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## **Obstacles and Opportunities for Albuminuria Testing Based on the Perspective of Primary Care: A Qualitative Study**

Agnès Oude Engberink, Julie Marc, Elodie Renk, Philippe Serayet, Gérard Bourrel, Olivier Moranne

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3 **Title:** Obstacles and Opportunities for Albuminuria Testing Based on the Perspective of  
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8  
9 **Authors:**

10 Agnès Oude Engberink<sup>1,2</sup> M.D., M.Sc., Julie Marc<sup>2</sup> M.D., Elodie Renk<sup>2</sup> M.D., Philippe Serayet<sup>2</sup>  
11 M.D., Gérard Bourrel<sup>1,2</sup> M.D. Ph.D., Olivier Moranne<sup>1,3</sup> M.D., Ph.D.

12 **Affiliations:**

13 <sup>1</sup> Desbrest Institute of Epidemiology and Public Health (IDESP). Univ Montpellier, INSERM,  
14 Montpellier, France

15 <sup>2</sup> Department of general practice, School of Medicine, University of Montpellier, France

16 <sup>3</sup> Nephrology-Dialysis-Apheresis Department, University Hospital of Nîmes, Université de  
17 Montpellier

18 agnes.oude-engberink@umontpellier.fr (ORCID: 0000-0002-71222626)

19 [julie.marc9@gmail.com](mailto:julie.marc9@gmail.com)

20 elodie.renk@orange.fr

21 g.bourrel@wanadoo.fr

22 olivier.moranne@chu-nimes.fr

23  
24  
25 **Correspondance to:**

26 Olivier Moranne, MD, PhD

27 Place Pr Debré, Hôpital Universitaire de Nîmes, France

28 E-mail : [olivier.moranne@chu-nimes.fr](mailto:olivier.moranne@chu-nimes.fr)

29 orcid: [0000-0002-3127-1415](https://orcid.org/0000-0002-3127-1415)

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## 44 **Key points**

- 45
- 46 - Pay-for-performance indicators and lack of knowledge about new drugs limit General
- 47 Practitioners' ability to identify target populations and carry out urinary protein assays.
- 48 - Choosing between several possible assays is associated with confusion and exposes GPs
- 49 to the risk of inappropriate referrals to nephrologists.
- 50 - Revising pay-for-performance indicators, drafting multidisciplinary guidelines, raising
- 51 multiprofessional collaboration, and patient awareness should be considered.

## 52 **Abstract**

### 53 Background

54 Albuminuria testing is an easy way to identify, early on, a higher risk of cardiovascular and renal  
55 kidney morbidity and mortality in patients at-risk. In France, the urine albumin-to-creatinine  
56 ratio is an indicator for Remuneration for Public Health Objectives (pay-for-performance P4P)  
57 for patients with diabetes or hypertension. These tests must be performed annually by general  
58 practitioners (GPs), but are not sufficiently performed, although drug therapies depend on them.  
59 We wanted to understand the practice of urinary protein screening assays by means of a  
60 qualitative study on the experience of GPs in a French region, with a view to developing  
61 facilitating strategies.

### 62 Methods.

63 This qualitative, semiopragmatic, phenomenological study analyzed in-depth interviews held  
64 with a purposive sample (age, gender, training, type of practice, rural/urban context) of 27  
65 general practitioners, with triangulation of researchers until data saturation.

### 66 Results.

67 GPs recognized the assay as a systematic screening tool in accordance with the guidelines, but  
68 limited it to patients with diabetes or hypertension encouraged by P4P. Noting that their  
69 intervention was limited to kidney-protective measures already in place and, unaware of the new  
70 drugs, they saw no benefits and considered it a non-priority test. The existence of several urinary  
71 assays with varying intervention thresholds, changes in guidelines and the fact that specialists in  
72 laboratory medicine can decide which test to use depending on reimbursement by the health  
73 insurance scheme, all contributed to GPs' confusion in prescribing and interpreting tests. One  
74 consequence of this was inappropriate referral to the nephrologist. These tests required them to  
75 adopt a patient-centered educational approach, making it difficult for certain patients to perform  
76 them.

81 Conclusion.

82 GPs were aware of guideline recommendations to screen for albuminuria in patients with  
83 diabetes and hypertension but had difficulty interpreting the results. Their lack of perceived  
84 clinical consequences and new drugs should be targeted to improve the situation.

85

86

87

88

89 **Keywords**

90

91 albuminuria ;

92 cardiovascular risk ;

93 chronic kidney disease ;

94 pay-for-performance ;

95 primary care.

96

97

## 98 **Introduction**

99 According to the World Health Organization, cardiovascular disease was the leading  
100 cause of death worldwide in 2019 (around 15 million deaths)<sup>1</sup>. The lower the estimated  
101 glomerular filtration rate (eGFR) and the higher the albuminuria, the greater the risk of death  
102 from cardiovascular disease in patients with chronic kidney disease (CKD)<sup>2</sup>. More than 10% of  
103 the population is thought to have CKD<sup>3</sup>.

