Prevalence of chronic kidney disease in a representative sample of the Polish population: results of the NATPOL 2011 survey

Łukasz Zdrojewski¹, Tomasz Zdrojewski², Marcin Rutkowski², Piotr Bandosz², Ewa Król¹, Bogdan Wyrzykowski³ and Bolesław Rutkowski¹

¹Department of Nephrology, Transplantology and Internal Medicine, Medical University of Gdansk, Gdansk, Poland, ²Department of Prevention and Medical Education, Medical University of Gdansk, Gdansk, Poland and ³Department of Hypertension and Diabetology, Medical University of Gdansk, Gdansk, Poland

Correspondence and offprint requests to: Łukasz Zdrojewski; E-mail: luke@gumed.edu.pl

ABSTRACT

Background. Chronic kidney disease (CKD) has been proven to be a major risk factor of cardiovascular disease (CVD). Until now, data on the prevalence of CKD among adults in Poland were limited. The NATPOL 2011 survey is a cross-sectional observational study designed to assess the prevalence and control of CVD risk factors in Poland, and the first study capable of evaluating CKD prevalence in adult Polish citizens.

Methods. Serum creatinine concentration and the urine albumin-to-creatinine ratio (ACR) were measured in 2413 randomly selected participants (ages 18–79 years) from a national survey study. CKD was diagnosed if the estimated glomerular filtration rate (eGFR) was <60 mL/min/1.73 m² or ≥60 mL/min/1.73 m² with coexisting albuminuria (ACR ≥ 30 mg/g). Additionally, comorbidities and anthropometric and social factors related to the prevalence of CKD were analysed.

Results. The prevalence of CKD was estimated at 5.8% [95% confidence interval (95% CI) 4.6–7.2] using Chronic Kidney Disease Epidemiology Collaboration formula. The general prevalence was higher when the MDRD was applied [6.2% (95% CI 4.0–7.6)]. An eGFR <60 mL/min/1.73 m² was found in 1.9% (95% CI 1.5–2.5) of the studied population. This was accompanied by low awareness of this condition (14.9%). The frequency of albuminuria was estimated at 4.5% (95% CI 3.4–5.9). Diabetes mellitus (DM) and arterial hypertension (AH) were more frequent among respondents with diagnosed CKD compared with those without CKD [18.5 versus 4.5% (P < 0.001) and 67.8 versus 29.0% (P < 0.001) respectively]. DM and AH were, apart from increasing age, the two greatest risk factors of CKD.

Conclusion. The estimated prevalence of CKD among adults in Poland is 5.8% (∼1 724 960 patients). Its prevalence was lower than expected. CKD is more frequent in older subjects, smokers and people with comorbidities such as AH and DM.

Keywords: albuminuria, chronic kidney disease, eGFR formula, glomerular filtration rate, national population survey

INTRODUCTION

Chronic kidney disease (CKD) is a well-defined pathologic condition of loss of kidney function or the presence of morphological damage to the kidney [1]. CKD has been widely recognized as an independent risk factor of cardiovascular disease (CVD) [2, 3]. On the basis of numerous epidemiological studies performed throughout the world, the prevalence of CKD has been established at 10–16% of studied populations [4–13]. Until now, data on the prevalence of CKD in Poland were based on the PolNef study, conducted in one region and extrapolated to the whole country population [14]. Recently, another analysis, based on the PolSenior study, showed a high (29.4%) prevalence of CKD among elderly Polish citizens [15]. Until now, however, data have been missing describing epidemiology of CKD in a representative group of Polish adults.

