VJKM: Varians Jurnal Kesehatan Masyarakat

Volume 2 Issue 1, Juni 2024
DOI: https://doi.org/10.63953/vjkm.v2i1.11
Website: https://jurnalvarians.com/index.php/vjkm

The Role of Primary Health Facilities in Screening for Risk Factors for Chronic Kidney Disease (CKD): Literature Review Study

Joue Abraham Trixie[1*], Pratika Lawrence Sasube[2], Priska Priyanka Maluenseng[3], Abraham Daniel Boltal[4], Michael Alexander Solang[5]

[1]Epidemiology Study Program, Faculty of Public Health, University of Indonesia
[2]General Practitioner, Puskesmas Remu, Sorong City, West Papua
[3]General Practitioner, Sorong General Hospital, West Papua
[4]Medical Doctor Study Program, Faculty of Medicine, Papua State University
[5]General Practitioner, Hermina Jatinegara Hospital, Jakarta

Corresponding email: joue.abraham@ui.ac.id

INFO ARTIKEL

Article History
Received : 28 April 2024
Revised: 30 May 2024
Accepted : 05 June 2024

Kata Kunci:
Diabetes Melitus, Fasilitas Kesehatan Tingkat Primer, Hipertensi, Penyakit Ginjal Kronik

Keywords:
Chronic Kidney Disease, Diabetes Mellitus, Hypertension, Primary Level Health Facilities

ABSTRAK

Penyakit Ginjal Kronik (PGK) adalah masalah kesehatan yang serius karena berkaitan dengan kualitas dan ketahanan hidup. Penyakit ini sudah menjadi masalah di bidang Kesehatan Masyarakat. Fasilitas Kesehatan Tingkat Pertama (FKTP) memiliki peran penting dalam menghadapi beban ini. Fasilitas Kesehatan Tingkat Pertama dapat memainkan tiga peran: pencegahan tingkat primer, pencegahan tingkat sekunder, dan pencegahan tingkat lanjutan. Pencegahan tingkat primer mencegah seseorang untuk mengalami PGK, pencegahan tingkat sekunder menegakkan diagnosis sedini mungkin, dan pencegahan tingkat sekunder mencegah komplikasi yang mungkin terjadi.

ABSTRACT

Chronic Kidney Disease (CKD) is a grave health issue because it is related to quality and survival. This disease has become a problem in Public Health. Primary Level Health Facilities (PLHF) are essential in overcoming this burden. Primary Level Health Facilities can carry out three prevention measures: primary-level prevention, secondary-level prevention, and tertiary-level prevention. Primary-level prevention plays a role in preventing someone from experiencing CKD, secondary-level prevention plays a role in making a diagnosis as early as possible, and tertiary-level prevention plays a role in preventing complications that might occur.

e-ISSN: 3048-0108

INTRODUCTION

Chronic Kidney Disease (CKD) is a severe problem for an individual related to both life quality and survival. Additionally, if CKD has reached stage 5, kidney failure, the said person will most likely routinely undergo hemodialysis every week.[1] Based on the 2018 Basic Health Research (Riset Kesehatan Dasar / Riskesdas) data, the prevalence of CKD in Indonesia is 0.38%.[2]

Chronic Kidney Disease has become a problem in public health. The most apparent social impacts are substantial financial losses and loss of productivity.[3] In 2019, the Indonesian Social Security Administering Agency (BPJS) spent IDR 2.79 trillion on CKD treatment.[4] Hemodialysis services in Indonesia are not evenly distributed; even now, there are no hemodialysis services in Sorong Regency, even though the 2018 Riskedas results showed an increase in CKD prevalence from 2013 to 2018 in West Papua Province.[5]

Some of the many risk factors for CKD are diabetes mellitus, hypertension, and obesity.[5,6] Of course, this requires more attention regarding hemodialysis services in Indonesia. Moreover, the role of Primary Level Health Facilities (PLHF) in preventive programs for CKD.[7]

Kidney function cannot return to normal in kidney failure patients who have undergone routine hemodialysis. Therefore, the sooner a diagnosis of CKD is made, the better the prevention of kidney failure. This literature review discusses the role of primary health facilities in screening for CKD risk factors.

