Evaluation of the analytical performance of two point of care INR meters

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Background

Coumarins are still the most widely used oral anticoagulants (OAC)s in the prophylaxis of the venous thromboembolism.

Dosing Coumarins must be individualized for each patient according to the patient's INR response to the drug and INR should be monitored regularly. INR measurements, can be done either by point of care (POC) method (POC-INR) in general practitioners (GP-s)'s offices or using a central laboratory method (CL-INR) in outpatients' clinics.

Although high-quality POC-INR methods can provide reliable results for the immediate decision-making within few minutes, POC-INR is applied very seldom in Hungary. Only 3% of INR measurements are performed by POC-INR method [1].

Analytical and diagnostic performance criteria of POC-INR have not been harmonised yet but available. The often referred criteria for POC-INR meters in Europe are set in the following standards: International Organisation of Standarization (ISO) guideline for POC methods: 17593:2007; and in the Scandinavian evaluation of laboratory equipment for primary health care (SKUP).

Aims

We compared the analytical and the diagnostic performance of two commercial POC-INR devices with the CL-INR reference method.

In addition, we investigated if the two POC INR meters' performance is conform with the criteria set by ISO 17593:2007 and SKUP standards.

Patients, Instruments, Methods

• After informed consent, we involved **134 patients** under OAC therapy in the study

• The two evaluated commercial POC devices were **CoaguChek XS Pro** *(Roche, Switzerland)*, and **Xprecia Stride** *(Siemens, Germany)*. The instrument characteristics are shown in the Table 1.

• CL-INR was measured from sodium citrated plasma (1500g, 20 minutes, 20°C) by BCS XP coagulometer *(Siemens, Germany)* using Dia-PT prothrombin time reagent *(Diagon, Hungary)*.

• In 134 patients INR was measured from venous and capillary blood in parallel and POC-INR and CL-INR values were correlated.

• Imprecisions of each POC INR meters were calculated from parallel INR measurements of 20 patients.

• K_3-EDTA anticoagulated blood was taken from all patients for haemoglobin and haematocrit measurements to detect values that can interfere in POC-INR methods.

• In addition, it was also evaluated whether the performance of the two POC-INR methods fulfils the analytical requirements of ISO 17593:2007 and SKUP standards.

Instrument	BCS XP	CoaguChek XS Pro	Xprecia Stride
Manufacturer	Siemens	Roche	Siemens
Principle of measurement	Photometry	Electrochemical method	Electrochemical method
Reagent/strip	Liquid Dia-PT (Diagon, Hungary) reagent, rabbit brain thromboplastin	Lyophilised reagent on the strip, The reactive components: recombinant human thromboplastin and a peptide substrate.	Lyophilised reagent on the strip, The reactive components: recombinant human thromboplastin with phospholipids and Ca^{2+}
INR measuring range	Dependent for the reagent type, variable	0,8 - 8,0	0,8 - 8,0
Sample type	Sodium citrated plasma	Capillary blood	Capillary blood
Time for INR results (minutes)	~ 25	< 1	< 1
Blood type	Venous	Capillary	Capillary
Sample volume (microliter)	200	10	6
Internal quality control	Normal and pathological control kits	Electronic QC + Liquid QC: CoaguChek XS PT control Level 1	Electronic QC+ Liquid QC: Xprecia PT control 1 and 2
Influencing factors	Haemolysis, lipaemia	Heparin: > 0,8 U/mL, Haematocrit: 25-55%, Triglyceride: >5,65 mM	Heparin: >3U/mL, Haematocrit: 25-55%, Triglyceride: >36 mmol/L

Table 1. Characteristics of the INR methods applied in this study.

Results

• Imprecision of both POC INR meters was found acceptable: $CV_{CoaguChek}$ 8,9%, $CV_{Xprecia\ Stride}$ 6,6%. The CV of CoaguChek XS Pro calculated from 20 pairs of INR: 0,07%

• Our finding on the imprecision of CoaguChek XS Pro INR meter corresponds well with the finding of SKUP on this INR meter in 2007.

• Both POC INR methods showed strong correlation with the reference CL method.

• The correlation between CoaguChek XS Pro and CL method is shown on Figure 1. The correlation between Xprecia Stride and CL method is presented on Figure 2.

