

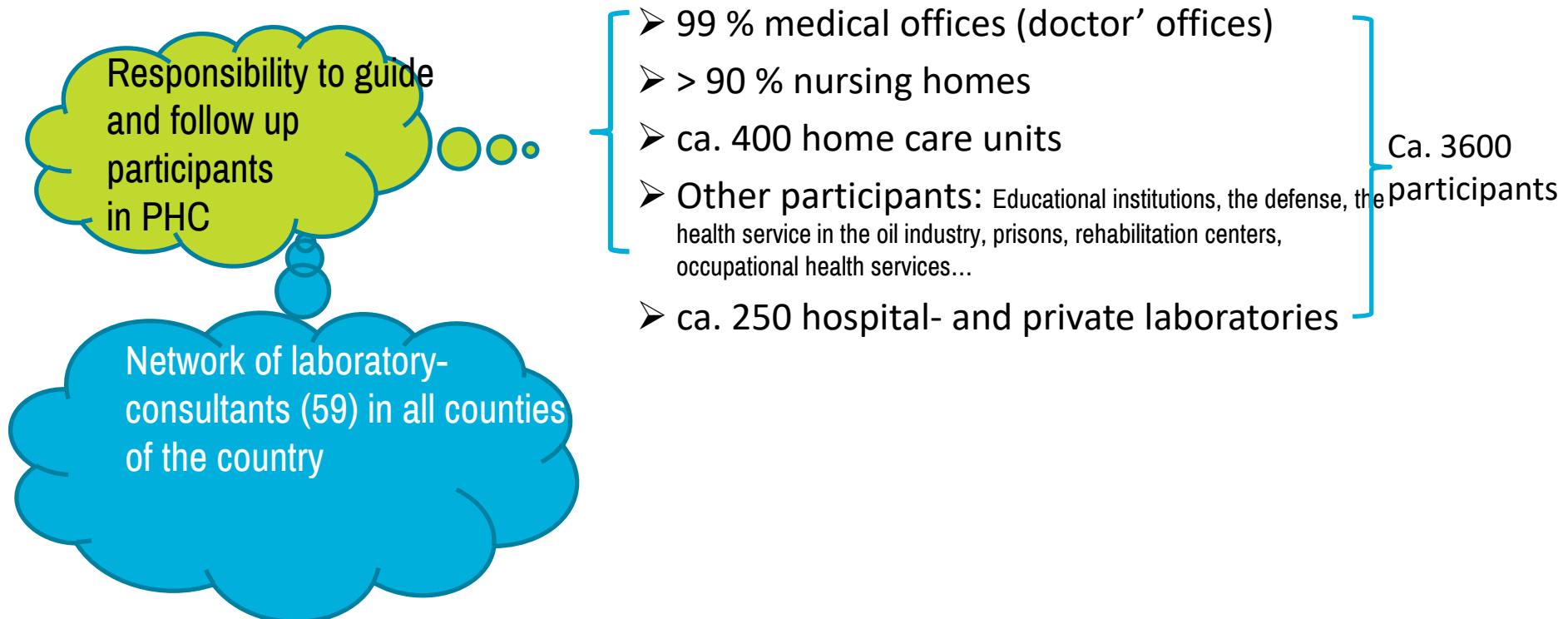
# External Quality Assessment Schemes (EQAS) for the non-analytical phases – challenges and opportunities

SKML Symposium 2022

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# The Norwegian Organization for Quality Improvement of Laboratory Examinations

A national non-profit organization created in 1992 that provides quality improvement services for the entire health chain, from home care to the specialist health service:



**Noklus works to ensure that medical laboratory examinations are requested, performed and interpreted correctly and in accordance with the patient's needs for investigation, treatment and follow-up.**

# Noklus...

- offers External Quality Assessment (EQA) programs to all Norwegian General Practitioner (GP) practices, hospital- and private medical laboratories, nursing homes and other health care institutions.
- organizes educational courses and provides laboratory counselling to health care providers in primary health care.
- hosts an annual national meeting in Clinical Chemistry for Biomedical laboratory scientists and Specialists in laboratory medicine in secondary health care.