The NATPOL 2011 survey was the third edition of a cross-sectional observational study aimed at assessing the prevalence and control of CVD risk factors in Poland [16]. For the first time, however, markers of kidney function and damage were included in the study design, allowing analysis of the prevalence of CKD.
residents ages 18–79 years. The planned sample size was 2400 subjects. An assumption was made that the margin of error should be <3% for a feature of 30% prevalence, with a statistical significance level of 0.05. Research participants were randomly recruited using multistage, stratified (by age, sex and place of residence) and clustered sample design. In the first stage, 60 territorial strata were defined according to geographic location and population density. Then, in each territorial stratum, municipalities were drawn, each with a probability proportional to their population sizes. In each municipality, streets (in urban municipalities) and villages (in rural ones) were randomly selected. In the last stage, individual respondents were selected, using the PESEL database (Polish Universal Electronic System for Registration of the Population). Supplementary sets of individuals were selected to be used if the target quantity of interviews was not reached, to satisfy the expected response rate level. More detailed information about the sampling procedure has been described elsewhere [16, 17].

Being on dialysis and after renal transplantation were not exclusion criteria in the study. However, there was only one respondent after renal transplantation in our database. Apart from that person, no one else on any type of renal replacement therapy (RRT) was selected to participate in the study.

The study involved a questionnaire interview, blood pressure and anthropometric measurements and blood and urine sample collection. This was performed by trained nurses during two visits at the subjects’ homes. The response rate was 66.5%. Overall, data from 2413 participants (1245 females (F) and 1168 males (M)) were studied. The structure of the study sample reflected the structure of the adult population quite well, though the weight adjustments were performed for epidemiological analyses to adjust the sample to the general population of Poland in 2011, according to the Central Statistical Office (Warsaw, Poland) [16].

Serum and urine samples were taken to the central certified laboratory for further analysis. The concentration of serum and urine creatinine was measured with an enzymatic method. Albuminuria was measured once in a morning urine sample using a high-sensitivity immunoturbidimetric method (Abbott Laboratories). Estimated glomerular filtration rate (eGFR) was determined with both the abbreviated re-expressed Modification of Diet in Renal Disease (MDRD4) formula and the 2009 Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) formula [18–20]. The albumin-to-creatinine ratio (ACR) was used as a diagnostic tool to assess excretion of albumin. An ACR ≥30 mg/g is a recognized marker of kidney damage and increased glomerular permeability, known as albuminuria. CKD was diagnosed for an eGFR <60 mL/min/1.73 m² or eGFR ≥60 mL/min/1.73 m² with coexisting albuminuria (ACR ≥30 mg/g). Subjects diagnosed with CKD were afterwards subdivided into CKD stages according to Kidney Disease: Improving Global Outcomes (KDIGO) guidelines: Stages G1 and G2A2–3 (eGFR ≥60 with albuminuria) and Stages G3a (45–59), G3b (30–44), G4 (15–29) and G5 (<15 mL/min/1.73 m²) [1, 21]. Diagnosis of diabetes was based on the patient’s declaration and/or if the fasting glucose was ≥126 mg/dL on two separate measurements. Arterial hypertension (AH), on the other hand, was diagnosed when blood pressure values of two measurements taken on two separate visits were ≥140/90 mmHg and/or the patient was receiving a hypotensive drug(s).

Additional data were obtained in the form of answers to questions included in a questionnaire checking the subject’s awareness of having renal insufficiency, proteinuria or the presence of nocturia and determining the subject’s socio-economic and educational background. Statistical analysis was performed with the use of the Complex Samples Module of SPSS Statistics v19 (IBM, Armonk, NY, USA), taking into account complex survey design. The chi-square test was used to assess statistical significance. Logistic regression analysis was performed to calculate odds ratios (ORs) and confidence intervals (CIs).

