

Cover letter

Intissar HADDIYA
Department of Nephrology
Faculty of medicine of Oujda
University Mohamed Premier
Oujda- Morocco

June 24th, 2020

Dear editor

I am pleased to submit an original article entitled (**How well are General practitioners informed about chronic kidney disease ?**) for consideration for publication in your valuable journal (BMC Nephrology).

I believe that this manuscript is appropriate for publication, because it aims to to assess the knowledge of general practitioners in the prevention, early detection and management of chronic kidney disease. In fact, General practitioners (GPs) represent the primary caregivers in our health system. They play an undeniable role in the care process, and should be able to manage patients at the beginning of the disease, ask for a specialized nephrology opinion and / or refer to a nephrology consultation at the appropriate time, reducing therefore, the morbidity and mortality inherent to delayed or unsuitable management of CKD.

This manuscript has not been published and is not under consideration for publication elsewhere. All the authors did approve it and do have no conflicts of interest to disclose.

Thank you for your consideration!

Sincerely,

Professor Intissar HADDIYA
Department of Nephrology
Faculty of medicine of Oujda
University Mohamed Premier
Oujda- Morocco

Research article

How well are General practitioners informed about chronic kidney disease ?

Intissar Haddiya, Jalal Elgharab, Y. Bentata

Department of Nephrology, Mohamed VI University hospital, Oujda-Morocco

Laboratory of Epidemiology, Clinical research and public health

Faculty of medicine and pharmacy of Oujda

Mohamed Premier University

Oujda-Morocco

Authors email addresses

Intissar HADDIYA intissarhaddiya@yahoo.fr

Jalal Elgharab jalalelgharab@gmail.com

Yassamine Bentata bentatayassamine@yahoo.com

Corresponding author

Pr Intissar HADDIYA

Department of Nephrology

Faculty of medicine of Oujda

University Mohamed Premier- Oujda-Morocco

intissarhaddiya@yahoo.fr

+212 661281400

Abstract:

Background : In most health systems, general practitioners (GPs) are the frontline caregivers. They, thus, should have the appropriate knowledge in order to detect, manage and refer patients to the specialist at the right time. In the context of Chronic kidney disease (CKD), a major public health issue, they have an important role to play in the care process. The purpose of this paper was to evaluate their CKD related knowledge.

Methods : We have performed a Cross-sectional survey, in the last trimester of 2019, that had included GPs practicing in Eastern morocco, using a Googleform questionnaire, based on the KDIGO 2012 guidelines.

Results : Our respondents' mean age was 42.4 ± 11.26 years old. 59% of them were women. Mean seniority in general practice was 14.3 ± 9.9 years. 64.47% worked in the public sector. 52.63% of GPs had insufficient CKD related knowledge. Less than half of the physicians could select the correct definition of CKD and only 29.61% knew that it is classified into five stages. Other than diabetes and high blood pressure, other CKD risk factors were identified by 38.15% of GPs. In addition, only 39.4% of the participants knew about peritoneal dialysis.

There was no statistically significant association between insufficient knowledge and the doctors' age ($p = 0.08$), gender ($p = 0.1$), seniority ($p = 0.06$) or sector of practice ($p = 0.4$).

Conclusion : Our study concluded to GPs' lack of CKD related knowledge. The continuing medical education of these frontline practitioners is mandatory in order to ameliorate patients management.

Keywords

General practitioners- Knowledge- Chronic kidney disease- Referral

Background:

Chronic kidney disease (CKD) is a major public health issue [1], and its prevalence is dramatically increasing worldwide. Moreover, CKD patients have higher cardiovascular risk and mortality rates in comparison to the general population [2-3].

In fact, many patients with CKD will require renal replacement therapy, which represents an economic burden for health systems [2]. Prevention, early detection and appropriate care are cost-effective strategies, especially in resource-limited countries, where access to renal therapies is often conditioned by financial constraints.

In Morocco, Maremar study, had estimated the prevalence of CKD at 5.1% of the general population [4]. In addition, CKD is constantly evolving in our country due to profound demographic changes (aging. Urbanization, and modern lifestyle) as well as the increase of risk factors such as diabetes, high blood pressure, obesity and dyslipidemia [5].