CHRONIC KIDNEY DISEASE AS A PUBLIC HEALTH PROBLEM

A disease considered a public health problem must meet four criteria: 1) impose a significant burden on society, a burden that is increasing significantly despite the efforts to control the disease; 2) the burden is unequally distributed in society; 3) there is evidence that upstream prevention strategies can significantly reduce the burden; and 4) prevention strategies do not yet to exist. Chronic kidney disease meets these four criteria.[8]

The burden of CKD is mainly driven by the prevalence of non-communicable diseases (NCDs), such as diabetes mellitus, hypertension, and obesity.[9] The results of the 2018 Riskesdas analysis show that 10% of respondents have NCDs.[2] Non-communicable diseases are a risk factor for CKD.[10]

The significant costs incurred by CKD are a global burden.[11] Another reason that makes CKD a burden for the country is that CKD patients also have a risk of developing cerebrovascular disease.[8] Such as stroke, which still is the most common cause of death in the world.[12]

HEMODIALYSIS SERVICES IN INDONESIA

In developing countries, many CKD patients die because they do not have access to hemodialysis services. The future increase in CKD patients will result in a significant financial burden, even for the wealthiest countries.[11]

A study by Kristina et al. (2020) shows that the economic burden of hemodialysis in Indonesia is high. Hemodialysis is the second largest service *BPJS Kesehatan* (Healthcare and Social Security Agency) provides, including laboratory costs and medicines. It is essential to develop a program to control the progression of CKD to chronic kidney failure so that the costs can be reduced.[13]

Until now, hemodialysis services have not been evenly distributed yet throughout Indonesia. In fact, there is no hemodialysis service in Sorong Regency, West Papua Province. If a patient is diagnosed with renal failure, the patient will be referred to the nearest city, such as Jayapura and Makassar. *BPJS Kesehatan* will not cover the transportation costs required by patients and companions.

QUALITY OF LIFE IN PATIENTS WITH CHRONIC KIDNEY FAILURE

Chronic Kidney Disease, especially in the early stages has yet to prove to have a significant negative impact on quality of life. Quality of life here includes social functions and roles in the family.[14] Both patients receive hemodialysis therapy and those who do not.[15] Since the beginning of the CKD stage, the patient's quality of life has decreased. Additionally, if the patient has a low income and hemoglobin level.[16]

A study by Yuliawati et al. (2021) in Bali shows that CKD patients tend to have a high level of education and income, which tends to have a good quality of life.[17] However, the incidence rate of CKD is higher in patients with lower levels of education.[18]

The burden of CKD affects not only the patient but also the family. The patient's family's

physical capacity can be impaired, for example, by fatigue. Renal failure patients must brought to the hemodialysis unit regularly. Also, the patients must be checked by a nephrology specialist or, at the very least, an internal medicine doctor at the due time. Other obstacles include the problem of long queues, which still needs to be solved for health insurance.[19]

Relations with fellow relatives and family are also disturbed. Some tend to be afraid to visit because they are worried they will be asked for help regarding financial assistance; this can happen in areas where insurance is unavailable. Mental fatigue and mild depressive disorders are also very likely to occur not only in the patient but also in those who take care of the patient.[19]

THE RELATIONSHIP BETWEEN CHRONIC KIDNEY DISEASE AND HYPERTENSION

The prevalence of hypertension is relatively high in CKD patients. The study by Aggarawal et al. (2022) showed that stage 3 CKD patients with systolic blood pressure < 130 mmHg had lower mortality when compared with systolic blood pressure < 140 mmHg.[20] The study by Hustrini et al. (2023) also showed that the proportion of hypertension in patients with renal failure is 74.2%.[21]

The kidneys are the organs that are the main target of hypertension.[22] Decreased kidney function will also worsen the condition of hypertension. Decreased nephron function, sodium retention, fluid volume expansion, regulation of the sympathetic nervous system, and the role of the renin-angiotensin-aldosterone hormone system are mechanisms that can explain the link between hypertension and chronic kidney failure.[22,23] Conversely, hypertension can also be a complication of CKD. The condition of hypertension will be worsened if the patient has poor compliance in taking medication.[24,25]