RESULTS

CKD

On the basis of the above-mentioned criteria, 164 respondents (F: 86, M: 78) reached the diagnosis of CKD: 19 were ages 18–39 years, 51 ages 40–59 years and 94 ages 60–79 years. The mean age in the CKD group was 60.2 years. The prevalence of CKD standardized to the general population was 5.8% [F: 6.2%, M: 5.3% (P = 0.475)] (Table 1). CKD was least frequent in the age group 18–39 years, reaching 1.8% [F: 2.0%, M: 1.6% (P = 0.725)]. In the age group 40–59 years, prevalence was 5.5% [F: 5.3%, M: 5.7% (P = 0.822)]. The highest CKD prevalence of 15.3% [F: 16.2%, M: 14.2% (P = 0.621)] was observed in the age group 60–79 years. A percentage distribution of CKD stages among patients with CKD (Supplementary data, Figure S1) shows that the vast majority (67.6%) are those with normal eGFR (>60 mL/min/1.73 m²) but significant albuminuria (≥30 mg/g)—CKD stages G1A2–3 and G2A2–3. The rest of the CKD patients are subdivided to stages G3a (24.4%), G3b (6.5%), G4 (0.7%) and G5 (0.8%). When presented as a percentage of the general Polish population, the frequencies of CKD stages are G1A2–3, 2.5%; G2A2–3, 1.5%; G3a, 1.4%; G3b, 0.4%; G4: 0.04% and G5, 0.04%. The prevalence of the two earliest CKD stages G1A2–3 and G2A2–3 was ~3.9% (95% CI 2.9–5.3). Therefore, it can be estimated that in Poland, 1724 960 (95% CI 1 321 907–2 128 012) adults between 18 and 79 years of age suffer from CKD.

The diagnosis of CKD is influenced by the diagnostic method applied. Recent guidelines suggest use of the CKD-EPI rather than MDRD formula. In this study, both methods were applied to observe any epidemiological bias (Table 1 and Supplementary data, Table S6). A higher frequency of CKD was found when the MDRD formula was used to estimate eGFR (6.2%) compared with the CKD-EPI formula (5.8%, statistically not significant). However, the results could suffer greater bias if the formerly used reference intervals for albuminuria were used.

**eGFR < 60 mL/min/1.73 m²**

Renal failure awareness, defined as an eGFR <60 mL/min/1.73 m², was surprisingly low. Only 14.9% of respondents were aware of having the disease. After standardization to the general population, awareness was 12.3% (F: 8.0%, M: 18.4%). Awareness increased with a decrease in the eGFR value.
In Table 2, the frequency of decreased eGFR (≤60 mL/min/1.73 m²) is presented. It is estimated that decreased eGFR was present in 1.9% (95% CI 1.5–2.5) of Polish residents. The frequency was higher in women (F: 2.2 versus M: 1.6%, P = 0.327). This tendency was observed in both the middle-age and oldest age groups. Due to the relatively small number of women ages 18–39 years with decreased eGFR in our sample, we cannot present reliable results in this group. The frequency of decreased eGFR increased with age, reaching 8.1% in the oldest age group.

### Albuminuria

With the criterion of ACR ≥ 30 mg/g, the prevalence of albuminuria was estimated as 4.5%. Again, a correlation of albuminuria and increasing age was observed. The frequency of albuminuria was almost equal in men and women. However, in the age group 18–39 years, albuminuria was more predominant among women, whereas in older age groups (40–59 and 60–79 years), it was more common in men (Table 2). The KDIGO 2012 Guidelines divide the ACR result into three categories: <30 mg/g (A1, normal to mildly increased), 30–300 mg/g (A2, moderately increased) and >300 mg/g (A3, severely increased). This is thought to have impact on the further prognosis and progression of CKD. In our analysis, we found that moderately increased ACR is almost 6-fold more frequent than severely increased ACR (Supplementary data, Figure S2).

### Risk stratification

On the basis of proposed by KDIGO guidelines method of cardio-renal events risk assessment, data on eGFR and albuminuria were adopted to analyse the risk for the investigated population. (Table 3) [1]. The vast majority of the population is assigned to the low risk category, which includes those with low and mildly increased urine excretion of albumin (ACR < 30 mg/g). Approximately 4.7% were burdened with moderately increased risk. This group mainly consists of those who have just crossed the line of decreased eGFR or have moderately increased albuminuria. The high-risk and very high-risk groups have low prevalences of 0.8 and 0.4%, respectively.