# What I am going to talk about

- Overview of different types of pre-and postanalytical EQAS
  - Examples
  - Challenges and opportunities

*Medical laboratories -  
Particular requirements for quality and  
competence (ISO 15189:2012):*

*5.6.4.*

*External quality assessment programmes should, as far as possible, provide clinically relevant challenges that mimic patient samples and have the effect of checking the entire examination process, including pre- and post-examination procedures*

**ISO 15189:2022** (released towards the end of 2022)

# Requirements for accreditation

Do you think that the accreditation body should require the laboratories to participate in the current pre- and postanalytical program in order to be accredited according to standard ISO/EN 15189

- A. Yes
- B. No
- C. Don't know



# Different types of pre- and postanalytical EQAS

- Type I: Registration of procedures
- Type II: Circulation of samples simulating errors
- Type III: Registration of errors/adverse events

Kristensen GBB et al, 2014



# Type I: Registration of procedures

- Circulation of questionnaires asking about routines for handling different parts of the pre- and postanalytical phase
  - How are these issues communicated to the physicians?
  - May include case histories
- Feedback report
  - Compare own result with those of other participants
  - Overview of recommendations from existing guidelines and recent studies
  - Advice on how to improve procedures and minimize errors

*Easy to conduct and limited resources needed!*

## Type I – Examples...

# Throat infection case

## Use of streptococcal rapid test and antibiotic treatment in PHC

*A web-based survey prepared by Noklus in collaboration with the Antibiotic Center for Primary Medicine in Norway*



### Purpose:

Do General Practitioners follow national guidelines for the use of strep tests and treatment with antibiotics for throat infections?

### Background:

- Antimicrobial resistance growing global public health problem
- Norway: 80% of all antibiotics are prescribed in PHC
- Gr A Streptococci (GAS) 15-30%

# Norwegian guidelines

## Centor criteria:

- Fever > 38,5 °C
- Coating on the tonsils
- Enlarged and sore throat glands
- Absence of cough *(Centor 1981)*



	Centor criteria	Strep test	Antibiotic treatment
Mild to moderate infection	1	No	No
Moderate infection	2-3	Yes	Yes if positive test
Moderate to severe infection	4	No	Yes

*(Antibiotic center for primary medicine)*

3 case histories with subsequent questions concerning patients with throat infection were sent out to the members of the general practitioners' (GP) association

*Response rate 19 % (905/4700)*

- Results scored according to Centor criteria:
  - Most GPs recommend antibiotics for sore throat according to guidelines.
  - Inadequate awareness among GPs regarding when to perform streptococcal antigen tests.
  - Some unnecessary use of broad-spectrum antibiotics.

*Included both pre- and postanalytical issues with focus on correct use of tests and antibiotics – in accordance with the «Choosing wisely» campaign*

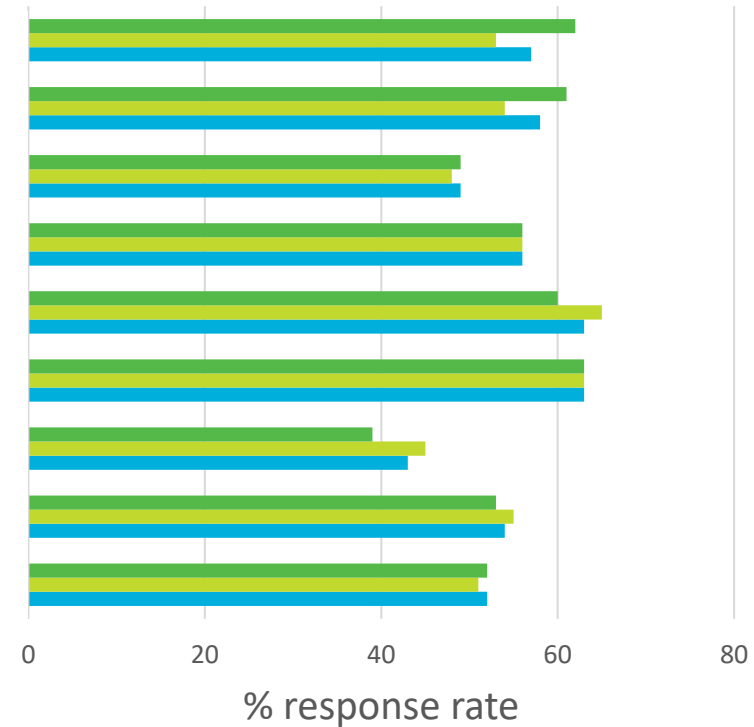
# Noklus Pre- and postanalytical EQAS 2013-2022