104 CKD is often asymptomatic and under-diagnosed<sup>4</sup> although it is useful to diagnose  
105 patients at risk in the early to moderate stages<sup>5,6</sup>. In France people with diabetes or high blood  
106 pressure form the majority of populations at risk and mainly consult their General Practitioners  
107 (GP)<sup>7,8</sup>. Blood creatinine levels can be used to identify a drop in eGFR, and urine protein assays  
108 to detect the presence of protein in the urine. The urine albumin-to-creatinine ratio (UACR) has  
109 been recognized as the most suitable for primary care, due to its ease of use and reliability<sup>9</sup>.  
110 Screening for albuminuria in patients at risk of cardiovascular disease would be cost-  
111 effective<sup>10,11</sup>, especially as antiproteinuric therapies exist to reduce morbidity and mortality<sup>12,13</sup>.

112 This measurement is not performed enough in primary care<sup>14,15</sup> despite the guidelines<sup>16</sup>.  
113 One retrospective study<sup>17</sup> showed that fewer than 10% of patients who obtained two eGFR  
114 measurements did a UACR test, with no evidence of changes in practice after the launch of the  
115 2012 Kidney Disease Improving Global Outcomes KDIGO guidelines<sup>2</sup>. A cohort of people with  
116 diabetes or hypertension<sup>18</sup> showed that around two-thirds of patients with significant albuminuria  
117 had not been detected due to a lack of urine screening tests.

118 In 2017, France incorporated kidney screening indicators into the primary care pay-for-  
119 performance (P4P) scheme (RPHO = Remuneration for Public Health Objectives). An annual  
120 UACR test is recommended for people with diabetes and sample-based proteinuria or an annual  
121 UACR test for people with hypertension (Supplemental data 1). Thanks to this system, screening  
122 is progressing both for patients with diabetes and hypertension although, in practice, it appears to  
123 be underperformed (45% of people with diabetes and 30% of people with hypertension were  
124 screened in 2023)<sup>19,20</sup> despite updated guidelines<sup>21</sup>. P4P systems seem to have raised awareness  
125 of CKD among United Kingdom doctors, with the development of earlier intervention<sup>22</sup> and  
126 enabled 70% of Canadian patients with CKD to do an UACR test<sup>23</sup>. Practices and organizations  
127 vary from one country to another, but albuminuria testing still appears insufficient<sup>24</sup>.

128 Studies have highlighted obstacles such as the possibility of prescribing different urine  
129 tests, with indications, costs and reimbursement varying according to the patient's pathology and  
130 country concerned<sup>9</sup>. Furthermore, in one survey, GPs mentioned the lack of impact of this  
131 screening on management and the perceived absence of guidelines<sup>25</sup>. In a qualitative study,  
132 American primary care professionals admitted using only certain parts of the CKD guidelines<sup>26</sup>.

133 ~~On the other hand, the concept of early stage CKD, which is not considered a real disease by~~  
134 ~~GPs, hinders screening~~<sup>24</sup>. On the other hand, European studies indicate that GPs perceive early-  
135 stage CKD as a complex and poorly defined condition, not always regarded as a real disease,  
136 which hinders screening efforts<sup>27</sup>. GPs also have difficulty distinguishing between cardiovascular  
137 risk factors and signs of physiological aging<sup>28,29,30</sup>.

138 Finally, none of the qualitative studies on CKD patient management prior to kidney  
139 replacement have focused on GPs' practical experience of urine protein screening. Among the  
140 methodological approaches used in qualitative studies, semiopragmatic phenomenology is  
141 original in that it limits the researcher's interpretation bias, without restricting the emergence of  
142 innovative data<sup>27</sup>. We therefore chose this method to study the experience of GPs in a region of  
143 France, to understand their practice of urinary protein screening assays and identify concrete  
144 ways to develop facilitating strategies.

145

## 146 **Methods**

147 **Design:** This was a qualitative phenomenological semiopragmatic study reported in accordance  
148 with COREQ guidelines<sup>31</sup>.

149

### 150 **Sampling strategy: “purposeful sampling”**

151 The target population GPs practicing in the east Occitania region. Volunteers were  
152 recruited after being contacted by e-mail or telephone (by authors AOE, JM, or ER), according  
153 to a purposeful sampling process targeting a variety of experiences according to pre-defined  
154 criteria (age, gender, mode and place of practice i.e. urban, semi-rural or rural, experience or  
155 training in nephrology, internship, etc.). Recruitment ended when saturation of data was  
156 obtained.

157

### 158 **The researcher as a tool**

159 The research team consisted of three general practitioners (AOE, PS, GB) with expertise  
160 in qualitative research, one nephrologist (OM) and two trained junior female GPs (JM, ER). The  
161 multidisciplinary nature of the team meant that the primary care professionals' experience could  
162 be measured against that of the nephrologist throughout the study. The influence of the  
163 researcher was thus limited by the investigators' training in data collection and analysis as well  
164 as the triangulation of analyses.