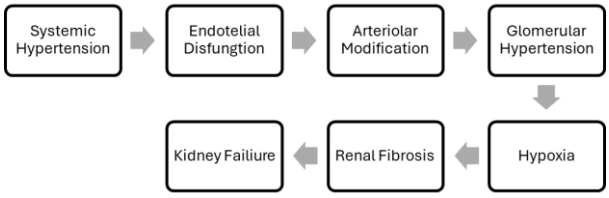

Figure 1.Relationship between Hypertension and Chronic Kidney Failure.

RELATIONSHIP BETWEEN CHRONIC KIDNEY DISEASE AND DIABETES MELLITUS

Hyperglycemia conditions can damage the blood vessels, both microvasculature and macrovasculature. Vascular damage causes albuminuria and decreased glomerular filtration rate. The longer a patient suffers from diabetes mellitus, the greater the patient's risk of developing CKD. They can worsened by the patient's lifestyle, such as smoking, rarely exercising, consuming alcohol, and obesity.[26] A study by Hustrini et al. (2023) shows that diabetes mellitus is the primary etiology of kidney failure.[21]

Insufficient insulin sensitivity will contribute to kidney damage. It will cause angiotensin II elevation, trigger proteinuria, and initiate cytokine production. The conditions are glomerular hyperfiltration, hypertrophy, hypercellularity, and widening of the mesangial area.[27]

Controlling diabetes mellitus is a form of prevention of CKD.[28] In fact, controlling diabetes mellitus also reduces mortality in CKD patients.[29] Likewise, CKD is a factor that influences the prognosis of diabetes mellitus patients.[30] Diabetes patients is vital for blood and urine screening for early detection to CKD.[31,32]

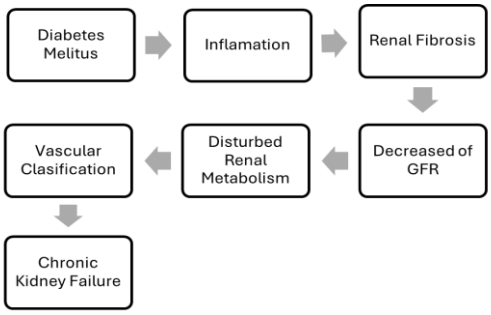

Figure 2. Relationship between Diabetes Mellitus and Chronic Kidney Failure

THE RELATIONSHIP BETWEEN CHRONIC KIDNEY DISEASE AND OBESITY

Obesity is closely linked to CKD. However, the specific relationship has yet to be discovered. Indirectly, obesity is related to diabetes mellitus and hypertension. Obesity is also related to hemodynamics, kidney structure, and histological changes in the kidney. Therefore, obesity is one of the causes of kidney failure.[27] Glomerulosclerosis caused by obesity will cause hyperfiltration, albuminuria, and impaired

filtration rate. Adipokine cells will also interfere with the response of kidney filtration.[33]

Obesity as a risk factor will be exacerbated if it has been experienced since childhood. Children who tend to play with gadgets and sweet snacks are one of the risks of obesity. Several studies show that the higher the GFR value and the lower body weight, will reduced proteinuria.[33]

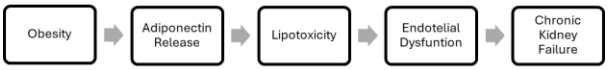

Figure 3. The Relationship between Obesity and Chronic Kidney Failure

COST BURDEN OF CHRONIC KIDNEY DISEASE IN INDONESIA

Chronic Kidney Disease is one of the catastrophic diseases with the highest costs, costing up to 6.5 trillion rupiah in 2021 (table 1). Compared to 2020, there is a 190% increase in costs. Some procedures, such as *Continuous Ambulatory Peritoneal Dialysis* (CAPD), hemodialysis, and organ transplants, can cost hundreds of millions of rupiah for one patient.[34,35]

A study by Nurtandhee (2023) estimates the cost of kidney failure patients in 2023 – 2025. Someone aged > 45 years is more likely to be diagnosed with kidney failure. Compared to women, the prevalence rate for men is higher. In 2023-2025, total medical costs will range between 2.4 and 3 trillion rupiah.[34] The most expensive treatment cost for CKD patients is hemodialysis. Hemodialysis can be done 1 – 3 times a week, the cost burden of CKD will continue to increase.