Web based surveys

Questions first, then reference to guidelines and best practice

## Topic and year of dispatch

Urine sampling for culture and strip examination (2021)  
 Capillary sampling (2020)  
 Processing of test results and transfer of answers (2019)  
 Pre-treatment, storage and transport (2018)  
 Patient ID, marking and registration of test results (2017)  
 Urine sampling for culture and strip examination (2016)  
 Venous sampling (2015)  
 Capillary sampling (2014)  
 Preparation for sampling, Patient ID, hand hygiene (2013)



■ S      ■ A      ■ Total

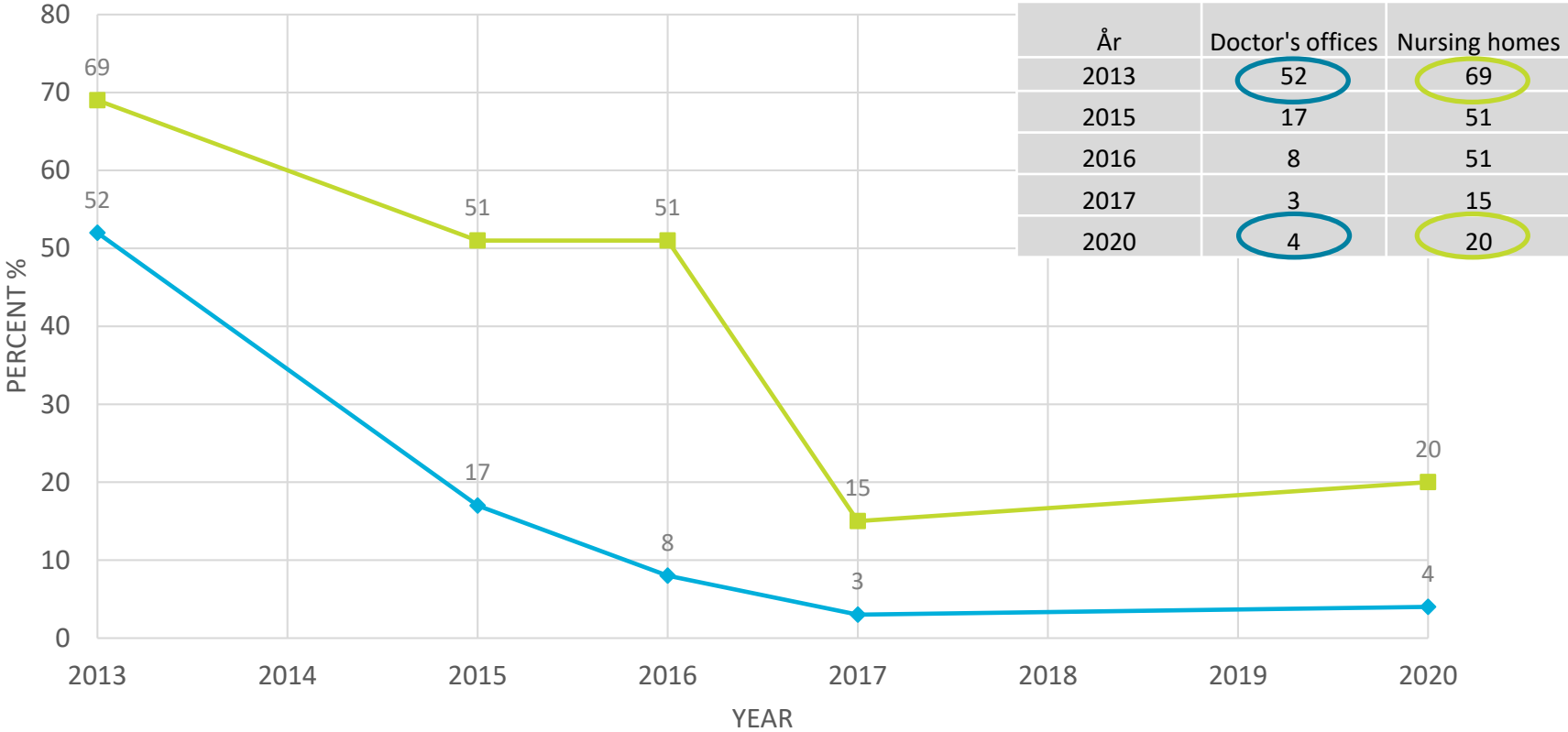
S= Nursing home and home care

A = GP's office

*Sent to 2000 - 3000 participants in Primary Health Care  
 Feedback from 1000-1600, response rate 50-60%*

# Patient identification

IF THE PATIENT IS KNOWN, WE DO NOT ASK FOR NAME, DATE OF BIRTH OR PERSONAL ID





# Type I – Challenges and possibilities

- Validated and pilot tested
  - circulated in different countries and not translated into local languages
- Response rate
  - Clear and concise and not too time consuming
  - High quality feedback report
- Variety of locations and staff groups outside the laboratory's direct control

