510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY AND INSTRUMENT COMBINATION TEMPLATE

A. 510(k) Number:
k093460

B. Purpose for Submission:
Submission for modifications to a cleared device

C. Measurand:
Prothrombin Time

D. Type of Test:
Electrochemical

E. Applicant:
Roche Diagnostics Corporation

F. Proprietary and Established Names:
CoaguChek® XS Pro System

G. Regulatory Information:

1. Regulation section:
   21 CFR 864.7750 - Prothrombin time test
2. Classification:
   Class II
3. Product code:
   GJS – Test, Time, Prothrombin
4. Panel:
   81 Hematology

H. Intended Use:

1. Intended use(s):
   The CoaguChek® XS Pro System is intended for use by professional healthcare providers for quantitative prothrombin time testing for the monitoring of warfarin therapy. The CoaguChek® XS System uses fresh capillary or non-anticoagulated venous whole blood.
2. Indication(s) for use:
   Same as Intended Use
3. Special conditions for use statement(s):
   Prescription Use
4. Special instrument requirements:
   CoaguChek XS Pro

I. Device Description:

The CoaguChek® XS Pro is a portable coagulation monitoring system to monitor prothrombin time (PT) in patients receiving oral anticoagulant therapy. The system uses the amperometric detection of thrombin in the blood sample. A test strip is used to determine a PT value from 8µL of whole blood. The system features onboard quality control on every test strip as well as optional external quality control material.
The system is composed of a Handheld Basic Module (HBM) which provides the power management of the AC adapter or rechargeable batteries and houses all the data

management features; the Measurement Module (MM) which converts raw signals from test strip into final PT result; and an embedded Barcode Reader (BR) when enables automatic strip lot identification.

The test strip incorporates quality control material that assesses strip integrity. The system also features a QC lockout feature which prevents the operator from performing a test if the QC results fail.

The CoaguChek® XS Plus automatically stores up to 1000 test results with date, time, patient ID, and operator ID, along with 500 QC results.

J. Substantial Equivalence Information:

1. Predicate device name(s):
   Roche Diagnostics CoaguChek XS Plus System
2. Predicate 510(k) number(s):
   k071041
3. Comparison with predicate:

Similarities		
Item	Device	Predicate
Intended Use	The CoaguChek® XS Pro System is intended for use by professional healthcare providers for quantitative prothrombin time testing for the monitoring of warfarin therapy. The CoaguChek® XS System uses fresh capillary or non-anticoagulated venous whole blood.	Same
Measuring Range	0.8 - 8.0 INR	Same
Components	Includes handheld basic module (power unit), measurement module (converts raw signal to final PT result), bar code reader (automatically ID strip lot	Same
Reagent	Human recombinant thromboplastin	Same
Quality Control	Lot specific target values provided on QC code chip/QC Lockout feature	Same

Differences		
Item	Device	Predicate
Hardware	Embedded bar code reader	External bar code reader
Minimum sample volume	8 µl	10 µl
Language	12 languages can be selected	Not available
Operating Temperature	15- 32ºC	18 – 32ºC
Blood application time	120 seconds	180 seconds
Memory	1000 INR results, 500 QC results	500 INR results/ 500 QC results

K. Standard/Guidance Document referenced (if applicable):

EN ISO 14971:2007: *Application of risk management to medical devices*
EN ISO 13485:2003: *Medical Devices Quality Management Systems*

L. Test Principle:

The reactive components of the lyophilized reagent consist of thromboplastin and a peptide substrate. When a blood sample is applied to the test strip, thromboplastin activates the coagulation cascade which leads to the formation of thrombin. At the same time, the meter starts to measure the time. Thrombin cleaves the peptide substrate creating an electrochemically active peptide, which generates an electrical signal. The signal is converted by means of an algorithm to an INR value and displayed by the CoaguChek XS Pro System.

The on-board quality control is a bi-level control that accesses test strip integrity. The PT test and QC testing are performed simultaneously. The test system determines whether the quality control is within preset limits. If it is, the meter displays a short term "QC✓", and then the PT test result. If the QC is not within limits, the meter displays "error QC", and no PT test result will be displayed.

M. Performance Characteristics (if/when applicable):

1. Analytical performance:

a. Precision/Reproducibility:

Intra/inter assay precision was demonstrated by testing 120 CoaguChek XS Pro meters against 6 CoaguChek XS Plus Reference meters. Controls and normal blood samples were used for the assessment.

Results demonstrated <2% CV and <2% bias for the Control samples, and <3% CV and <2% bias for the blood samples.