General practitioners (GPs) represent the primary caregivers in our health system. They play an undeniable role in the patient care process, and should be able to detect, manage patients at the beginning of the disease, ask for a specialized nephrology opinion and / or refer to a nephrology consultation at the appropriate time, reducing therefore, delayed or unsuitable CKD management inherent morbidity and mortality [6]. In the United States, GPs have been found to have many gaps in CKD related knowledge, including the appropriate time to refer patients to nephrologists [7]. Similar data were reported by other studies in Africa and Asia [2,8].

The purpose of this study was to assess the knowledge of general practitioners in the prevention, early detection and management of CKD.

Methods

We have conducted a cross-sectional survey that has enrolled GPs practicing in Oujda-Angad prefecture, Eastern Morocco, from September to December 2019, in order to assess their knowledge of CKD in terms of diagnosis and management.

We have developed a structured questionnaire **for this study**, based on KDIGO 2012- Chapter guidelines for chronic renal disease [9].

- The first part included doctors demographic data (age, sex, sector of activity (public, private), seniority as general practitioners).
- The second part was made of 15 questions (multiple choice as well as open questions) about CKD, divided into seven items as follows:
 - Definition and classification of CKD
 - Identification of CKD risk factors
 - CKD diagnosis methods and tools
 - CKD complications
 - Treatment and therapeutic targets of CKD
 - Reference to the nephrologist
 - Source of information

The questionnaire was previously tested on 10 GPs, then revised including changes based on the comments and suggestions of these first volunteers.

A rate of correct answers lower than 50% defined insufficient knowledge in terms of CKD

Inclusion criteria :

Consenting general practitioners practicing in Oujda-Angad prefecture.

Exclusion criteria

General practitioners working in a nephrology department or a dialysis center.

Data collection

We obtained a list of email addresses of 263 GPs practicing in Oujda-Angad prefecture through the regional council of physicians. Oujda-Angad prefecture is located in northeastern Morocco, and has a population of about 477,100 inhabitants. The questionnaire was spread via Googleform.

Ethical considerations:

This study was carried out in compliance with Moroccan laws and the Helsinki declaration on the protection of individuals. Physician participation was voluntary. All participants were informed of the objectives and procedures of the study. The questionnaire was anonymous without any request for personal information and the confidentiality of the data was guaranteed.

Statistical data

All statistical analyzes were carried out using the social science statistical

software SPSS (IBM SPSS statistics software version 21.0). Quantitative data were presented as means $\pm$ standard deviations. Qualitative data were expressed in frequencies and percentages. Associations between variables were analyzed by Chi-2 test or Fisher exact test. The threshold of statistical significance was set at a p value <0.05 .

Results

263 GPs were invited to participate to the survey, of whom 159 responded. The response rate for the questionnaire was 95.59% ($n = 152/159$) valid questionnaires.

Demographic data:

The mean age of GPs was 42.4 ± 11.26 years. 59% were women. The mean seniority in general practice was 14.3 ± 9.9 years. The average daily number of patients seen by the interviewed GPs was 38.2 ± 12.3 . 35.52% of GPs worked in the private sector, while 64.47% worked in the public sector.

Definition and stages of CKD

Of the 152 questioned physicians, 48.68% had selected the correct definition of CKD. However, only 29.61% knew the correct classification of CKD, while 31.57% said they had no idea about the right answer.

Identification of CKD risk factors

100% of GPs had identified diabetes and high blood pressure as risk factors for CKD. Obesity and acute renal failure were selected in 48.61% and 51.31% of the cases respectively.

However, only 38.15% had identified other risk factors, such as age over 60, family history of kidney disease, established cardiovascular disease and smoking.

CKD diagnosis

Serum creatinine was selected by 32.9% of the physicians as the best method for assessing renal function. Whereas, in 35.5% of the cases serum creatinine coupled with the estimated glomerular filtration rate (eGFR) were selected. Besides, eGFR alone was selected by 23.02% of the participating GPs .