### Comorbidities

Diabetes mellitus (DM) and AH are the two most frequent causes of CKD development and progression. DM is four times more frequent in respondents with CKD (18.5 versus 4.5%, P < 0.001) (Table 4). In the age-adjusted model, the OR of having DM was 1.9 (95% CI 1.1–3.21) in patients with CKD compared with subjects without CKD. In population of patients with CKD, the prevalence of DM was 20.3% (95% CI 13.9–28.7). A 2-fold increase in AH frequency was noticed in respondents with CKD compared with those without the disease (67.8 versus 29.0%, P < 0.001) (Table 4). In the logistic regression model, the age-adjusted OR of having AH was 1.47 (95% CI 1.1–2.14). Among subjects with an established diagnosis of AH, CKD was present in 12.6% (95% CI 9.7–16.2).

### Predictors of CKD

Logistic regression models were created to find the predictors of CKD, albuminuria and decreased eGFR (Table 5). As...

---

**Table 1. CKD prevalence standardized to resident population depending on applied diagnostic criteria**

<table>
<thead>
<tr>
<th>CKD criteria</th>
<th>Age 18–79 years</th>
<th>Age 18–39 years</th>
<th>Age 40–59 years</th>
<th>Age 60–79 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>CKD-EPI eGFR &lt; 60 mL/min/1.73 m² and/or ACR ≥ 30 mg/g</td>
<td>%</td>
<td>95% CI</td>
<td>%</td>
<td>95% CI</td>
</tr>
<tr>
<td>F + M</td>
<td>5.8</td>
<td>4.6–7.2</td>
<td>1.8</td>
<td>1.1–3.0</td>
</tr>
<tr>
<td>F</td>
<td>6.2</td>
<td>4.4–8.7</td>
<td>2.0</td>
<td>1.1–3.8</td>
</tr>
<tr>
<td>M</td>
<td>5.3</td>
<td>4.1–6.8</td>
<td>1.6</td>
<td>0.7–3.8</td>
</tr>
<tr>
<td>CKD-EPI eGFR &lt; 60 mL/min/1.73 m² and/or ACR ≥ 17 mg/g for men and ACR ≥ 25 mg/g for women</td>
<td>%</td>
<td>95% CI</td>
<td>%</td>
<td>95% CI</td>
</tr>
<tr>
<td>F + M</td>
<td>8.4</td>
<td>7.0–10.1</td>
<td>3.5</td>
<td>2.4–5.1</td>
</tr>
<tr>
<td>F</td>
<td>7.4</td>
<td>5.5–9.9</td>
<td>3.1</td>
<td>1.7–5.5</td>
</tr>
<tr>
<td>M</td>
<td>9.5</td>
<td>7.5–12.0</td>
<td>3.9</td>
<td>2.4–6.5</td>
</tr>
</tbody>
</table>

**Table 2. Prevalence of decreased eGFR and albuminuria**

<table>
<thead>
<tr>
<th></th>
<th>Age 18–79 years</th>
<th>Age 18–39 years</th>
<th>Age 40–59 years</th>
<th>Age 60–79 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decreased eGFR prevalence (&lt;60 mL/min/1.73 m²; CKD-EPI eGFR)</td>
<td>%</td>
<td>95% CI</td>
<td>%</td>
<td>95% CI</td>
</tr>
<tr>
<td>F + M</td>
<td>1.9</td>
<td>1.5–2.5</td>
<td>0.06</td>
<td>0.01–0.5</td>
</tr>
<tr>
<td>F</td>
<td>2.2</td>
<td>1.6–3.0</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>M</td>
<td>1.6</td>
<td>1.0–2.6</td>
<td>0.1</td>
<td>0.02–0.9</td>
</tr>
<tr>
<td>Albuminuria prevalence (ACR ≥ 30 mg/g; albuminuria stages A2–3)</td>
<td>%</td>
<td>95% CI</td>
<td>%</td>
<td>95% CI</td>
</tr>
<tr>
<td>F + M</td>
<td>4.5</td>
<td>3.4–5.9</td>
<td>1.7</td>
<td>1.0–3.0</td>
</tr>
<tr>
<td>F</td>
<td>4.4</td>
<td>2.8–7.0</td>
<td>2.0</td>
<td>1.0–3.8</td>
</tr>
<tr>
<td>M</td>
<td>4.5</td>
<td>3.4–6.0</td>
<td>1.5</td>
<td>0.6–3.6</td>
</tr>
</tbody>
</table>

