Years of Potential Life Lost (YPLL), the Key Metric in Strategic Planning for Chronic Kidney Disease Care

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The concept of years of potential life lost (YPLL) involves calculating the average lifespan an individual would have achieved, had they not experienced premature mortality.[1] Therefore YPLL is a measure of premature mortality, which gives more weight to deaths occurring in young people, as compared to "death rate" which is a crude measure of overall death. This measure, which is a metric for premature mortality, helps to quantify social and economic loss due to early death, and emphasizes specific causes of death affecting younger age groups.[2]

Any individual's YPLL can be calculated by subtracting the age of the person at the time of death from the reference age, i.e., the life expectancy of the population.[3] To calculate the YPLL of a particular population in a given year, one collects the individual YPLLs for all individuals who died in that year. This analysis can be performed for all-cause or cause-specific mortality. Only those who die before the reference age are included in the calculation and if a person dies in an age older than the reference age, that person's YPLL is considered zero, i.e., there are no "negative" YPLLs.[4]

According to data cited by the World Health Organization (WHO) and estimates from the Global Burden of Disease (GBD) study, chronic kidney disease (CKD) denotes a significant and escalating global health crisis. In 2023, about 788 million individuals aged 20 and older worldwide were diagnosed with CKD, with a 95% uncertainty interval (UI) of 743 to 843 million.[5] Chronic kidney disease ranked as the ninth leading cause of death globally in 2023, claiming almost 1.5 million lives, and was the twelfth leading cause of disability.[5]

Unlike most other leading causes of death, the global age-standardized mortality rate from CKD increased, from 24.9 per 100,000 in 1990 to 26.5 per 100,000 in 2023.[6] The rationale for this rise could be attributed in the increased prevalence of modifiable risk factors, i.e., diabetes mellitus and hypertension as primary drivers of CKD, and population growth and aging, which contribute to the overall rise, alongside the late diagnosis and lack of accessible prevention and treatment strategies.[7]

The prevalence of CKD is reported from 6.6%, 11.6%, and 15.3% to 23.7% in studies from different regions of Iran.[8-11] As shown in a study by Shahbazi *et al*, the age-specific CKD incidence rate has increased from 168.52 per 100,000 to 382.98 per 100,000 between 1990 and 2019 and is projected to increase to 469.04 in 2030 (95% credible interval, 399.20 to 538.87).[12] The incidence rate of CKD is expected to increase across all age groups and etiological categories by 2030.

Iran is among the countries which provides public funding for dialysis and kidney transplantation, which could positively affect the YPLL.[8] However no concrete data exist in this regard and to the best of our knowledge the research by Azarbakhsh *et al.* in this issue represents the first study on CKD mortality trends in Fars province, Iran, analyzing the YPLL. The 16-year window from 2004 to 2019 offers a crucial lens on the evolving burden of kidney failure and the use of population-based mortality data, YPLL, and joinpoint regression provides a time-resolved narrative that is often missing in cross-sectional snapshots. The crude mortality rate for CKD showed a stable trend in men but an increasing trend in women, while the age-standardized mortality rate remained stable in both sexes. This pattern suggests demographic

shifts rather than changes in underlying disease risk: as life expectancy rises, the age distribution of the population skews toward older ages, where kidney failure is more common, rendering crude rates susceptible to aging effects. On the other hand, standardized rates reflect underlying risks independent of age patterns. In this study total YLL due to CKD was substantial (19366 in men, 15769 in women), and the YPLL rate trend was reported as stable, with annual percent changes not reaching statistical significance for either sex. This indicates that, despite numerical differences in death counts by sex, the burden of premature mortality attributable to kidney failure did not exhibit a clear acceleration or deceleration over the study period.

The sex-specific divergence in crude mortality (stable in men, rising in women) was noteworthy, with possible contributors including longer female life expectancy, shifts in prevalence or management of comorbidities (e.g., hypertension, diabetes mellitus) that influence progression of kidney impairment, and potential disparities in access to kidney replacement therapies. The authors' interpretation linking the increasing crude mortality in women to longer life expectancy and rising non-communicable disease burden is plausible, though it invites deeper exploration with gender-disaggregated risk factors and healthcare data.

The disparity between crude and age-standardized mortality trends highlights aging as a dominant factor in recorded deaths, while the stability of age-standardized mortality and YLL underscores a persistent but potentially manageable burden rather than an accelerating trajectory.

These findings will have important implications for policy makers and practitioners, in strengthening primary care screening for kidney disease, especially among aging populations and women with cardiovascular risk profiles, and for healthcare system planning. Resource allocation should consider not only end-stage kidney disease management but also early-stage CKD care, cardiovascular risk management, and palliative care integration to optimize quality of life and life expectancy.

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