Regarding the appropriate diagnosis tools in CKD, 68.42% had chosen to combine serum creatinine, eGFR, urinalysis (albuminuria / creatinuria) and

renal ultrasound to diagnose CKD. The remainder did only choose eGFR (16.4%), or kidney ultrasound (11.8%), or urinalysis (4.6%).

CKD Complications

82.23% of GPs selected hyperkalemia as a complication of CKD, and 75.65% chose anemia. CKD related Mineral and bone disorders were only selected by 38.15% of the respondents. Other complications such as malnutrition, fluid overload and metabolic acidosis were recognized as CKD complications only in 27.6%, 38.15% and 28.2% of the cases respectively.

Furthermore, only 34.8% of GPs could establish a link between CKD and cardiovascular complications.

CKD management

Blood pressure targets in CKD as recommended by KDIGO were recognized by 32.89% of the GPs. 49.34% of them did select renin angiotensin system inhibitors (RAS) when asked about the therapy of choice for blood pressure control and renal protection in CKD.

Regarding diabetes, 40% of the questioned doctors did not know when to screen type 1 diabetics for the presence of kidney disease. However, 51.3% of them had provided a correct answer for the appropriate time to screen kidney impairment in type 2 diabetes, and the correct target of HbA1c in patients with diabetes and CKD was recognized by 67.1% of GPs.

As for kidney replacement therapy, 100% of physicians cited kidney transplantation and hemodialysis as replacement therapies. Peritoneal dialysis was the least known treatment, mentioned only by 39.4% of the physicians.

Reference to the nephrologist

26.97% of GPs said they were unaware of the circumstances and the appropriate moment to refer patients with CKD to the nephrologist. An eGFR of 30 to 60 ml / min was selected by 34.86% of the GPs, 15-29 ml / min by 19.07%, and <15 ml / min by 39.47% of the GPs as the right eGFR that requires a reference to the nephrologist.

Main source of information

60.5% of the questioned doctors declared that their major source of information was scientific meetings. Whereas 25% of them revealed that they seek information mainly in medical journals while 15.78% did not answer the

question.

insufficient CKD knowledge associated factors

At the end of the survey, we observed that 52.63% of GPs had a total of correct answers less than 50%, which defined insufficient CKD related knowledge.

Factors associated with insufficient knowledge were assessed, and no statistically significant association was observed between insufficient knowledge and the doctors' age ($p = 0.08$), gender ($p = 0.1$), seniority of practice ($p = 0.06$) or the sector of activity ($p = 0.4$) (Table 1).

Table I: insufficient CKD knowledge associated factors in GPs

Parameters	Respondents 152 (100%)	Correct answers>50% (52.63%)	Correct answers<50% (47.36%)	p
Age (years)	42.4 $\pm$ 11.26	43.21 $\pm$ 10.1	41 $\pm$ 9.21	0.08
Sex				
Male	41%	37.5%	44.44%	0.1
Female	59%	60%	58.33%	
Seniority (years)	14.3 $\pm$ 9.9	13.1 $\pm$ 10.4	14.5 $\pm$ 7.01	0.06
Activity sector				
Public	64.47%	66.25%	61,11%	0.4
Private	35.52%	33.75%	38,88%	

Discussion

Our survey did highlight gaps in CKD related knowledge among the interviewed GPs, as 52.63% of them had insufficient knowledge in it. Less than half of the respondents were able to select the right definition of CKD and only 29.61% knew that CKD is classified into five stages. Apart from

diabetes and high blood pressure, the other risk factors were only identified by 38.15% of GPs. Hyperkalemia and anemia were the most recognized complications in 82.23% and 75.65% of the cases, respectively. In addition, all participants cited hemodialysis and kidney transplantation as kidney replacement therapies, while peritoneal dialysis, less used in our context, was only mentioned by 39.4% of participants.

