

# The importance of urine specific gravity measurement in urine dipstick testing.

Taro KAMIMURA, Satoru SHICHIJO, Kento FUKUMITSU, Mika KONDO, Yutaro HIRASHIMA, Seishi AIHARA, Hideaki OKA and Atsumi HARADA  
Matsuyama Red Cross Hospital Kidney center, Matsuyama, Japan

## INTRODUCTION

Since the amount of urine protein(UP) is related to the CKD progression rate, accurate assesment of UP is essential for the clinical policy of CKD. The result of UP 1+ or higher of dipstick testing means morbid UP in CKD criteria of the Japanese Society of Nephrology(JSN), but dipstick testing is affected by urine specific gravity(uSG). Particularly, in case of diluted urine , morbid UP may be wrongly judged "normal", and opportunities for accurate diagnosis by secondary health examinations will be deprived.

## AIM

To evaluate the accuracy of dipstick testing for morbid UP, and try to clear the problem in the case of diluted urine.

## METHODS

From April 1 to June 30 in 2016, total of 1084 urine specimens of our outpatients was simultaneously examined by qualitative dipstick testing and quantitative UP to urine creatinine ratio(UPCR). In quantitative methods, UP categories is decided as follow: UP less than 0.15g/gCr is normal range, UP from 0.15 to 0.5g/gCr is mild UP, Up over 0.5g/gCr is highly UP. uSG categories is also decided as fellow: uSG less than 1.010g/mL is diluted, uSG from 1.010 to 1.020g/mL is normal and uSG over 1.020g/mL is concentrated. We determine that dipstick testing of 1+ or higher is positive according to the guideline of the JSN. We evaluate the sensitivity and specificity of dipstick testing for diagnosis of mobid UP.