165

### 166 **Data collection: In-depth interviews**

167

168 Developing the interview guide

169 An interview guide (supplemental item 2), with phenomenological questioning centered  
170 on the GPs' experience, was designed by the team based on a review of the literature and the  
171 “explicitation” interview<sup>32</sup>. It facilitated the participant's reflexivity by exploring different  
172 dimensions of the phenomenon under study<sup>33</sup>. After the first four interviews, Questions 3 and 4  
173 were reformulated (supplemental item 3). Participant characteristics were collected via a  
174 questionnaire on the day of the interview.

175

176 How the interviews were conducted:

177 Face-to-face interviews, conducted by JM or ER, were held at the workplace, following  
178 presentation of the principles (confidentiality, benevolence, freedom). They were audio recorded  
179 and faithfully transcribed by the investigators and pseudo-anonymized (GP1 for the first  
180 interview, GP27 for the last). The verbatims were not re-read by the participants, but certain  
181 points were clarified directly on the day of the interview. Non-verbal data were not collected.

182

183 **Data analysis: Semiopragmatic analysis**

184

185 Semiopragmatic analysis is a phenomenological approach with which experience  
186 collected in verbatim records can be categorized. The analytical procedures are described in  
187 Table 1. They integrate thematization with semiotic coding, through a process of constant  
188 comparison<sup>34</sup>.

189 The independent analyses of the two GPs with expertise in qualitative research, two interviewers  
190 and the nephrologist were compared by triangulation (a process whereby several researchers  
191 combine their analyses) until categories were saturated. A box detailing the method is available  
192 in Supplemental item 4.

193 **Saturation**

194 Data were collected and analyzed simultaneously, enabling us to control the quality of  
195 transcriptions, make iterative adjustments to the interview guide, and assess data saturation when  
196 no new data from the last 3 interviews led to changes in emerging categories<sup>35</sup>.

197 **Research ethics**

198 The protocol was approved by the academic hospital's ethics committee under IRB  
199 number 230602. The study was conducted in accordance with the Declaration of Helsinki and  
200 the General Regulations on Data Protection. Participants gave written consent for publication  
201 before inclusion.

202

## 203 **Results**

204

### 205 **Characteristics of participants**

206 Out of 36 contacted GPs, saturation was obtained after including 24 GPs, confirmed by  
207 conducting three additional interviews. Six GPs did not respond to the request to participate in  
208 the study, one refused for lack of time, two had accepted but could not arrange an appointment.  
209 None withdrew their consent retrospectively. Two participants knew the investigator prior to the  
210 test interviews. Only the subject of the study was presented in the introduction, to allow the  
211 participant to reflect without guiding the answer. The sample of 27 GPs is described in Table 2.

212

### 213 **Semiopragmatic analysis: Emerging categories**

214 Five categories, summarized in Table 3, emerged from the analysis.

215 Their phenomenological statement integrating the sub-categories is followed by a summary with  
216 verbatim in italics. Quotations reported by participants for each category are available in Table 4  
217 and Supplemental tables 1-4.

218

219 **Category 1: In line with the guidelines, GPs considered urine protein determination as a**  
220 **tool for systematic annual screening for kidney damage in patients at risk, which they**  
221 **limited to patients with diabetes and/or hypertension, encouraged by pay-for-performance**  
222 **indicators.**

223 GPs considered the urinary protein assay as a screening tool for *kidney impairment* or a  
224 *risk factor for kidney impairment*, and systematically included it in the annual check-up of their  
225 *high-risk patients, in line with guidelines*. For some GPs, this kidney impairment was the result  
226 of a co-morbidity, kidney failure or nephropathy, but rarely CKD. This assay was used for *early*  
227 *detection of impaired kidney function, before a decline in eGFR*, enabling *greater vigilance* and  
228 *prevention*. Only GP22 used the test to evaluate the cardiovascular risk.

229 They did the test systematically for *patients with diabetes*, but less so for *cardiovascular*  
230 *patients*. GP 23 followed the guidelines without questioning them. Their main motivation was  
231 P4P. Two participants declared a specific practice for this testing: GP18 for *patients with*  
232 *combined risk factors*, and GP21 *only if the eGFR dropped*. The sub-categories with quotations  
233 illustrating Category 1 are presented in Table 4.

234

235 **Category 2: In practice, GPs often reported that their role was limited to supporting kidney**  
236 **protective measures already in place. Coupled with the passive "wait-and-see" attitude of**

237 **other specialists, GPs did not recognize the full benefits of screening, were unaware of new**  
238 **therapies, and gave it second place.**

239  
240 In the event of proteinuria, most GPs supported the patient with *dietary hygiene and*  
241 *nephroprotective advice*, such as *adjusting the dosage of treatments*, eliminating nephrotoxic  
242 drugs, optimizing risk factors (hypertension and diabetes) and introducing *Angiotensin-*  
243 *Converting Enzyme inhibitor (ACEi)*, rarely SGLT2 inhibitors (SGLT2i) or, for GP22, *anti-*  
244 *platelet aggregators*. Only GP21 felt that *ACEi should be discontinued* due to nephrotoxicity.