NATPOL 2011 population: 2413 (F: 1245, M: 1168), 18–79 years of age; population with eGFR < 60 mL/min/1.73 m²: 80; population with ACR ≥ 30 mg/g: 116. F, female; M, male.
expected, the strongest associations of CKD and albuminuria were found for comorbidities such as hypertension and diabetes. Mean blood pressure was a single factor closely related to CKD. Additionally, ageing was identified to have positive correlation with CKD morbidity and eGFR decrease, but its association with albuminuria was not statistically significant. On the other hand, albuminuria was a strong predictor of decreased eGFR [OR 6.34 (95% CI 2.42–16.58)]. Social factors such as a higher level of education were associated with better kidney function among men [OR 0.205 (95% CI 0.50–0.79)]. In women, smoking was shown to be a predictor of CKD.

**DISCUSSION**

It had been previously estimated that CKD affects 10–16% of the adult population in Asia, Australia, Europe the and the USA [4–12]. In the PolNef study, the only observational study performed in Poland aimed at diagnosing CKD with special emphasis on detection of albuminuria, the prevalence reached 11.9%. Taking these numbers into account, the results of our analysis presented in this article—principally the general prevalence of CKD—seem to be surprisingly low. However, it should be taken into account that there are several important aspects in methodology of the NATPOL 2011 study that make its results unique and reliably accurate. First, the study was carried out on a representative sample of Polish residents ages 18–79 years. Results were presented proportionally to actual percentage representation of age subgroups; any possible overestimation of general prevalence caused by high morbidity among older respondents was excluded. Second, the diagnostic methods we used are recommended by leading scientific societies [1]. Therefore, our main diagnostic tool to estimate eGFR was the CKD-EPI formula, whereas in most of the above-mentioned studies, the MDRD4 formula was used. The proper formula choice has recently been a matter of major discussion in leading academic journals in the field of nephrology. There has been substantial evidence presented to support an opinion that the CKD-EPI is more accurate to describe eGFR, especially in terms of large population studies. It has also been proven to be more accurate especially with higher values of eGFR, thus leading to exclusion of part of the population that would have been classified by the MDRD4 as CKD [20, 22–24].

The difference in CKD prevalence estimation resulting from the type of formula applied has been shown in this article. White et al. [25] described a similar phenomenon by publishing recalculated results from the AusDiab study. In their analysis, the percentage of the population with CKD was 13.5% according to MDRD and 11.5% using the CKD-EPI formula.

What has even greater impact on CKD prevalence estimation is the albuminuria diagnostic threshold. We established the criterion of albuminuria diagnosis as an ACR ≥30 mg/g (likewise with the recent KDIGO guidelines), whereas some older studies used lower cut-off points according to guidelines that were in force when those studies were conducted (e.g. ≥20 mg/g in the PolNef study, >17 mg/g for women and ≥25 mg/g for men in the Norwegian HUNT II study) [21]. This issue should be taken into account, along with race or lifestyle differences, when one attempts to compare CKD or albuminuria prevalence in diverse regions. To sum up, all the above-mentioned reasons could result in the overestimation of CKD prevalence in previous reports. International initiatives have taken the first step to make these very basic diagnostic tools uniform and make the investigators speak a common language. To add to the discussion, recently De Nicola et al. [26] presented results of a health survey based on a large Italian population. The criteria of CKD diagnosis were identical to those applied in our analysis. The authors...
estimated that the prevalence of CKD in Italy is 6.29%. Whether there is a need to revise our epidemiological knowledge on CKD is a question to be answered.

