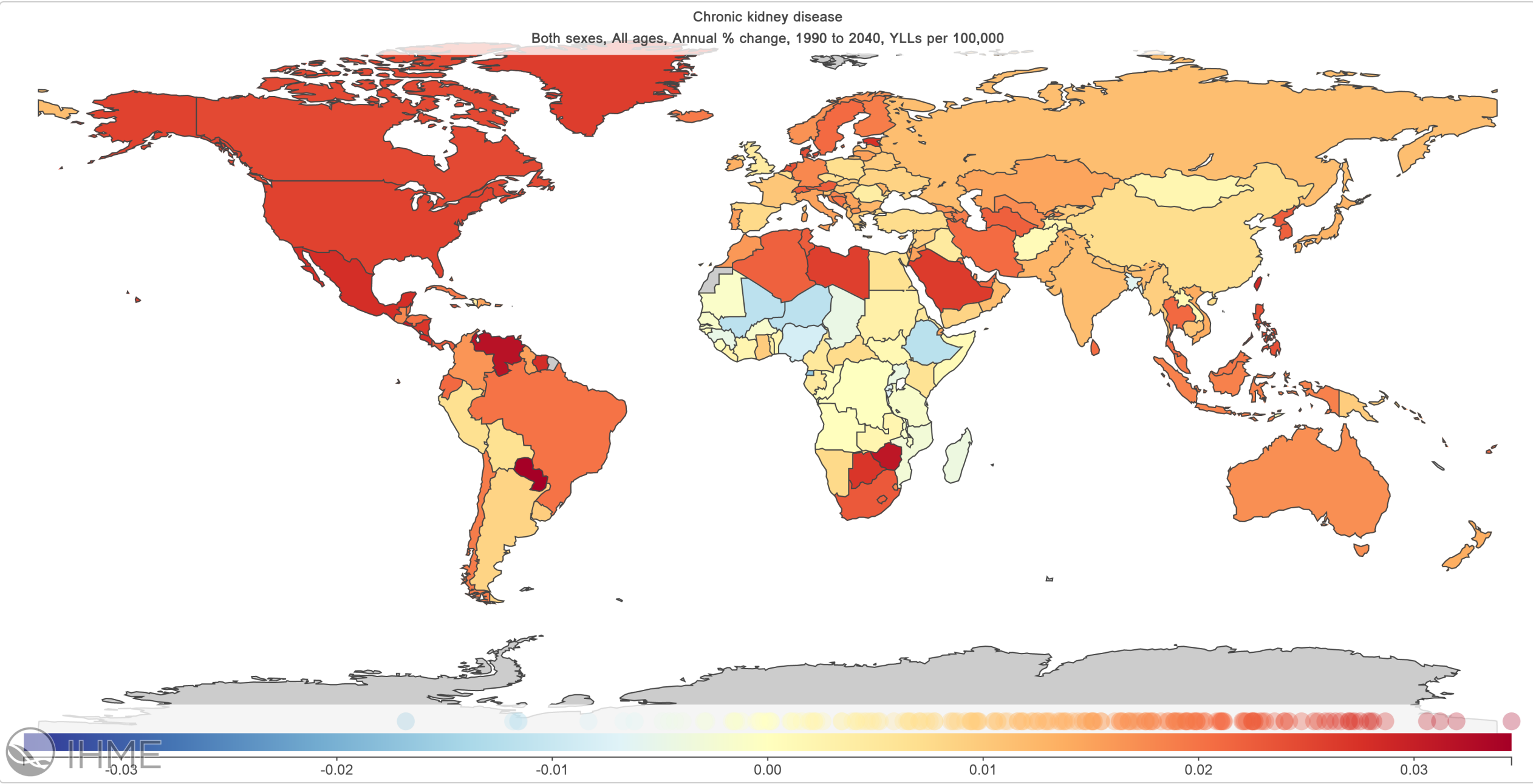
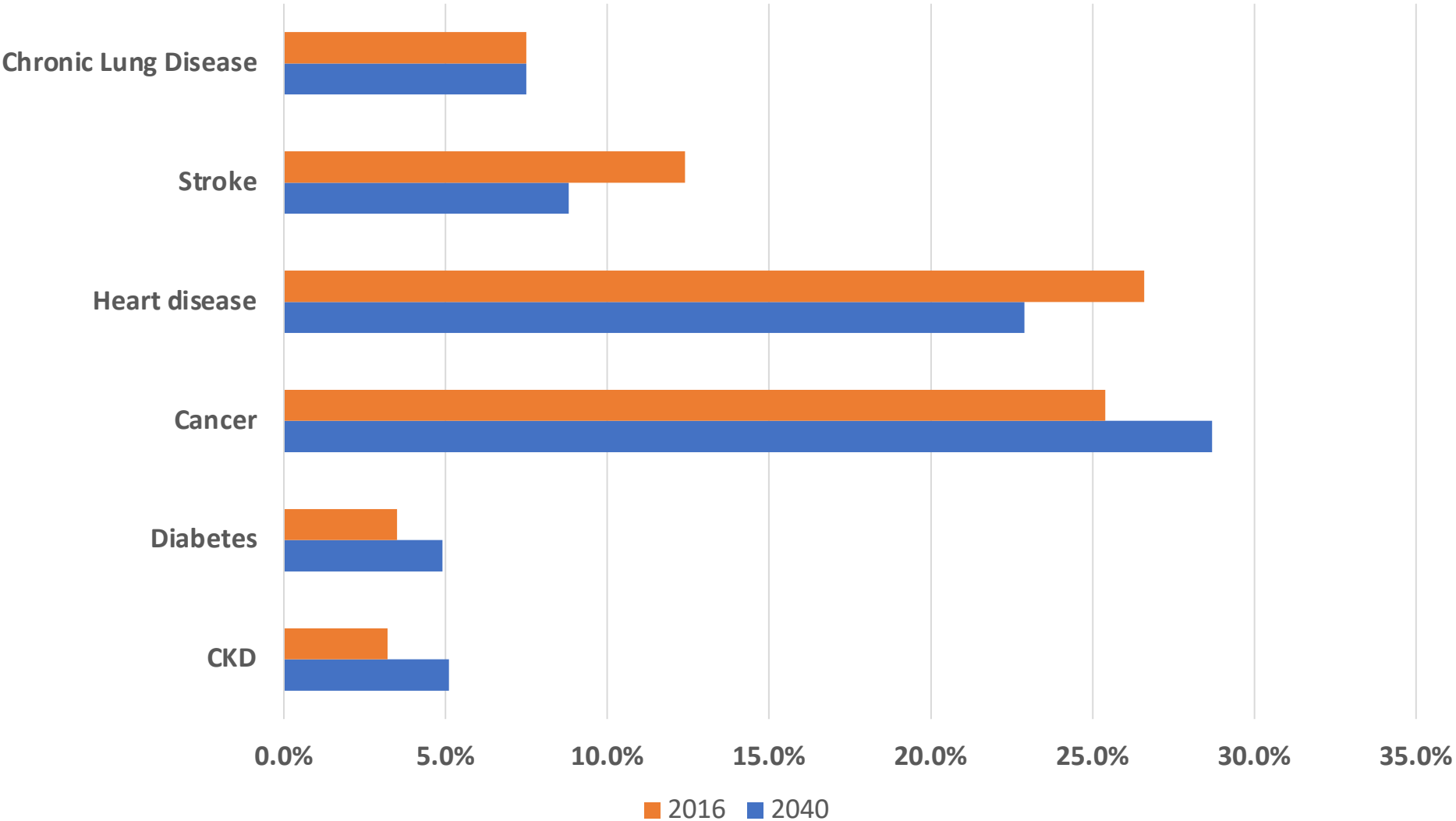


Figure 3. By 2040, kidney disease will account for a larger percentage of years of life lost globally due to non-communicable disease than diabetes.



Adapted from data from oreman KJ, Marquez N, Dolgert A, Fukutaki K, Fullman N, McGaughey M, et al. Forecasting life expectancy, years of life lost, and all-cause and cause-specific mortality for 250 causes of death: reference and alternative scenarios for 2016 -2040 for 195 countries and territories. The Lancet. 2018;392(10159):2052-90.