245 However, most GPs were skeptical about the value of screening to induce therapeutic  
246 changes, given that they had *already explained* the health and dietary rules involved and that  
247 ACEi were already *at optimal doses*. Aside from *monitoring*, testing was of little interest,  
248 amounting to testing for nothing. For GP12, the absence of *clear guidelines* on what to do if  
249 albuminuria was abnormal, despite optimal-dose ACEi, limited the use of these assays.

250 This skepticism was reinforced by a *let's wait-and-see attitude* on the part of  
251 nephrologists, or by the fact that *cardiologists never recommended this screening*, which  
252 discredited it. They had the impression that referral to a specialist was *pointless*, and felt *helpless*  
253 *or contemplative*, knowing that for some, *specialist letters were a source of training*. In practice,  
254 this screening became secondary to eGFR, particularly if the progression of CKD was  
255 *unavoidable*. GP22 had abandoned it, *as it made no difference*. As for sodium-glucose  
256 cotransporter-2 inhibitors (iSGLT2), some felt they *lacked experience* or were *unaware of the*  
257 *correct indications*, so they asked the specialist. Only GP26 dared prescribe them for CKD. The  
258 sub-categories with quotations illustrating Category 2 are presented in Supplemental table 1.

259  
260 **Category 3: The choice of several urinalysis assays, inconsistently recommended, and the**  
261 **autonomy of specialist in laboratory medicine, contributed to the GPs' confusion in**  
262 **prescribing and interpreting results, sometimes leading to inappropriate referrals to**  
263 **nephrologists.**

264  
265 The multitude of urine tests (i.e. microalbuminuria, albuminuria, proteinuria, UACR tests  
266 and urine protein creatinine ratio (UPCR) tests led to confusion among some GPs, who were *at a*  
267 *loss when it came to prescribing and interpreting results*. The choice was often dictated by the  
268 P4P and their variable guidelines over time could be perceived as *a fashion*.

269 This confusion was exacerbated by the fact that specialists in laboratory medicine were  
270 free to choose the assay they wanted to use, without taking the GP's prescription into account,  
271 because otherwise *the tests would not be reimbursed*. "*Honestly, I get everything mixed up,*

272 *before it was proteinuria, and now because of P4P it's microalbuminuria... now I prescribe it...*  
273 *and then the specialists in laboratory medicine does the UACR test... which I didn't ask for and I*  
274 *don't know how to interpret it", summarized GP20. Many supplemented this with 24-hour data*  
275 *collection, which they felt was more reliable.*

276 A lack of knowledge of action levels, sometimes attributed to *a lack of training*, led to  
277 varying interpretations of the results. They mainly considered *kinetics*, interpreted qualitatively  
278 or referred to *the standard*. GP 21 did not know *when to worry*. This lack of knowledge led to  
279 numerous *checks with no precise objective* and to *prioritization of the eGFR* to assess severity.

280 The management of CKD seemed more complex than *hyperthyroidism* or *heart failure*.  
281 As a result, referrals to specialists varied. Some preferred to refer to the nephrologist as soon as  
282 an *abnormal UACR was detected without quantification*, others requested a *tele-expertise*  
283 *opinion*, while others referred only *in the event of deterioration of the eGFR* or when  
284 albuminuria exceeded an *impressive* qualitative threshold or had *adverse kinetics*. Only GP23  
285 knew the thresholds but had difficulty *in the grey area between 30 and 300 mg/g*.

286 The sub-categories with quotations illustrating category 3 are presented in Supplemental table 2.

287  
288  
289 **Category 4: Acceptance of screening via urine collection required a patient-centered**  
290 **educational approach and raised ethical issues which reduced prescriptions for certain**  
291 **patients.**

292 For GP16, the educational approach was *simple*. For GP18, it *depended on his*  
293 *consultation time*, and required *adapting to the patient* by simplifying the discourse: *"check if*  
294 *diabetes is in the kidneys"* or for GP20 *"what comes out of the kidneys"*. Some felt it was  
295 *complicated*, taking *time and effort to convince*. Several GPs said they *didn't have the time*, as  
296 consultations *with diabetics are long*. The difficulty seemed to be accentuated for *disadvantaged*  
297 patients or those *unaware of their invisible illness*.

298 Urine collection was variably perceived as either *not a constraint* or *an important*  
299 *barrier*. GP9 retained the *restrictive and impossible* image of *collection over 24 hours*.

300 Ethical questions were raised about the value of these tests for *elderly people* or those with  
301 *limited life expectancy*. The sub-categories with quotations illustrating category 4 are presented  
302 in Supplemental table 3.