• The ISO 17593:2007 and SKUP performance specifications of both POC INR meters are presented on Figure 3. and on Figure 4. Both INR meters fulfilled the analytical requirements of ISO 17593:2007 standard while none of them was found conform with SKUP (Table 2.).
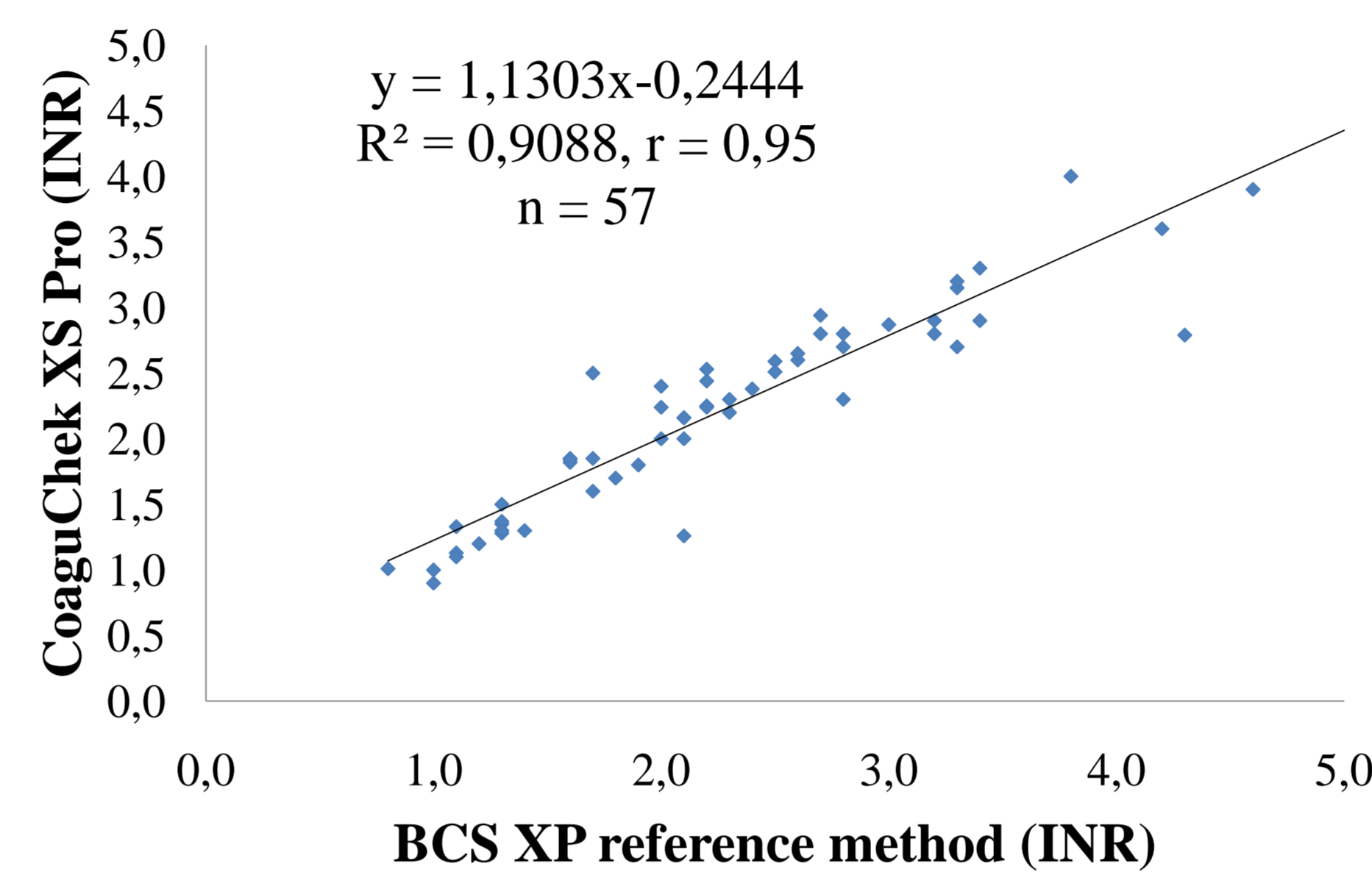