GPs often represent the first line of care for CKD patients prior to referring them to nephrologists. Several studies have identified the late referral of these patients to a nephrologist as an important predictor of poor prognosis [10-11]. In order to reverse these data, it is imperative that GPs have a good knowledge of the disease [11]. In fact, information related to CKD preventive and treatment strategies is a subject of guidelines from national and international scientific societies [5, 9].

CKD is defined according to KDIGO as the presence of structural or renal function abnormalities, present for more than three months. It is classified into five stages on the basis of the eGFR [9]. CKD definition and classification are crucial to consider in order to develop a therapeutic plan for the patient. However, less than half of the interviewed physicians did choose the right definition of CKD and only 29.61% knew that it is classified into five stages. Studies carried out in developing countries in Asia and Africa had reported variable results, in terms of CKD definition, varying from 58.8% in Cameroon [2] to 48.8% in Pakistan [12]. Regarding the classification, 44% of the questioned doctors in Cameroon and 42% in Nigeria were able to define the five stages of CKD [12-13].

It is well established that diabetes and high blood pressure are important CKD risk factors. Consequently, diabetic and hypertensive patients require screening [14-15]. All of our participants identified these two factors. However, only 38.15% recognized other risk factors, such as age over 60, family history of kidney disease, active nephropathy, established cardiovascular disease and tobacco. These data indicate the need to draw more attention to the renal impact of these factors in initial medical education as well as in continuing education.

As for CKD diagnostic tools, 68.42% of GPs would combine serum creatinine, eGFR, urinalysis and kidney ultrasound to diagnose CKD. While 32.9% of the

participants thought that the best method of estimating renal function was serum creatinine "alone". Similar data were found in North American and Asian studies, where several interviewed doctors also considered serum creatinine alone for the diagnosis of CKD [7-8]. In fact, creatinine is affected by muscle mass, which varies according to age, sex, ethnic group and dietary protein intake [16], it is, therefore, recommended to use serum creatinine and eGFR for the assessment of renal function [9].

From CKD stage 3, progressive and irreversible kidney damage exposes patients to various complications including anemia, mineral and bone disease, gastrointestinal disorders as well as cardiovascular complications, and, in the advanced stages of CKD, hydroelectrolytic disorders such as fluid overload and hyperkalemia occur.

82.23% of GPs recognized hyperkalemia as a CKD complications, while 75.65% identified anemia. The other complications were recognized by less than 40% of the questioned physicians, and only 34.8% of GPs established a link between CKD and cardiovascular complications. Several authors have reported similar findings highlighting the lack of information of GPs about CKD complications. In most publications, anemia was the most identified complication by GPs [13,17, 8].

Furthermore, CKD management was essentially based on controlling risk factors, such as high blood pressure which in addition to accelerating the progression of kidney disease, leads to a high risk of cardiovascular disease. Data from a number of clinical trials demonstrated that antihypertensive therapy reduces these risks. [18].

KDIGO's recommend a target blood pressure (BP) <140/90 mm Hg in patients with CKD with urinary albumin excretion (UAE) <30mg / 24h, and a target BP ≤130 / 80 mmHg if the UAE is ≥30mg / 24h [9]. In our survey, the aforementioned BP targets were only selected by 32.89% of the questioned GPs. This was similar to data from various published surveys, in which few GPs knew the optimal systolic and diastolic BP in CKD [19,2, 8].

KDIGO's also recommend the use of RAS inhibitors in CKD when UAE ≥30mg / 24h, since they reduce BP and proteinuria, slow the progression of kidney disease and probably reduce the risk of cardiovascular disease [20]. 49.34% of GPs selected RAS inhibitors when they were asked about first line

therapy for blood pressure control and kidney protection. These results were reported by other surveys [8,19].

40% of the interviewed physicians did not know when to detect kidney disease in type 1 diabetic patients, and half of them selected the correct answer for type 2 diabetes. In addition, HbA1c target in diabetic patients with CKD was recognized by 67.1% of GPs. These results were similar to those published by other authors, and remain of particular concern since diabetes is the leading cause of renal failure worldwide [21-22]. Screening for diabetic nephropathy is recommended upon diagnosis in type 2 diabetes, due to an often asymptomatic period of several years. For type 1 diabetes, screening should begin five years after diagnosis.