303

304

305 **Category 5: Multi-professional coordination around a shared medical information system,**  
306 **dissemination of clear, easily accessible guidelines, simplification of urine collection and**  
307 **raising public awareness are suggested by GPs as ways to improve testing.**

308 Some GPs would be in favor of *nurses, pharmacists and doctors* (GPs, specialists in  
309 laboratory medicine) *working together* in *coordinated practice* structures to *encourage* patients.  
310 Optimize the exchange and visibility of information, using tools such as *results curves* or  
311 *reminders in shared records*. However, they would like to see the *roles of each party* clarified:  
312 many feared *overloading* nurses by *diverting them from care* without guaranteeing a benefit.  
313 Opinions differ on the role of *nurse practitioners* (NPs). *Support from nephrologists through*  
314 *tele-expertise* seems an appropriate communication and training tool.

315 All GPs would like *clear, synthetic guidelines* on their practice, *such as an algorithm*  
316 indicating *which drugs are to be preferred* and how to *adapt their dosage according to the*  
317 *figures*. This would be an *educational tool* for patients.

318 All agree on the importance of training (*initial and continuing education, journal*  
319 *readings and conferences*) to disseminate the guidelines.

320 *Sending vials home* could simplify collection and empower patients.

321 They would like to see *awareness-raising campaigns on screening for CKD and*  
322 *cardiovascular risk*, via health insurance schemes, which could identify patients through their  
323 treatments.

324 The sub-categories with quotations illustrating category 5 are presented in Supplemental table 4.

325

326

## 327 **Discussion**

328

329 The first four phenomenological categories revealed obstacles to GPs doing urine protein  
330 screening tests. These categories were linked by GPs' lack of awareness of the clinical value of  
331 urine testing. Despite their knowledge of the guidelines and the P4P program, they doubted the  
332 clinical significance and limited their role to systematic annual screening with no specific  
333 objective, believing that nephroprotection measures were already in place and that the tests  
334 would not change their practice, ignoring new drugs. Their doubts were reinforced by the  
335 confusion linked to the existence of different tests, the results of which were difficult to interpret,  
336 leading to unnecessary referrals and the impression that specialists did not take urine test results  
337 into account (which further strengthened their doubts). As a result, they questioned clinical  
338 relevance and did not always engage in patient-centered education efforts that would have  
339 promoted adherence. The last category suggested room for improvement.

340 Although the participants thought they were familiar with the guidelines and benefits of  
341 screening, our study shows only partial knowledge of these guidelines and limitations due to  
342 pay-for-performance. GPs reduced the population at risk to patients targeted by P4P, omitting  
343 other risk factors detailed in the guidelines<sup>16</sup>. This is consistent with a Canadian study<sup>36</sup>  
344 identifying gaps in performance indicators in non-diabetic people with CKD. In a qualitative  
345 study, Nihat *et al.*<sup>37</sup> showed a lack of knowledge of the clinical guidelines, skepticism about  
346 their validity and saw performance-related pay as the main driver for change.

347 Our study suggests that a proportion of GPs are integrating UACR tests into their practice  
348 less and less because, whatever the evolution, they are unaware of intervention measures other  
349 than nephroprotective support, as ACEi are already prescribed for patients with hypertension and  
350 cardiac disease<sup>38,39</sup>. They were disappointed that other specialists did not offer other  
351 interventions, and saw no benefits in screening, as they were still unaware of recent specific  
352 treatments<sup>12,13</sup> as reported by Bramlage *et al.*<sup>15</sup>

353 Participants found it difficult to convince asymptomatic patients, and questioned the  
354 value of testing for those with limited life expectancy, echoing other questions raised by the  
355 elderly<sup>40</sup>.

356 Although the GPs in our study had trouble distinguishing and interpreting the various  
357 urine protein screening tests, surprisingly, none of them mentioned that the existence of different  
358 units made things worse, given that the main guidelines maintain expression in mg/g and  
359 mg/mmol<sup>16,20</sup>. They also seemed totally unaware of the variability of albuminuria<sup>41</sup> which might  
360 make them relativize results. They also had limited knowledge of the reimbursement conditions  
361 for these tests.(supplemental item 2)

362 In practice, GPs rely on laboratory standards, without referring to the threshold, and have  
363 doubts about which situations would require referral to the nephrologist, as shown by Chu *et al.*  
364<sup>14</sup> 51% of the 290,000 patients with UACR > 300 mg/g had been referred to a nephrologist.

365 Besides, recent work has shown that there is a linear relationship between the onset of  
366 albuminuria – even at a very low rate – and the risk of kidney<sup>42,43</sup> and cardiovascular morbidity<sup>44</sup>  
367 which ought to be communicated to GPs to facilitate screening and prescribing treatment.