## RESULTS

Figure-1:The relationship between dipstick testing & UPCR

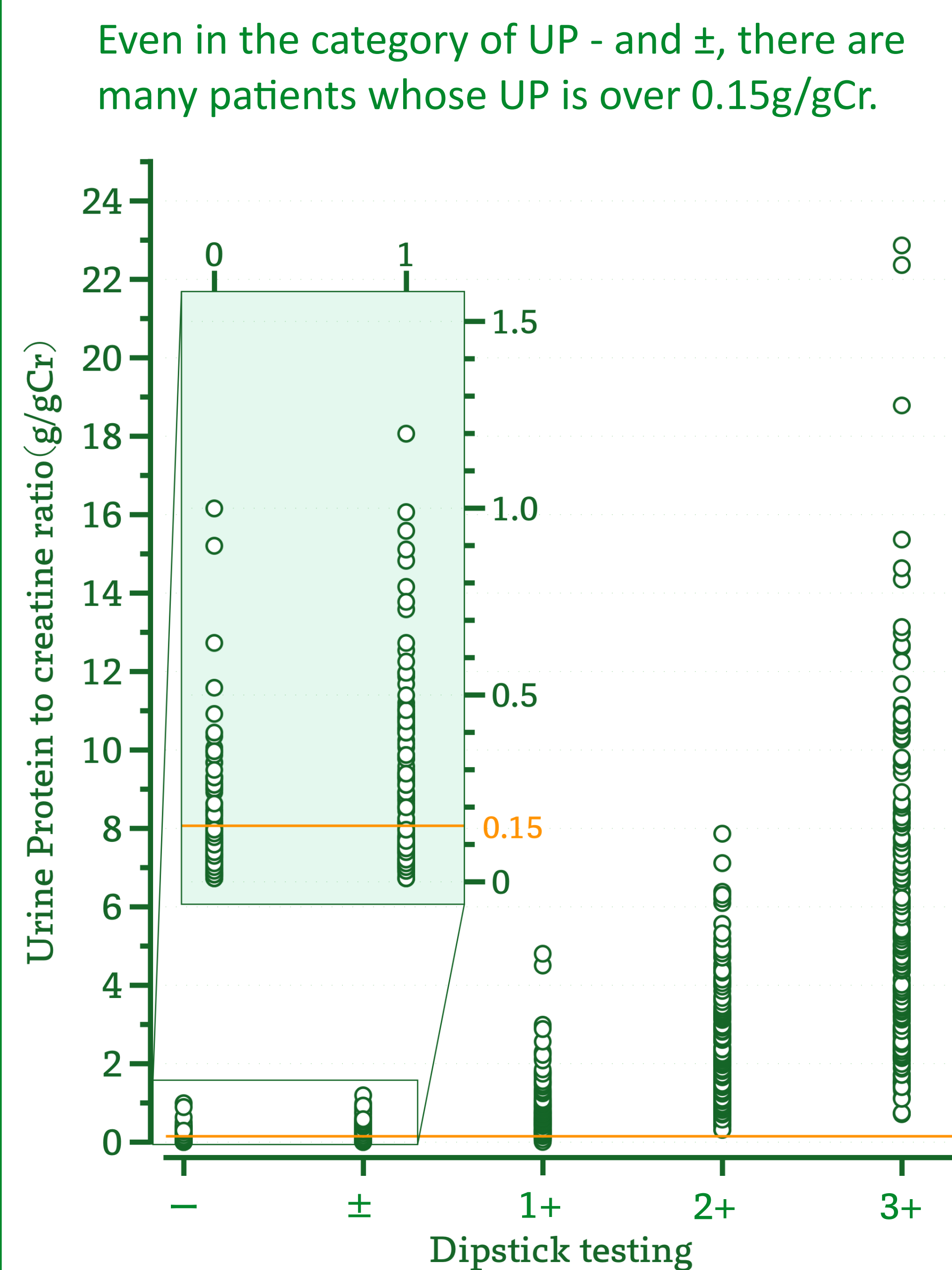


Figure-2:The relationship between dipstick testing & uSG in each UP categories.