What's more, HbA1C target should be individualized in non dialyzed CKD patients, ranging from <6.5% to <8.0% [23,9]. In our country, GPs play an important role in diabetes management and follow up, therefore, they must have the required knowledge to ensure this management.

Besides, hemodialysis is the most widely used kidney replacement therapy technique in our context. All participants did cite it, as well as kidney transplantation. However, peritoneal dialysis was mentioned by only 39.4% of physicians, which is preoccupying, as the lack of knowledge of this technique represents a real obstacle to its promotion [24-25].

Besides, several studies had shown that late referral to the nephrologist was generally associated with high morbidity and mortality [26-28]. 26.97% of GPs in our study said that they were unaware of the right moment as well as the reference circumstances of patients to the nephrologist. While 39.47% selected a eGFR <15 ml / min to refer the patients. Western data as well as studies from developing countries suggest that late referrals are quite common. Diegoli et al. had shown that late referral was associated to higher mortality in CKD and dialysis patients. [29]. In fact, good practice recommendations define the referral circumstances for patients with renal disease specialists, and should be known by GPs [9]. (Table 2).

Table II: CKD patients reference to the nephrologist Circumstances (according to KDIGO guidelines)[9].

Referral to specialist kidney care services for people with CKD is recommended in the following circumstances (1B):

- AKI or abrupt sustained fall in eGFR;
- GFR<30ml/min/1.73m²;
- A consistent finding of significant albuminuria (ACR ≥300mg/g [≥ 30mg/mmol] or AER ≥ 300 mg/24 hours, approximately equivalent to PCR ≥500mg/g [≥50mg/mmol] or PER ≥500 mg/24 hours;
- Progression of CKD
- Urinary red cell casts, RBC >20 per high power field sustained and not readily explained;
- CKD and hypertension refractory to treatment with 4 or more antihypertensive agents
- Persistent abnormalities of serum potassium
- Recurrent or extensive nephrolithiasis
- Hereditary kidney disease.

Timely referral for planning kidney replacement therapy in people with progressive CKD in whom the risk of kidney failure within 1 year is 10-20% or higher, as determined by validated risk prediction tools. (1B)

AKI: acute kidney injury; eGFR: estimated glomerular filtration rate; ACR: Albuminuria creatinuria ratio; AER: Albumin urinary secretion; PCR: Proteinuria Creatinuria ratio; PER: Protein excretion rate; CKD: Chronic kidney disease; RBC: red blood cell.

Regarding the main sources of information about CKD, 60.5% of the questioned doctors mentioned scientific events and only 25% of them revealed seeking information in medical journals. These rates are insufficient because continuing medical education is crucial for front-line practitioners and should be structured, regular and targeted, including primary and secondary prevention of CKD, as well as the circumstances of referral to the nephrologist, in order improve patients care and clinical outcomes.

As for the factors associated to GPs' insufficient knowledge of CKD, we did not find any significant associations between insufficient knowledge and the assessed parameters, namely: the age of the doctors, their gender, seniority and sector of activity. Authors that had studied this topic, had concluded to the

poor spreading of scientific societies guidelines, as well as to the lack of continuing medical education dedicated to CKD, as main factors of lack of CKD related knowledge among GPs [2,8,30].

Conclusion

Our survey pointed out GPs insufficient CKD related knowledge in terms of diagnosis and management. Efforts are needed to spread CKD recommendations of good clinical practice to these front-line practitioners who play a decisive role in our health system. In addition, continuing medical education should focus on prevention of CKD, as well as referral circumstances to the nephrologist, in order to improve overall patients management.