368 Given the lack of knowledge and awareness of CKD, our participants expressed the need  
369 for educational interventions and a multidisciplinary care team to deal with CKD patients with  
370 frequent comorbidities, as suggested by the study by Junaid *et al.*<sup>45</sup> or Smiths *et al.*'s model<sup>46</sup>:  
371 a patient-centered local care network, integrating a nephrology nursing care manager, a  
372 pharmacist specialized in CKD and nephrologists supporting primary care professionals.

373 As mentioned by Danforth *et al.*<sup>47</sup>, the participants in our study suggested improving the  
374 display of results in the medical record, and providing training for professionals and patients.

375 Although Japanese studies<sup>48</sup> show that the dissemination of guidelines does not improve  
376 screening, GPs expect clear, synthetic guidelines adapted to their practice, with the provision of  
377 educational tools as mentioned by Sperati *et al.*<sup>49</sup>. More specifically, it would be useful for the  
378 CKD guidelines to be harmonized with those for diabetes and cardiovascular disease<sup>50</sup> with a  
379 precise threshold test and a synthetic algorithm for implementing the various treatments, and  
380 therapy adapted to the results of the UACR test.

381 Finally, they wish to formalize multi-professional collaboration around the patient,  
382 specifying the roles of each, as discussed in several studies<sup>47,51,52</sup>. One randomized controlled  
383 trial showed that the NP intervention significantly improved CKD coding in the medical record  
384 and the performance of urine protein assays<sup>53</sup>. More recently, James *et al.*<sup>54</sup> showed that care of  
385 CKD patients by NPs was more in line with the guidelines, with more albuminuria and less all-  
386 cause hospitalization. Two GPs in our study suggested the role of pharmacists, but their  
387 intervention was not associated with an increase in the practice of proteinuria testing in a  
388 pragmatic randomized trial<sup>55</sup>. Several participants mentioned the role of specialists in laboratory  
389 medicine to improve the readability of urinary results. This has never been evaluated, unlike the  
390 rendering of eGFR results in the CKD ASSIST project<sup>56</sup> which showed that GPs used eGFR  
391 curves as an educational tool for their patients and as a guide for referral to nephrologists.

392 Regarding their relationship with nephrologists, GPs would like co-management to keep their  
393 knowledge up-to-date and optimize patient identification, as demonstrated by Samal *et al.*<sup>57</sup>.  
394 Although co-management by tele-expertise is appreciated<sup>58</sup> and suggested by several of our  
395 participants, its value in improving the performance of urine tests has not been demonstrated.

396 Other tools could address the issues raised by participants. The “CKD pathway,” a  
397 Canadian online clinical decision support tool, which has shown a slight improvement in the  
398 practice of UACRs in nondiabetic patient<sup>59</sup>. A tool to help identify “CKD” in the electronic  
399 medical record<sup>60</sup> or the implementation of a CKD register in primary care teams<sup>61</sup> show a  
400 higher rate of albuminuria testing and improved patient management. The challenge remains to  
401 identify Stage 3a<sup>62</sup>. The participants would like to see campaigns to raise awareness of the value  
402 of albuminuria testing in screening for dual cardiovascular and kidney risk<sup>63</sup> in patients who are  
403 mainly asymptomatic<sup>64</sup>. They suggest sending a letter and a sampling device to patients at risk,  
404 as recently tested in a Dutch study with a 59% patient adherence rate<sup>65</sup>.

405 Multimodal interventions are promising, such as combining software with the  
406 intervention of a nephrology NP to increase test performance<sup>66</sup> or combine GPs’ clinical decision  
407 support software with self-management tools for patients<sup>67</sup>. Finally, a nephrologist-GP network  
408 has led to a 121% increase in the number of urine tests performed on all at-risk patient  
409 groups<sup>68</sup>. These complex interventions could be the subject of implementation research. On that

410 very subject, in their review, Ttsang et al.<sup>69</sup> suggest three key points for CKD implementation  
411 studies: to contextualize them within the framework of cardiovascular health or diabetes to  
412 promote adherence; second, to focus on tools that are compatible with the daily lives of patients  
413 or healthcare professionals; and third, to integrate feedback to improve the tool based on specific  
414 needs.

415

### 416 **Strengths and limitations**

417 The strengths of our study lie in the diversity of experience of the doctors interviewed,  
418 and the authenticity of their responses, in line with their reality in the field. Triangulation  
419 between researchers improved the reliability of the results. The semiopragmatic coding system is  
420 the only qualitative analysis technique that organizes experiential data logically until the  
421 categories are fully saturated, reinforcing the credibility, dependability and confirmability of the  
422 results<sup>26</sup>. It also addresses the problem of interpretation being influenced by the researcher's  
423 individual sensitivity

424

425 However, there are several limitations. First, there is the issue of participant selection,  
426 which was based on voluntary participation. After analyzing the responses, we observed  
427 considerable variation in experience among the interviewees, though GPs working in  
428 multidisciplinary healthcare centers (MHCs) and rural areas were slightly over-represented. The  
429 rise in GPs practicing in MHCs is a trend confirmed by the behavior of younger GPs, whereas  
430 the number of GPs working in rural areas is in decline.