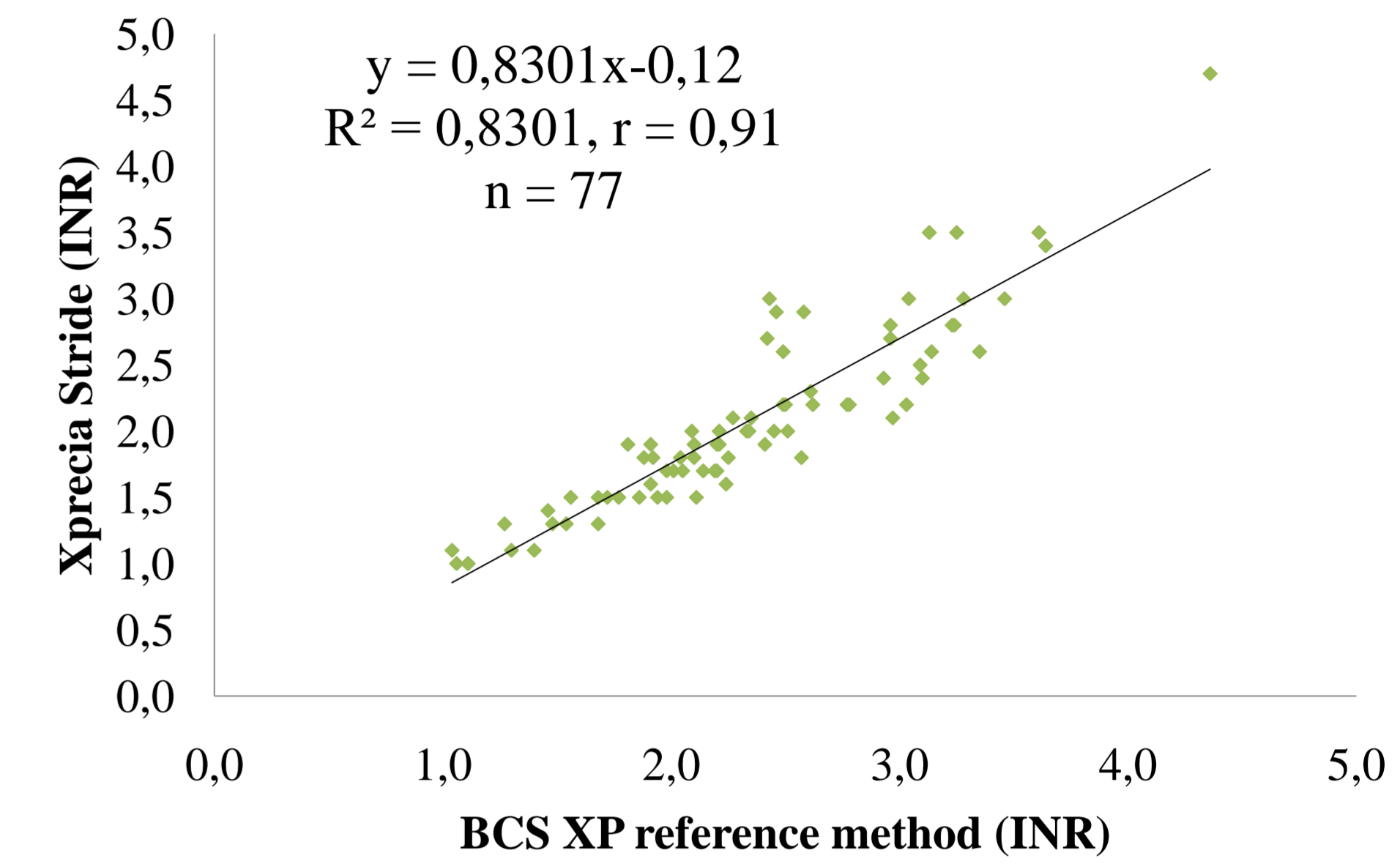Figure 1. The correlation between CoaguChek XS Pro and BCS XP INR methods