Abbreviations

AKI : Acute kidney injury

BP : Blood pressure

CKD : Chronic kidney disease

eGFR : Estimated glomerular filtration rate

GP: General practitioner

KDIGO: Kidney disease improving global outcomes

PCR : Proteinuria creatinuria ratio

PER : Protein excretion rate

RAS : Renin angiotensin system

RBC : Red blood cells

SPSS : Statistical package for social sciences

UAE : Urinary albumin excretion

Declarations

Ethics approval and consent to participate

Our study was carried out in compliance with **the ethics guidelines of the Moroccan law concerning the protection of human subjects participating in biomedical research (31)**. The **authorization to carry out the study was obtained from the moroccan Ministry of Health as well as from the chief of each participating healthcare facility**. Prior to participation to the survey, we explained the purpose of the study and informed the general practioners that participation was voluntary and that all

data will be anonymous and confidential. **Verbal consent** was obtained before respondents completed the anonymous questionnaires.

Consent for publication

Consent for publication was not required for this manuscript as it does not include details, images or videos relating to individuals. The participating doctors were anonymous and the manuscript does not include any detail that could identify them.

Availability of data and materials :

All data generated or analyzed during this study are included in this published article

Competing interests :

The authors declare that they have no competing interests

Funding :

None

Authors' contributions

All authors (I.H,J.G., Y.B.) made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; have agreed on the journal to which the article will be submitted; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

Acknowledgements

We acknowledge the valuable help and support of Eastern Moroccan general practitioners who voluntarily participated to the present study and made it possible, in order to enable us to improve the care of chronic kidney patients.

References:

- 1- Kim KM, Oh HJ, Choi HY, Lee H, Ryu DR. Impact of chronic kidney disease on mortality: A nationwide cohort study. *Kidney Res Clin Pract.* 2019;38(3):382-390
- 2- Choukem S.P., Nchifor P. K., Halle M.-P., et al. Knowledge of physicians on chronic kidney disease and their attitudes towards referral, in two cities of

Cameroon: a cross-sectional study. BMC Res Notes.2016; 9:29

3- Subbiah AK, Chhabra YK, Mahajan S. Cardiovascular disease in patients with chronic kidney disease: a neglected subgroup. Heart Asia. 2016;8(2):56-61

4-Benghanem Gharbi M., Elseviers M, Zamd M et al. Chronic kidney disease, hypertension, diabetes, and obesity in the adult population of Morocco: how to avoid "over"- and "under"-diagnosis of CKD. Kidney Int. 2016 ; 89 (6) : 1363–71

5-Recommandations de bonne pratique médicale. Affection longue durée, ALD 17, Insuffisance rénale terminale. Mars 2013. CIM 10: N 18 Code ANAM : L008.

6- Crinson I, Gallagher H, Thomas N, et al. How ready is general practice to improve quality in chronic kidney disease? A diagnostic analysis. British Journal of General Practice 2010; 60 (575): 403-409.

7- Fox C, Brooks A, Zayas L, et al. Primary care physicians' knowledge and practice patterns in the treatment of chronic kidney disease: an upstate New York practice-based research Network (UNYNET) study. J Am Board Fam Med. 2006;19(1):54–61.

8- Yaqub S, Kashif W, Raza MQ, et al. General practitioners' knowledge and approach to chronic kidney disease in Karachi, Pakistan. Indian J Nephrol 2013;23:184-90.

9- Eknoyan G., Lameire N., Eckardt K., et al., "KDIGO 2012 clinical practice guideline for the evaluation and management of chronic kidney disease," Kidney Int Suppl. 2013 ; 3 (1) : 5–14.

10- Fischer M, J, Ahya S, N, Gordon E, J: Interventions to Reduce Late Referrals to Nephrologists. Am J Nephrol 2011;33:60-69

11- Helal I, Hamida FB, Abderrahim E, Goucha R, Kaaroud H, Elyounsi F, et al. Early nephrology referral influences on mortality of dialysis patients in developing country [abstract]. NDT Plus 2010;3(Suppl 3):iii409–10.

