Discussion article

Chronic Kidney Disease (CKD) classification for low-resource settings: Taking into account patients' social vulnerability

Carlos G. Musso [ID][✉][1,2], Ana C. Ricardo [ID][3], Gustavo Aroca-Martinez [ID][2,4] and Martin Chaparro [ID][5]

[1]Research Department, Hospital Italiano de Buenos Aires, Buenos Aires, Argentina
[2]Health Sciences Faculty, Universidad Simón Bolivar, Barranquilla, Colombia
[3]Department of Medicine, Division of Nephrology, University of Illinois Chicago, Chicago, IL, United States
[4]Clínica de la Costa, Barranquilla, Colombia
[5]Faculty of Medicine, Universidad de Buenos Aires, Buenos Aires, Argentina

Abstract

Introduction: Chronic kidney disease (CKD) has increasingly become a significant public health problem and economic burden for health systems worldwide. In addition, social vulnerability (SV) can also contribute to the high burden of chronic kidney disease.

Contents: Social vulnerability can be explored by evaluating five dimensions: household composition, income, unstable housing, segregation, and immigration status, proposed by Jimenez-Garcia et al.

Conclusions: Based on these variables a social vulnerability index score (SOVI) was described. This article proposes integrating the social vulnerability index score into the CKD-KDIGO classification in order to provide a more comprehensive approach to the problem of chronic kidney disease burden, with the goal of promoting kidney health an improving current kidney prevention programs.

Keywords: Chronic kidney disease, social vulnerability classification.

✉ **Correspondence:** Carlos G. Musso. Hospital Italiano de Buenos Aires, Gascón 450, Ciudad Autónoma de Buenos Aires, Argentina. E-mail: carlos.musso@hospitalitaliano.org.ar

Clasificación de la Enfermedad Renal Crónica (ERC) para entornos de bajos recursos: teniendo en cuenta la vulnerabilidad social de los pacientes

Resumen

Introducción: la enfermedad renal crónica (ERC) se ha convertido en un problema de salud pública y una carga económica para los sistemas de salud en todo el mundo. Además, la vulnerabilidad social (VS) también puede contribuir a la alta carga de la enfermedad renal crónica.

Contenidos: la vulnerabilidad social se puede explorar evaluando cinco dimensiones: composición del hogar, ingresos, vivienda inestable, segregación e inmigración, propuestas por Jiménez-García et al. Con base en estas variables, se describió un índice de vulnerabilidad social (SOVI).

Conclusiones: en el presente artículo, se propone en forma original incorporar índice de vulnerabilidad social a la clasificación CKD-KDIGO para proporcionar un enfoque más integral al problema de la enfermedad renal crónica, con el objetivo de promover la salud renal y mejorar los programas actuales de prevención renal.

Palabras clave: enfermedad renal crónica, vulnerabilidad social, clasificación.

Introduction

Chronic kidney disease (CKD) has increasingly become a significant public health problem and economic burden for health systems worldwide. The global median prevalence of CKD is estimated at 9.5 % [1], similar to the global prevalence of diabetes at 9.3 % [2], which is considered the most common cause of CKD. This high prevalence of CKD has been attributed to a combination of individual factors such as aging, unhealthy lifestyle, and increasing prevalence of other comorbidities including obesity and hypertension. In addition, in low-resource settings, social determinants of health (SDOH) can also contribute to the high burden of the disease [3, 4].

The World Health Organization (WHO) defines SDOH as the non-medical conditions influencing the environments where people are born, grow, work, live and age, all of which impact health outcomes [5]. SDOH also includes the wider set of forces that shape a person's daily life (economic policies, social policies and political systems) [5] and have been grouped into five domains that include economic stability, education access and quality, health care access and quality, neighborhood and built environment, and social and community context [6]. Notably, poverty is considered one of the most significant social conditions of

our time [7], as it can hinder healthy behaviors and health care access, increasing the risk of exposure to environmental toxins such as lead, cadmium, and arsenic. Moreover, in vulnerable populations, CKD screening campaigns have shown a high burden of kidney disease that usually remains undiagnosed and untreated. Therefore, management of the individual-level (proximal) CKD-related factors alone would not be sufficient to reduce the burden of CKD, particularly in low-resource settings. There is extensive evidence demonstrating that it is necessary to integrate social (distal) factors into CKD management [8].

Current CKD management programs in low-resource settings are mostly based on targeting individual-level factors such as blood pressure, glucose, lipids, acidosis, anemia and albuminuria, using the Kidney Disease Improving Global Outcomes (KDIGO)-CKD clinical practice guidelines, as they are implemented worldwide [3]. While recent proposals suggest modifying this classification to incorporate kidney aging [9], it still remains centered on individual factors, lacking a broader social perspective [10].

Social vulnerability

Vulnerability is defined as [11]:

> The probability that a subject exposed to a natural, technological, anthropic or socio-natural threat will suffer damage and losses, both human and material, at the time of impact of the phenomenon, also having difficulty in recovering from it, in the short, medium or long term.