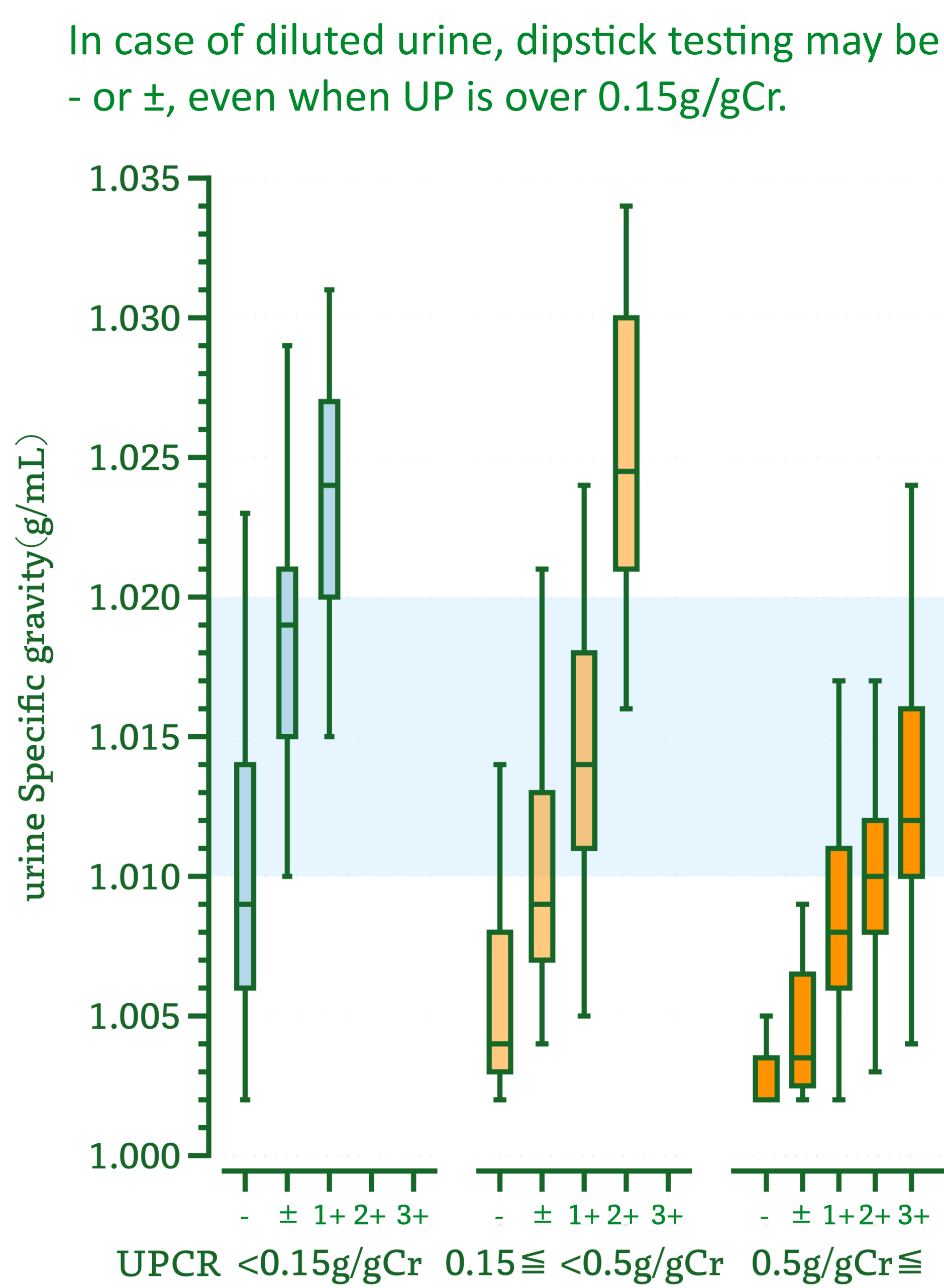


Table-1:The accuracy of dipstick test for morbid UP in all specimes.(n=1,084)

Dipstick	Highly proteinuria (>0.5g/gCr)	Mild proteinuria (0.15-0.5g/gCr)	Normal (<0.15g/gCr)	Total
3+	223			223
2+	203	6		209
1+	155	81	18	254
±	16	68	67	151
-	4	45	198	247
<b>Total</b>	<b>601</b>	<b>200</b>	<b>283</b>	<b>1084</b>

	Estimated value	Confidence interval
Positive rare Prevalence	0.633	0.603-0.662
Sensitivity	0.739	0.712-0.765
Specificity	0.834	0.806-0.859
Positive predictive value(PPV)	0.936	0.901-0.962
Negative predictive value(NPV)	0.974	0.959-0.984
Accuracy	0.666	0.617-0.712
	0.861	0.839-0.881

Table-2:The accuracy of dipstick testing for morbid UP in low uSG specimes.(n=439)

Dipstick	Highly proteinuria (>0.5g/gCr)	Mild proteinuria (0.15-0.5g/gCr)	Normal (<0.15g/gCr)	Total
3+	44			44
2+	86			86
1+	101	13	1	115
±	16	37		53
-	4	37	100	141
<b>total</b>	<b>251</b>	<b>87</b>	<b>101</b>	<b>439</b>

Table-3:The accuracy of dipstick testing for morbid UP in low uSG specimes after switching the cut-off level to ±.(n=439)

Dipstick	Highly proteinuria (>0.5g/gCr)	Mild proteinuria (0.15-0.5g/gCr)	Normal (<0.15g/gCr)	Total
3+	44			44
2+	86			86
1+	101	13	1	115
±	16	37		53
-	4	37	100	141
<b>total</b>	<b>251</b>	<b>87</b>	<b>101</b>	<b>439</b>

value	0.558	Positive rate	0.679
	0.770	Prevalence	0.770
	0.722	Sensitivity	0.879
	0.990	Specificity	0.990
	0.996	PPV	0.997
	0.515	NPV	0.709
	0.784	Accuracy	0.904

## CONCLUSION

According to the results of the japanese primary health checkup in 2008, the prevalence of Urine dipstick testing of UP 1+ or higher is reported up to 5.45%<sup>1)</sup>. In addition to the risk of end stage renal failure, the degree of UP is strongly associated with the risk of cardiovascular disease and prognosis<sup>2)</sup>. Accurate diagnosis of UP is essential not only for early diagnosis of CKD and but also for clinical policy of CKD. Dipstick testing is usually used for screening purposes in primary health checkup, however this qualitative method has false positives in the concentrated urine and false negatives in the diluted urine. False positives can be distinguished from morbid UP by performing quantitative analysis in secondary examination, however since false negatives are wrongly judged "normal", the chance of proper intervention is missed without performing secondary examination. From our study, the sensitivity of qualitative method is about 72% in case of diluted urine. This means that about 28% of morbid UP is wrongly judged "normal" when urine is diluted. After switching the cut-off level of the dipstick testing from UP 1+ to ±, the sensitivity of dipstick tensting improve to about 88%. Therefore in case of diluted urine, we should repeat the dipstick testing more than once or set the cut-off level of the morbid UP on ±, even when dipstick testing of UP is negative to reduce the misjudgment of morbid UP.

## REFERENCES

- 1)Clinical Practice Guidebook for Diagnosis and Treatment of Chronic Kidney Disease 2012
- 2) Matsushita K, et al. Lancet 2010;375:2073—2081.