## Type II

### Circulation of samples simulating errors

- Use of real samples with matrices potentially interfering with the measurement procedures
- Wrong sample material
- Including case histories to elucidate which pre- and postanalytical procedures are performed

## Type II – Examples...

# Nordic hemolysis survey 2014

Effects of hemolysis on some common serum analysis

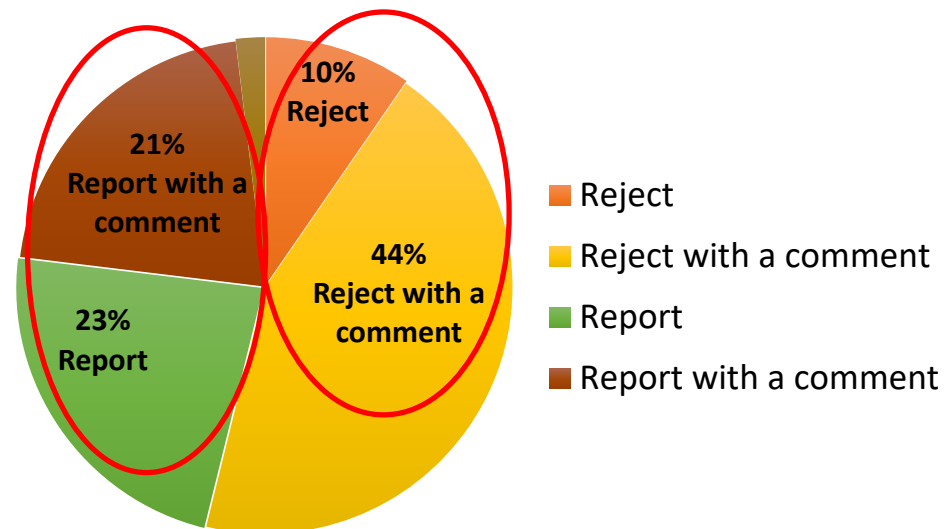
- 142 Nordic laboratories received 4 hemolyzed samples (hemolysis degree 0, 1, 2, 4 g/L)
- Analyzed 15 different clinical chemistry analytes in duplicate
- Answered questions on routine handling of hemolysed patient samples

*Update information on the effect of hemolysis on analytical procedures and how hemolyzed samples are handled.*

# Result

- Response rate 97%
- Difference in how to respond to hemolysis within the same instrument group:

Roche Cobas, ALP (Hb 2 g/L)



*88 % has written procedures for handling of hemolysed samples*

## Serumindex (437) **EQUALIS**

Quality assurance of the HIL analysis;  
hemolysis-, lipemia- and icterus - Increased control of  
pre-analytical measurements

**Sample material:** Pooled serum samples that are modified to  
simulate hemolysis, icterus and lipemia at varying levels. Frequency:  
4/year