The difference in thresholds for albuminuria, however, does not completely justify different trends in the occurrence of albuminuria in specified groups of respondents. As with other studies, we have shown that the frequency of albuminuria increases with age. However, contrary to the PolNef study, we did not prove a significant predominance of older men in the group of subjects with an ACR >30 mg/g [27]. This may have been caused by adjustment of our results to the population of the whole country. What might have negatively affected the presented outcomes of the albuminuria analysis in this study was that the ACR was measured only once. This, however, is a drawback typical of most of the epidemiological studies in this field.

Results discussed in this article come from a population observational study, and as such may be influenced to some extent by the inadequacy of the above-described statistical methodology. A simple method of verification is a comparison with rough data drawn from registries. We showed that 0.8% (~5678 patients) had end-stage renal disease (ESRD), whereas the national registry confirms that 5082 patients did in fact begin either type of RRT in year 2011 [28].

Patients’ awareness of disease is an interesting parameter for a practitioner. Not only does it give an idea about the scale of challenge to public health, but it also provides indirect information on an inadequacy of healthcare delivered to the community. It has been reported elsewhere that awareness of CKD increases with a decrease in eGFR, an increase in albuminuria and the coexistence of diseases such as diabetes, CVD and malignancies. The above reported awareness of kidney failure (12.3%) in adults seems unacceptably low. However, it is significantly higher than that in the elderly Polish cohort of the PolSenior study (3.2%) [14]. Furthermore, wide access to complimentary healthcare in Poland is probably the major reason for greater awareness in Poles compared with Americans. In an analysis published by Whaley-Connell et al. [29], only 9% of US citizens with CKD were conscious of this fact. Nonetheless, there is still a major need to actively search for the disease and

for implementation of kidney protective behavioural and pharmacologic therapies.

In the KDIGO 2012 Clinical Guideline for the Evaluation and Management of Chronic Kidney Disease, a novel approach to assessment and stratification of CKD outcome was proposed. The authors aimed to underline the negative value of declining eGFR together with increasing albuminuria in predicting the progression of kidney failure, cardiovascular events and all-cause mortality. Such an approach given in a clear graphical way (see Table 3) should improve medical service delivered to a patient.

Special attention should be paid to the category of moderately increased risk, with a frequency estimated in our analysis at 4.7%. This group of potentially asymptomatic patients is characterized by an eGFR that has just fallen below 60 mL/min/1.73 m² or with albuminuria. This is also a group that will benefit most from proper nephroprotective treatment. Although high and the very high risk affect relatively a small percentage of the population (0.84 and 0.39%), patients in these groups are especially in danger of all types of cardiovascular events. In general, our analysis showed a similar percentage risk group distribution as what was previously described in Italian and US cohorts [1, 26].

As mentioned before, we observed a high percentage of CKD diagnoses due to the presence of albuminuria. The cumulative prevalence of CKD stages G1A2–3 and G2A2–3 reached 4%, and these two stages included >67% of all CKD diagnoses. Therefore, an active search in order to diagnose early albuminuric stages is crucial for the patient’s prognosis. Such a statement is justified by evidence showing that albuminuria is a strong independent predictor of renal function impairment, ESRD, CVD and mortality in the general population [30–32].