$y = 1,1303x-0,2444$
$R^2 = 0,9088, r = 0,95$
$n = 57$

Figure 2. The correlation between Xprecia Stride and BCS XP INR methods

$y = 0,8301x-0,12$
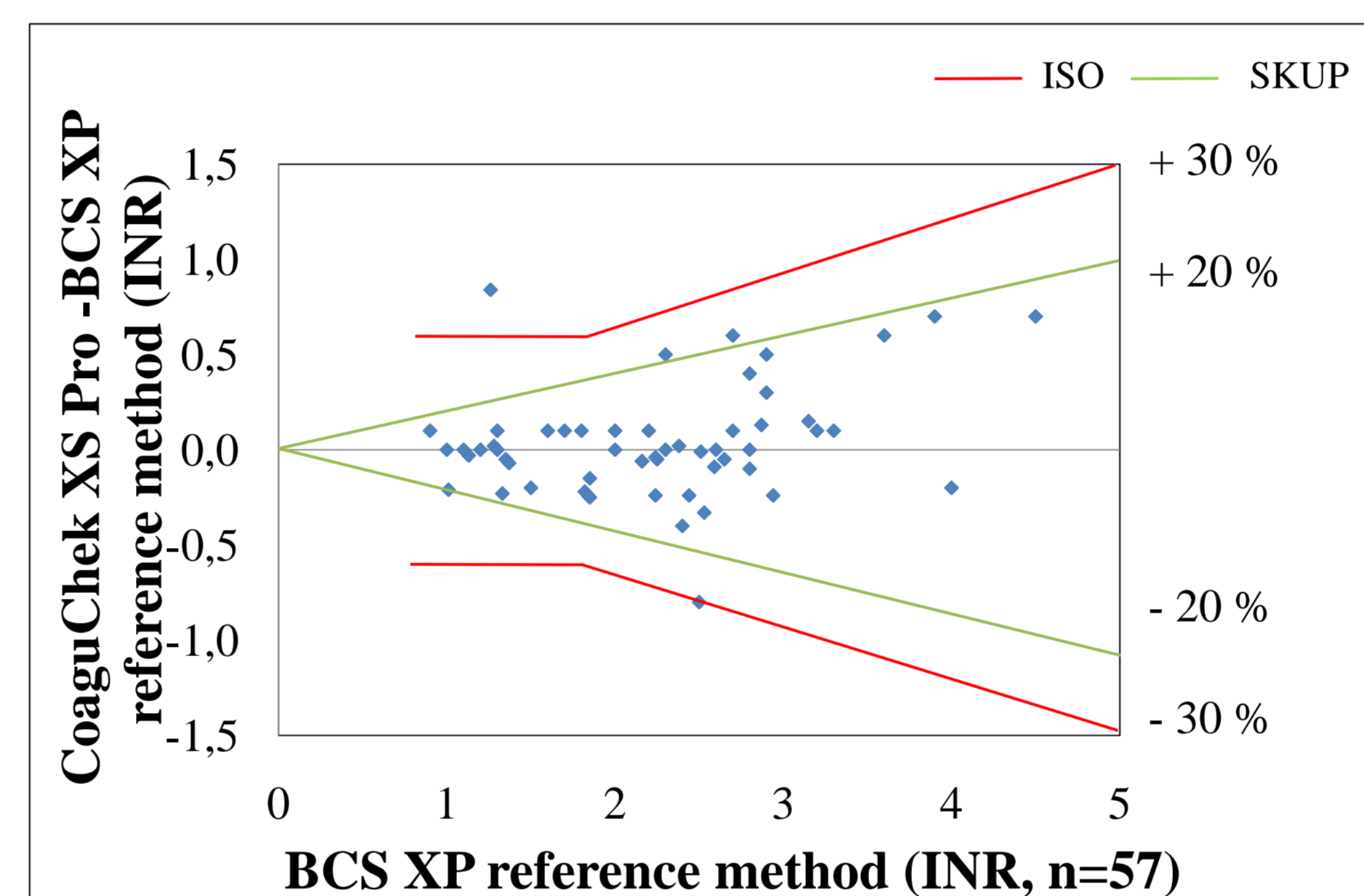$R^2 = 0,8301, r = 0,91$
$n = 77$

Figure 3. A POC-INR of CoaguChek XS Pro versus CL-INR using criteria set in ISO 17593:2007 and SKUP standards