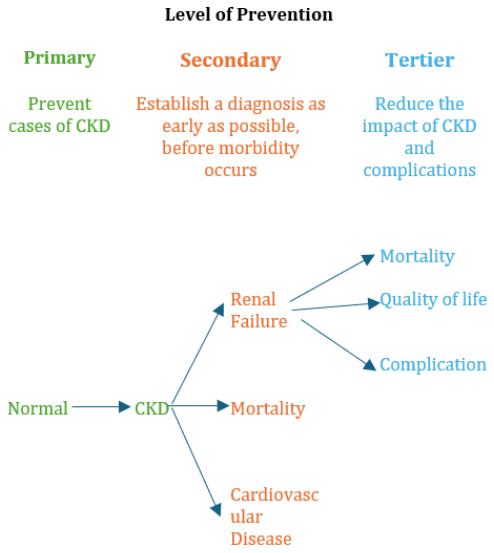

Table 1. Estimated Total CKD Cases and Total Hemodialysis Costs[34]

Year	Cases	Cost
2020	6,029,411	Rp 5,216,031,871.00
2021	5,489,579	Rp 4,748,818,479.300
2022	6,490,243	Rp 5,610,814,719.989
2023	6,822,682	Rp 5,979,680,659.232
2024	7,155,120	Rp 6,348,546,598,474
2025	7,487,558	Rp, 6,717,412,537.717

Kidney failure is one of the diseases that burden society economically because the costs are pretty significant, and the treatment time is quite long.[36] Therefore, it is necessary to create a scheme for controlling the financing of this disease well, especially in the health insurance scheme. If not, the burden on the state will continue to increase.

ADDRESSING THE BURDEN OF CHRONIC KIDNEY DISEASE FROM A PUBLIC HEALTH PERSPECTIVE

A study by Ke et al. (2022) shows that CKD burdens lower-middle-income countries.[35] Countries with lower middle income have high disability-adjusted life year rates (DALY).[37] The DALY rate is a measure that assesses the number of years lost divided by the number of years lived with disability.[36] A high DALY rate is related to risk factors, a weak health system, inadequate funding, and less effective access to health services.[37]

Bello et al. (2024), in the International Society of Nephrology Global Kidney Health Atlas, stated that the burden of CKD occurs in around all countries.[38] Chronic Kidney Disease has become a burden on society. Based on Minister of Health Regulation No. 75 of 2014 states that Community Health Centers (*Puskesmas*) have an essential role in the national health system. This role takes the form of a prevention program that includes primary-level prevention, secondary-level prevention, and tertiary-level prevention (Figure 4)[39,40]

PRIMARY LEVEL PREVENTION OF CHRONIC KIDNEY DISEASE

The incidence and prevalence of CKD continue to increase throughout the world because it is related to lifestyle. This lifestyle is also related to risk factors for CKD itself, such as hypertension and diabetes mellitus.[41] Primary-level prevention focuses on public awareness of risk factors for CKD. The main risk factors for CKD are diabetes mellitus and hypertension. An increase in glomerular filtration rate will cause damage to the kidneys. This generally occurs in patients with hypertension, diabetes mellitus, and obesity.[39]

Primary-level prevention can only be carried out in patients who are still healthy and have not experienced CKD. Furthermore, patients who are obese but yet to have hypertension or diabetes mellitus are already at risk. Appropriate health promotion includes education regarding physical activity and a healthy diet. Nutritious intake includes vegetables, reducing salt levels, reducing red meat, reducing high fiber, and reducing sugar intake.[39]

Even if the patient already has diabetes and hypertension, primary-level prevention can still be done to prevent further damage, such as CKD. For example, we can educate patients and their families to continue taking medication regularly and check in with the health center regularly.[39] The results of the 2023 Indonesian Health Survey/ *Survei Kesehatan Indonesia* (SKI) show that the prevalence of hypertension has decreased compared to 2018, but diabetes mellitus has increased compared to 2018.[42] Therefore, the challenges of primary-level prevention require special attention.