Both hypertension and diabetes proven previously to be the most common aetiology of CKD. They were additionally confirmed in our regression models to be strong, age-independent predictors of CKD in general, but also of decreased eGFR and albuminuria. Ageing was another strong risk factor. Its impact was observed between age groups and the risk of having CKD and albuminuria increased by ~1.5 times every 10 years. The almost 4.5-fold increase in the risk of kidney failure, interpreted as an eGFR <60 mL/min/1.73 m², is even more remarkable. This
leads to a conclusion that along with ageing of the general population and an increase of life expectancy, we should expect an increasing number of patients to be affected by renal failure. Although the worsening renal function in the elderly can be described as physiological organ ageing, it has been proven elsewhere that it is independently associated with an increased CVD-related death risk. This indicates an emerging problem in the decades to come.

As with earlier publications [33], a correlation of smoking and deteriorated kidney function was found in regression models. However, this reached a level of statistical significance only in women (P < 0.05). Quite unexpectedly, several classic risk factors were not proven to have a statistically significant association with CKD, decreased eGFR or albuminuria. Among those negatively verified, nocturia, CVDs in general, body mass index, hypercholesterolaemia and systolic and diastolic values of blood pressure should be mentioned. Socio-behavioural factors such as education or daily physical activity had little or no impact on CKD prevalence.

Even though the response rate in the NATPOL 2011 study was relatively high (66.5%), it suffered some limitations typical of population-based investigations. This could affect some data collected via the questionnaire, which may had a negative impact on the analysis of associations in regression models. Finally, the diagnostic criteria of CKD were simplified, and this may have biased the outcome results. Creatinine (and thus eGFR), urine albumin and creatinine concentration were measured only once. This is in contrast with the definition of CKD, which states that the decrease in eGFR and the presence of albuminuria (marker of kidney damage) must persist for at least 3 months. This systemic mistake, which may cause an overdiagnosis of CKD, is inevitable in population studies.

With increasing mortality due to cardiovascular events, an effort must be made to recognize factors responsible for this situation. Both decreased eGFR and albuminuria have been proven to be independent predictors of mortality risk in the general population [34]. Therefore, a direct advantage of this report is its depiction of the scale of kidney disease in the Polish population.

CONCLUSION

CKD is a major challenge to public health as a proven risk factor of CVD. Its prevalence, however, turned out to be lower than previously expected. Comorbidities such as AH, DM, increasing age and smoking were found to be predictors of CKD.

SUPPLEMENTARY DATA

Supplementary data are available online at http://ndt.oxfordjournals.org.

ACKNOWLEDGEMENTS

This study was partly supported by ST-4 statutory grants and a Young Scientist grant from the Medical University of Gdansk. Other sources of funding for the NATPOL 2011 Survey are as stated elsewhere [16].

CONFLICT OF INTEREST STATEMENT

None declared.


REFERENCES


Prevalence and complications of chronic kidney disease in a representative elderly population in Iceland

Aghogho Okparavero, Meredith C. Foster, Hocine Tighiouart, Vilmundur Gudnason, Olafur Ingridason, Hrefna Gudmundsdottir, Gudny Eiriksdottir, Elias F. Gudmundsson, Lesley A. Inker and Andrew S. Levey

Division of Nephrology, Tufts Medical Center, Boston, MA, USA. The Institute for Clinical Research and Health Policy Studies, Tufts Medical Center, Boston, MA, USA. Tufts Clinical and Translational Science Institute, Tufts University, Boston, MA, USA. Icelandic Heart Association, Kopavogur, Iceland. University of Iceland, Reykjavik, Iceland and Landspitali—The National University Hospital of Iceland, Reykjavik, Iceland.

Correspondence and offprint requests to: Lesley A. Inker; E-mail: linker@tuftsmedicalcenter.org

ABSTRACT

Background. Chronic kidney disease (CKD) is common in the elderly, but data are limited on the distribution of glomerular filtration rate (GFR) and albuminuria and the prevalence of CKD and related complications in this population.

Methods. A cross-sectional study of 3173 older Icelandic adults [42% men; mean (standard deviation, SD) age of 80 (5) years] was performed to examine the distribution of estimated

© The Author 2015. Published by Oxford University Press on behalf of ERA-EDTA. All rights reserved.