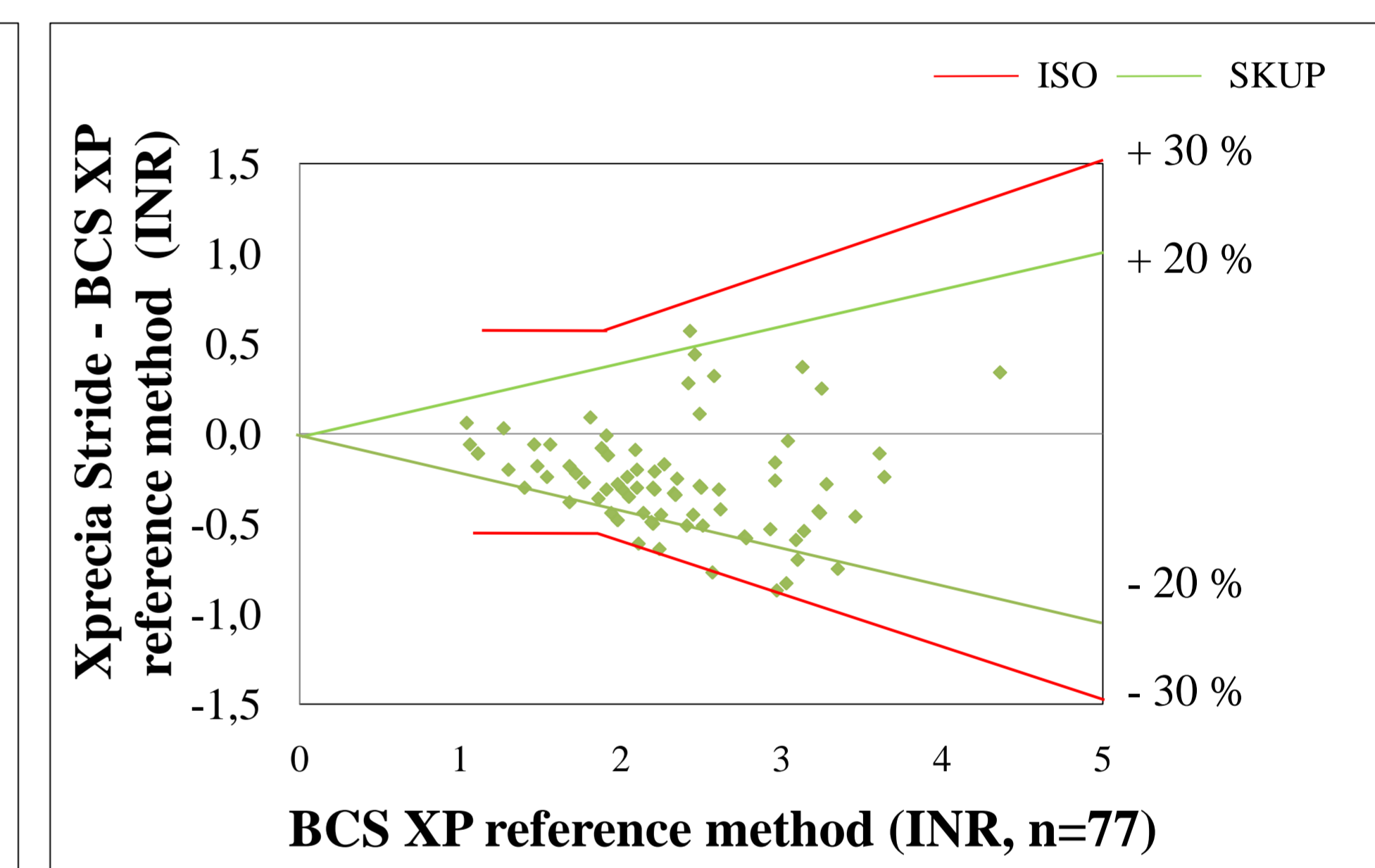Figure 4. A POC-INR of Xprecia Stride versus CL-INR using criteria set by ISO 17593:2007 and SKUP standards.

		ISO 17593:2007		SKUP		
Guideline		Performance criteria for POC-INR meters				
		±0,5 allowable difference (90% of the results) INR interval <2	±30% allowable difference (90% of the results) INR interval 2-4,5	Impreci-sion <5% (INR= 0-9)	95% of the results between ±20% (full INR range)	99% of the results between ±25% (full INR range)
Performance of the tested POC-INR-meters	**CoaguCheck XS Pro**	20 out of 21 measurements (95%), ACCEPTED	34 out of 36 measurements (94%), ACCEPTED	8,87 %* (n=20)	53 out of 57 measurements (93%), FAILED	54 out of 57 measurements (95%), FAILED
	Xprecia Stride	20 out of 20 measurements (100%), ACCEPTED	57 out of 57 measurements (100%), ACCEPTED	6,60 % (n=20)	67 out of 77 measurements (87%), FAILED	74 out of 77 measurements (96%), FAILED

Table 2. Performance characteristics of the evaluated POC-INR methods in comparison with CL-INR. Performance criteria of the ISO 17593:2007 and SKUP standards have been used in the evaluations. * CV after recalculation on 19 pairs of results: 0,07%

Conclusions

The analytical performance of both POC INR meters was found conform with the requirements of the ISO 17593:2007 standard, while both meters failed to fulfil the more strict performance requirements of SKUP. The analytical performance of Xprecia Stride POC-INR meter was found very similar to the long applied CoaguChek XS Pro INR meter, therefore both meters are suitable for INR monitoring in everyday practice.

Reference

[1] Trydal T. *et al*. Analysis of prothrombin time in primary health care. Tidsskr Nor Laegeforen 2005; 125: 2048 – 2049.