PREVENTION OF SECONDARY LEVEL OF CHRONIC KIDNEY DISEASE

Secondary prevention is carried out in patients who already have CKD. However, CKD patients in the early stages, stage 1, stage 2, stage 3a, and stage 3b, generally have no symptoms. Somebody with kidney damage can be detected with a urine examination because albumin findings can be marked as damage to the kidney. The earlier kidney damage is detected, the better it will be for slowing the damage.[39]

It is important to identify individuals at risk to reduce the burden of CKD.[8] Especially, if patients have poor compliance with routine medication consumption.[39] Primary health facilities are essential in screening for CKD risk factors. The screening is carried out by organizing an Integrated Development Post (Posbindu).[43]

Through the Posbindu program, people can be screened for the risk of kidney failure. One of them is hypertension. A study conducted by Fuada and Naning (2018) shows a relationship between knowledge of hypertension sufferers and the use of Posbindu. Education is carried out through posbindu activities.[44] The posbindu program needs to be evaluated periodically regarding human resources, financing, facilities, and infrastructure.[45]

The groups of people who need to be screened are those with hypertension, diabetes and cardiovascular disease.[11] Analysis of 2018 Riskesdas data shows that consuming fatty foods, drinking unhealthy drinks and diabetes mellitus are the risk factors that have the most influence on CKD.[2]

Apart from checking blood pressure and blood sugar, PLHF must be able to carry out urinalysis examinations. In the early stages of CKD, urine albumin examination is a sensitive test. The condition known as microalbumin can marked as there is damage on the kidney.[8] A statement by the American Heart Association regarding metabolic syndrome associated with the heart and kidneys, urinalysis examination when the glomerular filtration rate is still normal is important.[46]

Based on health minister no. 75 of 2014, article 38 states that community health centers must provide laboratory services. Urinalysis examinations include simple laboratory services.[47] Minister of Health Regulation 37 of 2012 states that community health centers can check creatinine and urea levels to determine kidney function.[48]

In health regulation no. 75 of 2014 states that community health centers in urban areas, rural areas, and remote and very remote areas are required to have medical laboratory technology experts.[47] Therefore, CKD screening must be held at the Community Health Center.

TERTIARY LEVEL OF PREVENTION OF CHRONIC KIDNEY DISEASE

Tertiary-level prevention is carried out in patients who already have CKD. At this level, prevention aims to minimize symptoms and maximize quality of life. Epidemiologically, tertiary-level prevention aims to reduce complications from CKD.[49]

For patients who already have CKD, the patient will routinely seek treatment at the hospital because a specialist in Nephrology, or at the very least internal medicine, can directly treat them. However, primary-level health facilities can still carry out tertiary-level prevention.[39] Tertiary-level prevention is difficult to separate from providing therapy. Therefore, administering medication to diabetes and hypertension patients is included in tertiary prevention.[49]

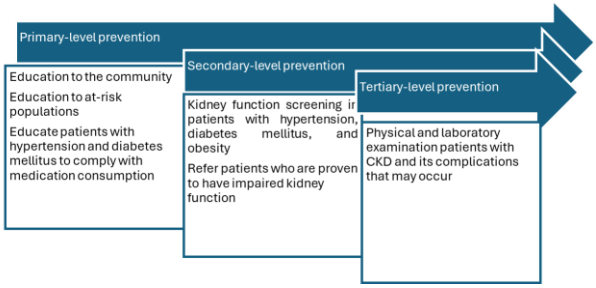

Figure 5. Primary Prevention, Secondary Prevention, and Tertiary Prevention of CKD in Primary Health Facilities

CONCLUSION

Chronic Kidney Disease is a burden for Indonesia. Therefore, primary health facilities have an important role in overcoming this burden.