- 12-Tamizuddin S., Ahmed W. Knowledge, attitude and practices regarding chronic kidney disease and estimated GFR in a tertiary care hospital in Pakistan. *J Pak Med Assoc.* 2010;60(5):342–6.
- 13-Agaba E., Agaba P., Dankyau M., et al. Specialist physician knowledge of chronic kidney disease: a comparison of internists and family physicians in West Africa. *Afr J Prm Health Care Fam Med.* 2012;4(1):7.
- 14- Verma A, Vyas S, Agarwal A, Abbas S, Agarwal DP, Kumar R. Diabetic Kidney Disease and Hypertension: A True Love Story. *J Clin Diagn Res.* 2016;10(3):OC11-OC13
- 15- Wang, Y; Zhong, B ; Li, Y. et al. Relationship of diabetes with renal dysfunction in hypertensive adults, *Medicine*: 2017; 96(24): e7169
- 16- Fiseha, T., Mengesha, T., Girma, R. et al. Estimation of renal function in adult outpatients with normal serum creatinine. *BMC Res Notes* 12, 462 (2019).
- 17-Agrawal V, Agarwal M, Ghosh AK, et al. Identification and management of chronic kidney disease complications by internal medicine residents: a national survey. *Am J Ther.* 2011;18(3):e40–7.
- 18- Baltatzi M, Savopoulos Ch, Hatzitolios A. Role of angiotensin converting enzyme inhibitors and angiotensin receptor blockers in hypertension of chronic kidney disease and renoprotection. Study results. *Hippokratia.* 2011;15(Suppl 1):27-32.
- 19- Van Dipten, C., van Berkel, S., de Grauw, W.J.C. et al. General practitioners' perspectives on management of early-stage chronic kidney disease: a focus group study. *BMC Fam Pract* . 2018;19, 81.
- 20-KDIGO BP Work Group. KDIGO clinical practice guideline for the management of blood pressure in chronic kidney disease. *Kidney int Suppl.* 2012; 2: 337–414.

- 21- Collins A., Vassalotti J., Wang C., Li S., et al. Who should be targeted for CKD screening? impact of diabetes, hypertension, and cardiovascular disease. *Am J Kidney Dis.* 2009; 53(3):S71–7.
- 22- National Kidney Foundation. KDOQI clinical practice guideline for diabetes and chronic kidney disease: 2012 Update. *Am J Kidney Dis* 2012; 60: 850–86.
- 23- Lim AKh. Diabetic nephropathy - complications and treatment. *Int J Nephrol Renovasc Dis.* 2014;7:361-381
- 24- Briggs V, Davies S, Wilkie M. International Variations in Peritoneal Dialysis Utilization and Implications for Practice. *Am J Kidney Dis.* 2019;74(1):101-110. doi:10.1053/j.ajkd.2018.12.033
- 25- Perl J, Davies SJ, Lambie M, et al. The Peritoneal Dialysis Outcomes and Practice Patterns Study (PDOPPS): Unifying Efforts to Inform Practice and Improve Global Outcomes in Peritoneal Dialysis. *Perit Dial Int.* 2016;36(3):297-307.
- 26- Lee J, Lee JP, An JN, et al. Factors Affecting the Referral Time to Nephrologists in Patients With Chronic Kidney Disease: A Prospective Cohort Study in Korea. *Medicine (Baltimore).* 2016;95(19):e3648.
- 27- Diegoli H., Silva Castro Gonçalves M., Diogo Spengler Barcelos M., et al.. Late nephrologist referral and mortality association in dialytic patients. *J Bras Nefrol.* 2015; 37(1): 32-7.
- 28- Black C, Sharma P, Scotland G, et al. Early referral strategies for management of people with markers of renal disease: a systematic review of the evidence of clinical effectiveness, cost-effectiveness and economic analysis. *Health Technol Assess.* 2010;14(21):1-184.
- 29- Diegoli H; SILVA, M., Gonçalves C; et al. Late nephrologist referral and mortality association in dialytic patients. *J. Bras. Nefrol.* [online]. 2015; 37(1): 32-37

30-Frimat L1, Siewe G, Loos-Ayav C, et al. Chronic kidney disease: do generalists and nephrologists differ in their care? *Nephrol Ther.* 2006; 2(3):127-35

31- Law No. 28-13 on the Protection of Persons Participating in Biomedical Research. (In French) available at: <http://adala.justice.gov.ma/production/html/Fr/190513.htm> last accessed July 1st, 2020