**Feedback report:** Comparison of own result with the total  
mean or the method group mean

## HIL index and interference (4131)

Joining pre-analytical index with post-analytical comments to the clinicians

3 rounds pr. year

2 samples each round, similar pools of serum:

- 1 normal sample A
- 1 modified sample B with added interference (haemolysis, icterus or lipemia)

Cover the total testing process:

**Pre-analytical:** Do all find the same haemolytic, icterical and lipemic index?

**Analytical:** Measurement of Cholesterol, Creatinine, Ferritin, Potassium, LDH, Phosphate – interference effect?

**Post-analytical:** Does everyone add the same comment, when having measured the same interference?

## Type II – Challenges and possibilities

- Bias may be introduced when the laboratories know they will receive a manipulated sample
- Production of sample material reflecting poor preanalytical conditions in a large scale
  - Commutable? Homogeneous? Stable?



# Preparing sample material

The control material must give a correct picture of the hemolysis that may occur pre-analytically in laboratory samples, due to poor blood sampling.

Compared three methods:

1. Osmotic shock- lysis of erythrocytes by distilled water after removal of the buffy coat **Feasible**
  2. Freeze - lysis of whole blood by freezing **Easy and feasible**
  3. Shear - lysis by multiple aspirations of whole blood through a fine needle **Unfit and not feasible due to large interindividual differences in Hb concentration**
- } Include leukocytes, platelets and erythrocytes

*The same degree of hemolysis affects the measurements of several analytes differently, especially LDH, depending on the method used in the preparation of the hemolysate*

# Type III: Registration of errors/adverse events

- EQA-organization suggests actual quality indicators (QIs) related to pre- and postanalytical errors and develops a common registration system
- The laboratories report their QI data regularly over a given period using the standardized system
- Feedback report
  - Own QI performance compared to the results of all participants and to desirable quality specifications
  - Historical data showing the development of the performance of the laboratory's QIs

## Type III – Examples...



## Spanish Preanalytical Quality Monitoring Program (2001-2022)

- Register the number and cause of rejections obtained for one month, 4 times a year
  - for each type of sample: serum, whole blood EDTA, plasma citrate, random urine
  - for different causes of rejection: **hemolysed**, clotted, not received, insufficient
- Redesigned in 2014
  - Include only data from routine samples
  - Data obtained directly from the laboratory information system
  - Performance specifications based on the state of the art (p25 best, p50 common, p75 worst, p90 unacceptable)

# Noklus EQA-program for common quality indicators 2018-2021

- 5 quality indicators (2021):
  1. Proportion of rejected potassium analyzes due to hemolysis (Preanalytical)
  2. Proportion of EQA results for HbA1c outside Noklus' acceptance limits (Analytical)
  3. Turn Around Time (TAT) of CRP/INR value at 90<sup>th</sup> percentile (STAT) (Postanalytical)
  4. Incorrectly sent laboratory reports (Postanalytical)
  5. Waiting time at the outpatient clinic (Preanalytical)
- September each year as registration period
- Anonymous reporting
- 48 registered and 45 submitted answers (94%)

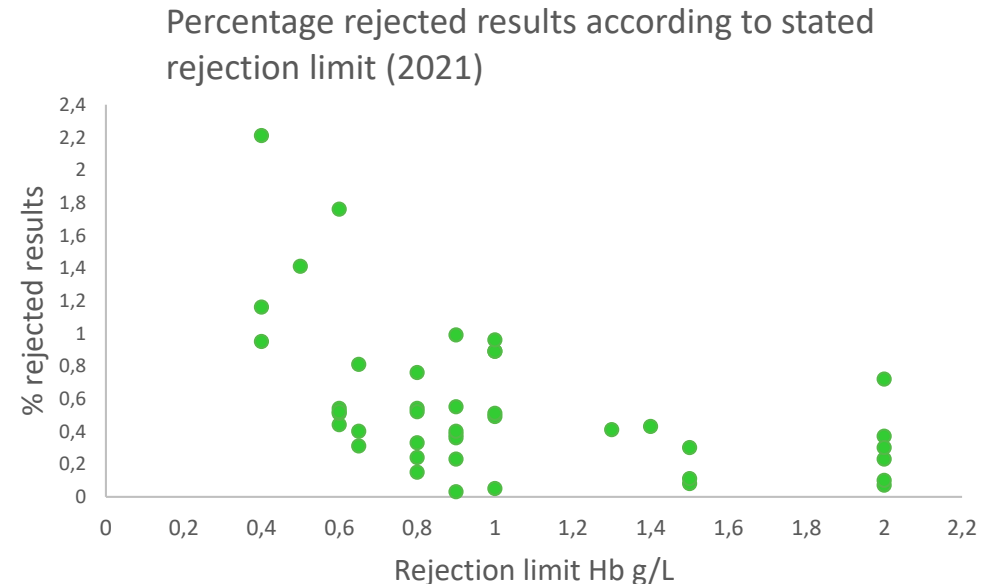
# Type III – Challenges and possibilities