REFERENCES

1. Dąbrowska-Bender M, Dykowska G, Żuk W, Milewska M, Staniszewska A. The impact on quality of life of dialysis patients with renal insufficiency. Patient Prefer Adherence. 2018 Apr 19;12:577–83.

2. Hidayangsih PS, Tjandrarini DH, Sukoco NEW, Sitorus N, Dharmayanti I, Ahmadi F. Chronic kidney disease in Indonesia: evidence from a national health survey. Osong Public Health Res Perspect. 2023 Feb;14(1):23–30.

3. Weiner DE. Public Health Consequences of Chronic Kidney Disease. Clin Pharmacol Ther. 2009 Nov;86(5):566–9.

4. BPJS Kesehatan Habiskan 6,4 Triliun untuk Pelayanan Gagal Ginjal pada 2018 hingga 2020 - Health Liputan6.com [Internet]. [cited 2024 Apr 28]. Available from: https://www.liputan6.com/health/read/4503346/bpjs-kesehatan-habiskan-64-triliun-untuk-pelayanan-gagal-ginjal-pada-2018-hingga-2020

5. Badan Penelitian dan Pengembangan Kesehatan -. Laporan Nasional Riskesdas 2018 [Internet]. Jakarta: Lembaga Penerbit Badan Penelitian dan Pengembangan Kesehatan; 2020 [cited 2024 Apr 28]. 628 p. Available from: https://repository.badankebijakan.kemkes.go.id/id/eprint/3514/

6. Kovesdy CP. Epidemiology of chronic kidney disease: an update 2022. Kidney Int Suppl. 2022 Apr;12(1):7–11.

7. Quiñones J, Hammad Z. Social Determinants of Health and Chronic Kidney Disease. Cureus. 12(9):e10266.

8. Schoolwerth AC, Engelgau MM, Rufo KH, Vinicor F, Hostetter TH, Chianchiano D, et al. Chronic Kidney Disease: A Public Health Problem That Needs a Public Health Action Plan. Prev Chronic Dis. 2006 Mar 15;3(2):A57.

9. Lv JC, Zhang LX. Prevalence and Disease Burden of Chronic Kidney Disease. In: Liu BC, Lan HY, Lv LL, editors. Renal Fibrosis: Mechanisms and Therapies [Internet]. Singapore: Springer; 2019 [cited 2024 Mar 11]. p. 3–15. (Advances in Experimental Medicine and Biology). Available from: https://doi.org/10.1007/978-981-13-8871-2_1

10. Arifin H, Chou KR, Ibrahim K, Fitri SUR, Pradipta RO, Rias YA, et al. Analysis of Modifiable, Non-Modifiable, and Physiological Risk Factors of Non-Communicable Diseases in Indonesia: Evidence from the 2018 Indonesian Basic

Health Research. J Multidiscip Healthc. 2022 Sep 30;15:2203–21.

11. Schieppati A, Remuzzi G. Chronic renal diseases as a public health problem: epidemiology, social, and economic implications. Kidney Int Suppl. 2005 Sep;(98):S7–10.

12. Feigin VL, Brainin M, Norrving B, Martins S, Sacco RL, Hacke W, et al. World Stroke Organization (WSO): Global Stroke Fact Sheet 2022. Int J Stroke Off J Int Stroke Soc. 2022 Jan;17(1):18–29.

13. Kristina S, Endarti D, Andayani T, Aditama H. Cost of illness of hemodialysis in Indonesia: A survey from eight hospitals in Indonesia. Int J Pharm Res. 2020 Dec 25;13.

14. Hakeem Ismael N, Omer Rashid A. Health-Related Quality of Life in End-Stage Renal Disease Patients and Healthy Individuals. Galen Med J. 2020 Dec 29;9:e1987.

15. So S, Li K, Hoffman AT, Josland E, Brown MA. Quality of Life in Patients with Chronic Kidney Disease Managed with or without Dialysis: An Observational Study. Kidney360. 2022 Jul 13;3(11):1890–8.

16. Kefale B, Alebachew M, Tadesse Y, Engidawork E. Quality of life and its predictors among patients with chronic kidney disease: A hospital-based cross sectional study. PLoS ONE. 2019 Feb 27;14(2):e0212184.