431 The potential for social desirability bias and the influence of relationships between the  
432 investigators and two former GP supervisors during the test interviews were controlled by  
433 specialized training in interviewing techniques and the establishment of a communication  
434 contract at the start of each session."The lack of generalizability of results from qualitative  
435 studies is accentuated by the regional nature of our study. However, linking our results with those  
436 of foreign studies demonstrates their transferability.

437

### 438 **Prospects**

439 Including all populations at risk of CKD in pay-for-performance systems would enable GPs to  
440 avoid limiting the target population to diabetics and hypertensives.

441 Justifying the indication for dual-risk screening (cardiovascular and kidney) in a  
442 multidisciplinary recommendation harmonized around a single urine protein assay, with a  
443 precise threshold, and addressing the dose adaptation of various treatments, would reinforce  
444 professionals' knowledge and should be the subject of training.

445 Focusing communication and training on the impact of new treatments to slow down the  
446 progression of CKD would help change the perception that urine screening is clinically pointless.  
447 Defining everyone's role would help optimize multi-professional collaboration according to local  
448 resources and organization (nurses/NPs, GPs, specialists in laboratory medicine, nephrologists).  
449 Finally, patients at risk could be empowered by raising their awareness and sending them  
450 sampling devices. These points must be considered depending on each country's health system,  
451 health resources, costs and possibilities of financial coverage.

452

453

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455 The authors have no conflicts of interest to declare.

456

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458

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#### 463 **Author Contributions\***

464 AOE, OM conceived the study, with proposal development also supported by ER, JM. AOE, GB  
465 trained JM and ER for semi-structured in-depth interviews. AOE, ER and JM coordinated the  
466 study promotion, inclusion, and collected and transcribed the data. AOE, JM and ER analyzed  
467 the data and triangulated the data with the help of GB, PS and OM. AOE and OM drafted the  
468 manuscript, with significant contributions from GB, PS, JM and ER. All authors reviewed the  
469 manuscript and provided critical inputs prior to final approval.

470

#### 471 **Data Sharing Statement\***

472 Data (French verbatim) are available upon request from the corresponding author and may be  
473 provided to researchers with an analysis protocol. The data will be kept for up to 2 years after  
474 publication of the results.

475

#### 476 **Table of contents for the Supplemental Material:**

- 477 - **Supplemental Item 1 : Pay-for-performance indicators for CKD screening and**
- 478 **reimbursement conditions for albuminuria testing**

- 479 - **Supplemental Item 2: five key points on the interview guide’s development process**  
 480 **and evolution**
- 481 - **Supplemental Item 3 : Interview guide first version and final version**
- 482 - **Supplemental Item 4: Description of Semiopragmatic Analysis with the example of**  
 483 **category 2**
- 484 - **Supplemental table 1 : Sub-categories and quotations illustrating category 2 (avec**  
 485 **version française)**
- 486 - **Supplemental table 2 : Sub-categories and quotations illustrating category 3 (avec**  
 487 **version française)**
- 488 - **Supplemental table 3 : Sub-categories and quotations illustrating category 4 (avec**  
 489 **version française)**
- 490 - **Supplemental table 4 : Sub-categories and quotations illustrating category 5 (avec**  
 491 **version française)**

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 493

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712 **Tables (all cited) with legends (appropriate descriptive titles)**

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Table 1: The different stages of the semiopragmatic analysis.

Word-for-word transcription of the recordings (French verbatim).
Reading using a floating attention, followed by focused reading.
Dividing the text into meaningful sections and assigning a theme to each one.
Identifying all textual and contextual clues relevant to the research question.
Semiotic coding of these themes according to the theory of signs by C.S. Peirce.
Assembling and ordering these semiotic items to construct first-level empirical categories.
Raising these categories into a more general category by constant comparison up to theoretical saturation.

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Table 2 : Description of the sample of 27 GPs

	Participants (n= 27)
Female sex	13 (48 %)
Median age in years [IQ]	44 [35-57]
Department of practice	
Gard	8 (30%)
Hérault	7 (25%)
Aude	4 (15 %)
Pyrénées Orientales	8 (30%)
Place of practice	
Rural	2 (8%)
Semi-rural	17 (62%)
Urban	8 (30%)
Type of practice	
Individual	2 (8%)
Group practice	7 (26%)
Primary care team	3 (11%)
Multidisciplinary health center	15 (55%)
Median number of years in general practice [IQ]	14.5 [7-26]
Time devoted to general practice	
< 25%	1 (4%)
25-50%	1(4%)
> 50%	25 (92%)
Number of patients seen per week	
≤ 100	7 (26 %)
> 100	20 (74%)
Number of patients suffering from CKD per week*	
< 10	8 (30%)
10 – 30	15 (55%)
> 30	4 (15%)
Specific experience or training	
Geriatrics (diploma, CMT, experience in a geriatric service)	8 (30%)
Interest in caring for the elderly (elderly patients, residence for seniors)	19 (70%)
Training in nephrology (CMT, internship)	6 (22%)
Training in diabetology (CMT, internship)	6 (22%)

University internship supervisor	16 (59%)
Median interview length in minutes [IQ]	18 [15-28]

729 IQ: interquartile, CMT: continuous medical training, EHPAD : Etablissement d’Hébergement  
730 pour Personne Âgée Dépendante = Home for the elderly \* : according to self-assessment by  
731 general practitioners.