Acceptance criteria were as follows:

Controls:

Meter imprecision (meter to meter)	<15%
Bias to mean Reference meter	<±3.0%
Percentage of meters within specified range (mean±2 SD)	>95% all meters
System imprecision (CV within one meter)	<4.5%

Blood:

Meter imprecision (meter to meter)	not applicable
Bias to mean Reference meter	<±3.0%
Percentage of meters within specified range (mean±2 SD)	Not applicable
System imprecision (CV within one meter)	<4.5%

For both sample types:

Overall error rate	<4%

Acceptance criteria were met for all blood and control samples

b. *Linearity/assay reportable range:*
Not applicable

c. *Traceability, Stability, Expected values (controls, calibrators, or methods):*
The CoaguChek XS Test strips are calibrated to a master reagent lot which has in turn been calibrated to a WHO International Reference Preparations (rTF/95) using the manual tilt tube method.

d. *Detection limit:*
Not applicable

e. *Analytical specificity:*
Reviewed under k060978 (original CoaguChek XS submission)
Testing demonstrated no interference with unfractionated heparin up to 2 u/mL from normal donors, and up to 0.8 u/mL for warfarin patients. Acceptance criteria was <10% difference when compared to the unspiked sample.
Tinzaparin and Enoxaparin (LMW H's) showed no interference up to 2 IU anti-Xa activity/ml for both normal donors and warfarin patients. Acceptance criteria was <10% difference when compared to the unspiked sample.
Testing was performed to demonstrate the interference of bilirubin, lipemia, and hemolysis. Results showed no interference from bilirubin up to 30 mg/dL, lipemia up to 500 mg/dL, and hemolysis up to 1000 mg/dL. Acceptance criteria was <10% difference when compared to the unspiked sample.

f. *Assay cut-off:*
Not applicable

2. Comparison studies:

a. *Method comparison with predicate device:*
The CoaguChek XS was originally cleared under k060978. Analytical parameters were reviewed along with a three site comparison study that compared venous (n=710) and capillary (n=700) specimens to a laboratory reference method.
The CoaguChek XS Plus, which attached an external bar code reader to the XS, was cleared under k071041. There was no change in the analytical performance with the XS Plus. The submission included a three site comparison study that compared venous (n = 811, y = 1.090X – 0.2, r = 0.974) and capillary (n = 822, y = 1.075X – 0.1, r = 0.972) specimens to a laboratory reference method.
This submission, k093460, embeds the bar code reader that was cleared under k071041. Analytical performance has not changed. To demonstrate comparison to the predicate, an internal study that tested twenty four CoaguChek XS Pro meters against 24 CoaguChek XS Plus meters was submitted. The testing pool consisted of five hematocrit variations (0%, 25%, 35%, 45%, 55%) prepared from 8 donors (2 normal, 6 anticoagulated) and tested on 3 different test strip lots (eight instruments per lot), for a n of 1,037 (8 samples x 5 preps x 3 lots x 8 instruments + 57 additional patient samples). Regression analysis was calculated for all 8 samples, on 3 test strip lots for HCT, clotting time (sec), clotting time (INR), and the electrical resistance in the AC (alternating current) measuring mode (termed Admittance by the Sponsor), that demonstrated acceptable correlation. The acceptance criteria however, were set as:

Specified hematocrit range	25 – 55 %
Mean INR bias	≤3%
INR System imprecision (CV w/in one meter and one test strip lot)	<4.5%
Error rate	<4.0%

All acceptance criteria were met for all blood samples.

b. Matrix comparison:
Not applicable

3. Clinical studies:
   a. Clinical Sensitivity:
   Not applicable
   b. Clinical specificity:
   Not applicable
   c. Other clinical supportive data (when a. and b. are not applicable):
   Not applicable
4. Clinical cut-off:
   Not applicable
5. Expected values/Reference range:
   Reviewed under k060978

N. Instrument Name:
CoaguChek XS Pro System

O. System Descriptions:
1. Modes of Operation:
   Manual; Closed system
2. Software:
   Software Development for the CoaguChek XS Plus System was previously reviewed in k060978 and k071041
   Yes __✓____ or No _____
3. Specimen Identification:
   Date and time of testing is recorded by the CoaguChek XS Pro meter
4. Specimen Sampling and Handling:
   Whole blood is manually applied to the target area of the test strip either from the top or side of the strip.
5. Calibration:
   The CoaguChek XS Test strips are calibrated to a master reagent lot which has in turn been calibrated to a WHO International Reference Preparations (rTF/95) using the manual tilt tube method.
6. Quality Control:
   The CoaguChek XS System incorporates a bi-level on-board quality control (OBC) within the CoaguChek XS test strip that monitors test strip integrity.
   Level 1 OBC detects strip defects such as reagent defects, capillary compression and electrode defects. Level 2 OBC directly measures strip damage due to such things as exposure to increased humidity, light, and temperature.
   The pre-determined OBC ranges are programmed into the lot specific code chip that is packaged with the matching test strip lot.
   Acceptable data was presented validating the OBC in k60978.

P. Other Supportive Instrument Performance Characteristics Data Not Covered In the "Performance Characteristics" Section above:

Q. Proposed Labeling:

The labeling is sufficient and it satisfies the requirements of 21 CFR Part 809.10.

R. Conclusion:

The submitted information in this premarket notification is complete and supports a substantial equivalence decision