17. Yuliawati AN, Ratnasari PMD, Pratiwi IGAS. Hubungan Kepatuhan Pengobatan Dengan Kualitas Hidup Pasien Gagal Ginjal Kronik Disertai Hipertensi dan Menjalani Hemodialisis. J Manaj DAN PELAYANAN Farm J Manag Pharm Pract. 2022 Mar 31;12(1):28–39.

18. Thio CHL, Vart P, Kieneker LM, Snieder H, Gansevoort RT, Bültmann U. Educational level and risk of chronic kidney disease: longitudinal data from the PREVEND study. Nephrol Dial Transplant. 2020 Jul 1;35(7):1211–8.

19. Nimah L, Nursalam N, Wahyudi AS, Mariyanti H. Quality of Life of Family Caregivers of Patients Undergoing Dialysis: A Literature Review. SAGE Open Nurs. 2024 Jan 1;10:23779608241240124.

20. Aggarwal R, Petrie B, Bala W, Chiu N. Mortality Outcomes With Intensive Blood Pressure Targets in Chronic Kidney Disease Patients. Hypertens Dallas Tex 1979. 2019 Jun;73(6):1275–82.

21. Hustrini NM, Susalit E, Lydia A, Marbun MBH, Syafiq M, Yassir, et al. The Etiology of Kidney Failure in Indonesia: A Multicenter Study in Tertiary-Care Centers in Jakarta. Ann Glob Health. 89(1):36.

22. Griffin KA. Hypertensive Kidney Injury and the Progression of Chronic Kidney Disease. Hypertension. 2017 Oct;70(4):687–94.

23. Salem MM. Pathophysiology of hypertension in renal failure. Semin Nephrol. 2002 Jan;22(1):17–26.

24. Hameed MA, Dasgupta I. Medication adherence and treatment-resistant hypertension: a review. Drugs Context. 2019 Feb 4;8:212560.

25. Ponticelli C, Podestà MA, Moroni G. Hyperuricemia as a trigger of immune response in hypertension and chronic kidney disease. Kidney Int. 2020 Nov 1;98(5):1149–59.

26. McGrath K, Edi R. Diabetic Kidney Disease: Diagnosis, Treatment, and Prevention. Am Fam Physician. 2019 Jun 15;99(12):751–9.

27. Prasad R, Jha RK, Keerti A. Chronic Kidney Disease: Its Relationship With Obesity. Cureus. 14(10):e30535.

28. Nasri H, Rafieian-Kopaei M. Diabetes mellitus and renal failure: Prevention and management. J Res Med Sci Off J Isfahan Univ Med Sci. 2015 Nov;20(11):1112–20.

29. González-Pérez A, Saez M, Vizcaya D, Lind M, Garcia Rodriguez L. Incidence and risk factors for mortality and end-stage renal disease in people with type 2 diabetes and

diabetic kidney disease: a population-based cohort study in the UK. BMJ Open Diabetes Res Care. 2021 Oct;9(1):e002146.

30. Mihardja L, Delima D, Massie RGA, Karyana M, Nugroho P, Yunir E. Prevalence of kidney dysfunction in diabetes mellitus and associated risk factors among productive age Indonesian. J Diabetes Metab Disord. 2018 Mar 27;17(1):53–61.

31. de Boer IH, Khunti K, Sadusky T, Tuttle KR, Neumiller JJ, Rhee CM, et al. Diabetes Management in Chronic Kidney Disease: A Consensus Report by the American Diabetes Association (ADA) and Kidney Disease: Improving Global Outcomes (KDIGO). Diabetes Care. 2022 Oct 3;45(12):3075–90.

32. Gajjala PR, Sanati M, Jankowski J. Cellular and Molecular Mechanisms of Chronic Kidney Disease with Diabetes Mellitus and Cardiovascular Diseases as Its Comorbidities. Front Immunol. 2015 Jul 8;6:340.