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739 Table 3: The 5 categories emerging from the question: “How do GPs use urine protein assays?”

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1. The idea of systematic screening in line with guidelines, but limited to diabetics and hypertensives who are encouraged by their payment to perform.
2. Second-rate testing: GPs see their intervention as limited, and doubt its real value, as they are unfamiliar with the new drugs.
3. The multitude of urinary protein assays and the autonomy of specialists in laboratory medicine add interpretation difficulties that encourage inappropriate referral.
4. Acceptance requires a patient centered educational approach, and raises ethical issues that restrict prescribing to certain patients.
5. Clear guidelines, multi-professional collaboration and patient awareness-raising initiatives are the way forward.

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746 Table 4 : Sub-categories and quotations illustrating categorie1

**Category 1 : In line with guidelines, GPs considered urine protein determination as a tool for systematic annual screening for kidney damage in at-risk patients, which they reduced to diabetic and/or hypertensive patients, encouraged by pay-for-performance indicators.**

Sub-categories	Verbatim
<p><b>Theoretically recognized as a good tool for early detection of kidney damage.</b></p>	<p>GP3 "to see if there is an alteration in kidney function that would not be visible via the blood test".</p> <p>GP12 GP23" to detect chronic kidney disease that is at a stage before kidney failure, so that we can take steps to prevent the patient from going into kidney failure at some point".</p> <p>GP14 "If I find microalbuminuria above the norm, [...] which often can also show that there are blocked arteries, . [...] It's a patient with a higher mortality."</p> <p>GP10 "Increased monitoring of the complications of chronic pathologies. With earlier detection, better care and faster treatment".</p> <p>GP13 "I feel like I'm watching the kidneys, that it's quite telling".</p> <p>GP17 GP23 "to see if there is a kidney impact of his pathology."</p> <p>GP18, 22 "to detect kidney impairment in patients at high cardiovascular risk".</p> <p>GP21 "kidney failure" GP20 GP16, 17 "or nephropathy"</p> <p>GP23 "worsening of their CKD"</p>
<p><b>Mainly for diabetics and hypertensives</b></p>	<p>GP1*, GP7 "I do it systematically for chronic kidney failure and diabetes. For hypertension, I don't do it systematically. I don't do it for cardiovascular disease".</p> <p>GP4 "It's true that the guidelines talk mainly about diabetes and hypertension, but then sometimes it's not very clear in at-risk populations such as the obese".</p> <p>GP12*, GP6 "diabetes was ingrained, we did it every year, it was quite institutional [...] but for the patient with well-balanced hypertension, we think about it much less".</p> <p>GP2, GP16, GP17 "then I have cardio or hypertension patients"</p> <p>GP25 "diabetes, hypertension, for the over-60s and known cardiovascular disease, and yes, the obese too from time to time ... because they can often also end up with kidney failure".</p>
<p><b>Systematic testing in line with guidelines, with reminder tool in medical records</b></p>	<p>GP11*, 1, 8, 16, 17,18, 20, 21 "It's really a systematic thing that I do".</p> <p>GP4 "According to the guidelines, I try to do it".</p> <p>GP12 "As soon as someone tells me that it's important to do it and that it's of interest and that it has practical consequences, I think we're all saying that we have to do it!</p> <p>GP22 "In the guidelines, we say you have to dose it".</p> <p>GP23 "In fact, I follow what I'm told, and if tomorrow I'm told 'stop doing the ratio and do albuminuria or microalbuminuria', well, let's go for it! (laughs) No, no, but it's true that I tend to follow the guidelines rather dumbly."</p> <p>GP17: "In fact, in my basic check-up, I have my hypertension and diabetes check-ups, and that's going to come out".</p> <p>GP21 "Proteinuria and microalbuminuria are in my prescription for follow-up. "For all diabetics"; "Because I was told to do it!"</p> <p>GP24 "I set myself reminders, let's say, for patient with diabetes and for patients with hypertension."</p>
<p><b>Strong incentive through performance-based remuneration indicators (P4P)</b></p>	<p>GP2*, 4 "when I saw it was in the P4P, it made me wonder a bit, and that's when I started doing it a bit more".</p> <p>GP8*, J3 "So why am I doing it? Because today, diabetics have to do it" "It's not us who systematized it, it's the social security system".</p> <p>GP20 "since they made us do it, especially for hypertensives [...] So P4P have been effective in reminding me".</p>

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