From a social perspective, vulnerability refers to a household's state, inversely related to its ability to influence the forces that shape its destiny or mitigate their effects on well-being [12]. Social vulnerability can be explored by evaluation of the following five dimensions (D) proposed by Jimenez-Garcia et al. [12]:

D1, Household composition and basic social rights: This dimension evaluates household circumstances that may deplete essential resources (e.g., economic, educational, temporal, experiential) necessary to prepare, face and resist adversity. Some examples include households led by a single female head (single-parent household), low schooling, unemployment, and/or with children outside the school system.

D2, Income and access to consumer goods: This dimension, which probably has the greatest weight in the explanatory models of vulnerability (the lower the income, the greater the vulnerability), measures the total household income and classifies it according to the per capita income of the study area. Vulnerability is identified when a household has no income

or when four or more individuals rely on a single income. It also considers access to basic goods and utilities, health services, and telecommunications, as being able to communicate is essential for managing emergencies.

D3, Quality and ownership of housing (unstable housing): The nature of the home, the property, and its location (generally in risk areas) can be sources of social vulnerability. Likewise, overcrowding increases vulnerability since it increases the number of potential victims in a single event and fosters conditions that may lead to traumatic stress.

D4, Segregation: Segregation implies vulnerability since socio-spatial exclusion decimates the effect of relief and protection mechanisms and dilutes the capacity of individuals to face adversities beyond their control. The remoteness of the home from care centers further heightens vulnerability.

D5, Immigration: Migrants, as minorities in urban areas, often face discrimination when seeking health care. Furthermore, internal immigration tends to cluster in the most marginalized and segregated urban areas, where access to basic services is limited, increasing vulnerability. As an example, Burgos-Calderón et al. describe how ethnic, religious or linguistic minorities, such as indigenous, Afro-Latin and Afro-Caribbean communities, due to their low socioeconomic status, language barriers, lower education attainment, lack of access to healthy nutrition, contaminated environments (all distal factors), have increased risk of early onset hypertension, diabetes mellitus, and CKD [8]. Moreover, in women of childbearing age, poor nutrition is recognized as a risk factor for low birth weight and kidney development problems [8, 13].

Using exploratory factor analysis, Jiménez-García et al. identified eight factors as the most influential within the social vulnerability dimensions: young head of household (EDJH1), home with school dropouts (OUTSCHO), low-income household (VULNE), home without assets (BAGOOD), home without technologies (TIGOOD), unstable housing (HACIN), housing-overcrowding in segregated sector (SEGRE), and home with migrants (MIGRA). Each of these eight social vulnerability variables is assigned a binary value of 1 or 0 (where 1 represents the presence of a deficiency and 0 the absence of it). These data are incorporated into a social vulnerability index (SOVI) score, with a minimum value of zero (0, no deficiencies are seen), and a maximum value of eight, which is calculated as follows:

$$\textbf{SOVI} = \sum \text{EDJH1 + OUTSCHO + VULNE + BAGOOD + TIGOOD + HACIN + SEGRE + MIGRA}$$

Based on the SOVI formula, the authors developed a simplified version that categorizes households into three categories of varying degrees of social vulnerability: low (SV1), medium (SV2), and high (SV3). Households with 0 to 1 deficiencies are classified as having low social vulnerability (SV1), those with 2 deficiencies as medium vulnerability (SV2), and those with 3 or more deficiencies as high vulnerability (SV3) [12].

Conclusions

Given the current contrast between the importance of distal factors in the incidence and progression of CKD and their frequent neglect, we believe that it is crucial to increase the recognition of social vulnerability by incorporating it into the CKD classification, particularly in resource-poor settings. For this purpose, the simplified version of SOVI could be incorporated into the current KDIGO-CKD classification, particularly in the evaluation of patients living in low- income countries. Therefore, we propose to add a social vulnerability indicator to the KDIGO classification as shown in Figure 1.

KDIGO 2012: Prognosis of CKD by GFR and albuminuria categories			Persistent albuminuria categories Description and range		
			A1	A2	A3
			Normal to mildly increased	Moderately increased	Severely increased
			<30 mg/g	30-300 mg/g	>300 mg/g
GFR categories (ml/min/1.73m²) Description and range	G1	Normal or high ≥ 90	🟩	🟨	🟧
	G2	Mildly decreased 60-89	🟩	🟨	🟧
	G3a	Mildly to moderately decreased 45-59	🟨	🟧	🟥
	G3b	Moderately to severely decrease 30-44	🟧	🟥	🟥
	G4	Severely decreased 15-29	🟥	🟥	🟥
	G5	Kidney failure <15	🟥	🟥	🟥
Social Vulnerability			1 2 3	1 2 3	1 2 3

Figure 1. KDIGO 2012: Prognosis of CKD by GFR and albuminuria categories

Note. Proposal to add a social vulnerability measure to the Kidney Disease Improving Global Outcomes (KDIGO) classification. CKD: chronic kidney disease; GFR: glomerular filtration rate; Green: low risk; yellow: moderately high risk; red: very high risk.
Source: The authors.