33. García-Carro C, Vergara A, Bermejo S, Azancot MA, Sellarés J, Soler MJ. A Nephrologist Perspective on Obesity: From Kidney Injury to Clinical Management. Front Med [Internet]. 2021 Apr 13 [cited 2024 Mar 12];8. Available from: https://www.frontiersin.org/articles/10.3389/fmed.2021.655871

34. Nurtandhee M. Estimasi Biaya Pelayanan Kesehatan sebagai Upaya Pencegahan Defisit Dana Jaminan Sosial untuk Penyakit Gagal Ginjal. J Jaminan Kesehat Nas. 2023 Dec 29;3(2):84–101.

35. Ke C, Liang J, Liu M, Liu S, Wang C. 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. BMC Nephrol. 2022 Jan 5;23(1):17.

36. Global Burden of Disease (GBD) [Internet]. [cited 2024 Mar 21]. Available from: https://www.healthdata.org/research-analysis/about-gbd

37. Ameh OI, Ekrikpo UE, Kengne AP. Preventing CKD in Low- and Middle-Income Countries: A Call for Urgent Action. Kidney Int Rep. 2020 Mar 1;5(3):255–62.

38. 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 Mar 1;12(3):e382–95.

39. Li PKT, Garcia-Garcia G, Lui SF, Andreoli S, Fung WWS, Hradsky A, et al. Kidney health for everyone everywhere – from prevention to detection and equitable access to care. Braz J Med Biol Res. 2020 Mar 9;53(3):e9614.

40. Kidney Health Research Collaborative [Internet]. [cited 2024 Apr 4]. Kidney Disease Prevention. Available from: https://khrc.ucsf.edu/kidney-disease-prevention

41. Kuma A, Kato A. Lifestyle-Related Risk Factors for the Incidence and Progression of Chronic Kidney Disease in the Healthy Young and Middle-Aged Population. Nutrients [Internet]. 2022 Sep [cited 2024 Mar 22];14(18). Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9506421/

42. Survei Kesehatan Indonesia (SKI) 2023 [Internet]. Badan Kebijakan Pembangunan Kesehatan | BKPK Kemenkes. [cited 2024 Apr 28]. Available from: https://www.badankebijakan.kemkes.go.id/hasil-ski-2023/

43. Buku Pintar Kader Posbindu. Direktorat Jenderal Pencegahan dan Pengendalian Penyakit, Direktorat Pencegahan dan Pengendalian Penyakit Tidak Menular, Tahun 2019.

44. Fuadah DZ, Rahayu NF. Pemanfaatan POS Pembinaan Terpadu (POSBINDU) Penyakit tidak Menular (PTM) pada Penderita Hipertensi. J Ners Dan Kebidanan J Ners Midwifery. 2018 Apr 1;5(1):020–8.

45. Mahdur RR, Sulistiadi W. Evaluasi Program Pos Pembinaan Terpadu Penyakit Tidak Menular (Posbindu PTM). J Ilm Kesehat Masy Media Komun Komunitas Kesehat Masy. 2020 Apr 4;12(1):43–8.

46. A Synopsis of the Evidence for the Science and Clinical Management of Cardiovascular-Kidney-Metabolic (CKM) Syndrome: A Scientific Statement From the American Heart Association | Circulation [Internet]. [cited 2024 Mar 21]. Available from: https://www.ahajournals.org/doi/full/10.1161/CIR.0000000000001186

47. Database Peraturan | JDIH BPK [Internet]. [cited 2024 May 31]. Permenkes No. 75 Tahun 2014. Available from: http://peraturan.bpk.go.id/Details/139202/permenkes-no-75-tahun-2014

48. Permenkes No. 37 Tahun 2012 Tentang Penyelenggaraan Laboratorium Pusat Kesehatan Masyarakat [Internet]. [cited 2024 Apr 28]. Available from: https://peraturan.go.id/id/permenkes-no-37-tahun-2012

49. Nolte E. Disease Prevention. In: Heggenhougen HK (Kris), editor. International Encyclopedia of Public Health [Internet]. Oxford: Academic Press; 2008 [cited 2024 Apr 1]. p. 222–34. Available from: https://www.sciencedirect.com/science/article/pii/B9780123739605006754