- Harmonization of QIs
  - Standardized reporting system
  - Uniquely defined and measurable
- Labor intensive process
- Performance specifications
- Under-reporting

# Harmonization of QIs?

Q1 Proportion of rejected potassium analyzes due to hemolysis...will depend on the rejection limits used..

Rejection limits reported	
2018	0,01-2,35 g/L
2019	0,2-2 g/L
2020	0,2-2,23 g/L
2021	0,4-2,0 g/L



*Not harmonized - not suitable as a common quality indicator...*

*Rejection limits should be decided by the professional community*

# Performance specifications

«State-of-the-art» (IFCC WG-LEPS: MQI)?

- High, 25th percentile value – Best performance
- Medium, 50th percentile value – more frequent/common performance
- Low, 75th percentile value – worst performance

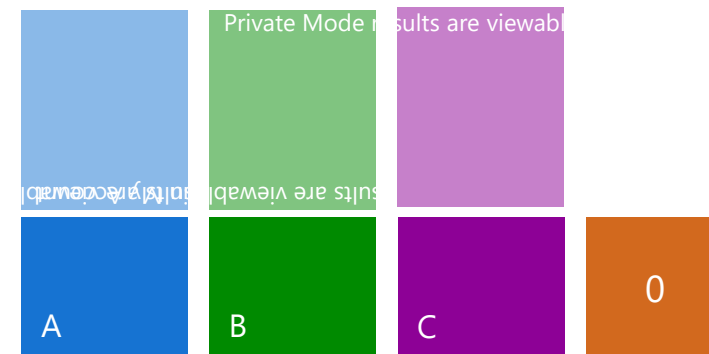
*Calculated at the end of the year and used as quality criteria for the coming year*



# Quality specifications based on «state-of-the-art»

Does it make sense to define the 25% lowest performing laboratories as poor performers?

- A. Yes
- B. No
- C. Don't know



# EQA by monitoring patient medians

Noklus offers to laboratories worldwide to participate in:

- The Percentiler
- The Flagger



# The Percentiler program



Participating laboratories calculate, and report instrument-specific medians based on patient results. The total number of patient results is also reported.



Ideally, patient medians are reported daily, but less frequent reporting is also possible.



Results are exported to a central database by standardized e-mails.

*>120 Laboratories from 18 different countries*

# The Flagger program



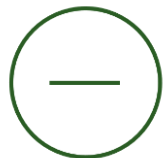
Participating laboratories calculate, and report instrument-specific percentage of patient results above and below the reference limit.



Ideally, flagging rates are reported daily, but less frequent reporting is also possible.



Results are exported to a central database by standardized e-mails (containing an additional two columns compared to The Percentiler export).



Laboratories can choose to participate in the Percentiler program only

*Ca 50 laboratories*

## *The concept:*

Patient medians and flagging rates are normally stable over time, and any change is usually due to pre-analytical/analytical/post-analytical instability or error.

*Covers the total testing process*

# “What is in it for the laboratory”



Participation in the Flagger gives additional information about the consequences of a potential bias for the number of results outside locally used reference limits.



Participation in the Percentiler- and Flagger programs can help to assess the effect of reagent or calibrator lot-to-lot variation.




Effects of changes in pre-analytical factors, like sample tubes used and different dietary supplements, can be seen in the Percentiler- and Flagger programs.

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Thanks