Alternatively, other validated social vulnerability measures could be incorporated into the KDIGO-CKD classification instead, depending on the geographic location. For instance the U.S. Centers for Disease Control and Prevention (CDC) developed the Social Vulnerability Index (SVI), which uses 16 U.S. census variables to help local officials identify communities that may need support before, during, or after disasters [14].

This perspective is in line with the concept of population health, which brings together individual or proximal factors (e.g., genetics, lifestyle, comorbidities) and social or distal factors (e.g., social, environmental, economic) in order to provide a more comprehensive approach to the problem of CKD burden, with the goal of promoting kidney health an improving current kidney prevention programs.

Ethical statement

All authors declare no conflicts of interest and confirm that no funding was received for the completion of this article.

Funding

The authors did not receive any financial support for the research, authorship and publication of this article.

Conflicts of interest

None declared by authors.

Authors contribution

Carlos G. Musso: Conceptualization, Formal analysis, Writing – original draft, Writing – review & editing; Ana C. Ricardo: Conceptualization, Formal analysis, Writing – original draft, Writing – review & editing; Martin Chaparro: Conceptualization, Formal analysis, Writing – original draft; Gustavo Aroca-Martinez: Conceptualization, Writing – original draft, Writing – review & editing.

References

[1] Bello AK, Okpechi IG, Levin A, Ye F, Damster S, Arruebo S, et al. An update on the global disparities in kidney disease burden and care across world countries and regions. Lancet Glob Health. 2024;12: e382–e395. ↑See Page 2

[2] Saeedi P, Petersohn I, Salpea P, Malanda B, Karuranga S, Unwin N, et al. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9th edition. Diabetes Res Clin Pract. 2019;157:107843. https://doi.org/10.1016/j.diabres.2019.107843 ↑See Page 2

[3] Ulasi II, Awobusuyi O, Nayak S, Ramachandran R, Musso CG, Depine SA, et al. Chronic Kidney Disease Burden in Low-Resource Settings: Regional Perspectives. Semin Nephrol. 2022;42:151336. https://doi.org/10.1016/j.semnephrol.2023.151336 ↑See Page 2, 3

[4] Hundemer GL, Ravani P, Sood MM, Zimmerman D, Molnar AO, Moorman D, et al. Social determinants of health and the transition from advanced chronic kidney disease to kidney failure. Nephrol Dial Transplant. 2023;38(7):1682–1690. https://doi.org/10.1093/ndt/gfac302 ↑See Page 2

[5] Social determinants of health [Internet]. [cited Aug 6, 2021]. Available from: https://www.who.int/westernpacific/health-topics/social-determinants-of-health ↑See Page 2

[6] Social Determinants of Health - Healthy People 2030 | health.gov [Internet]. [cited Aug 6, 2021]. Available from: https://health.gov/healthypeople/priority-areas/social-determinants-health ↑See Page 2

[7] Norris KC, Beech BM. Social Determinants of Kidney Health: Focus on Poverty. Clin J Am Soc Nephrol. 2021;16(5):809–811. https://doi.org/10.2215/CJN.12710820 ↑See Page 3

[8] Burgos-Calderón R, Depine SÁ, Aroca-Martínez G. Population Kidney Health. A New Paradigm for Chronic Kidney Disease Management. Int J Environ Res Public Health. 2021;18(13): 6786. https://doi.org/10.3390/ijerph18136786 ↑See Page 3, 4

[9] Musso CG, Ricardo AC, Aroca-Martinez G. The fourth wave in chronic kidney disease (CKD) classification: taking into account the aging kidney. Int Urol Nephrol. 2023;56:805-806. https://doi.org/10.1007/s11255-023-03642-w ↑See Page 3

[10] Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group: KDIGO 2024 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. Kidney Int. 2024;105(4):S117–S314. https://doi.org/10.1016/j.kint.2023.10.018 ↑See Page 3

[11] Chardon AC. Threat, vulnerability and urban societies, management and atmosphere. Gestión y ambiente. 2008:123–136. ↑See Page 3

[12] Jiménez-García WG, Manzano-Chávez L, Mohor-Bellalta A. Medición de la vulnerabilidad social: propuesta de un índice para el estudio de barrios vulnerables a la violencia en América Latina. Papers. Revista de Sociologia. 2021;106(3):381–412. https://doi.org/10.5565/rev/papers.2850 ↑See Page 3, 5

[13] Norton JM, Moxey-Mims MM, Eggers PW, Narva AS, Star RA, Kimmel PL, et al. Social Determinants of Racial Disparities in CKD. J. Am. Soc. Nephrol. 2016:27(9);2576–2595. https://doi.org/10.1681/ASN.2016010027 ↑See Page 4

[14] CDC/ATSDR's Social Vulnerability Index (SVI) [Internet]. 2021, [cited Aug 27, 2021]. Available from: https://www.atsdr.cdc.gov/placeandhealth/svi/index.html ↑See Page 6