FACULTY OF VETERINARY MEDICINE
accredited by EAEVE

Department of Virology, Parasitology and Immunology
Laboratory of Parasitology

Coprological methods: soil-transmitted helminths as a case study

Bruno Levecke – Winter Symposium Swiss TPH – December 7, 2017

200 YEARS
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Overview

- What are the options?
- Which one to use?
- What is priority for R&D?

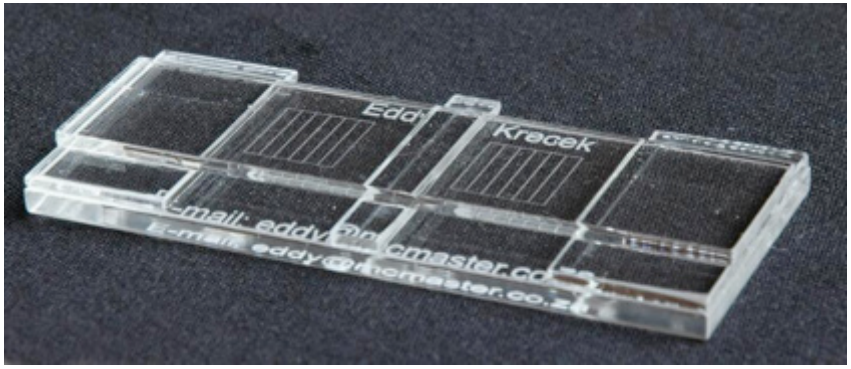
What are the options?

What is out there?

Kato-Katz thick smear

FLOTAC

Mini-FLOTAC

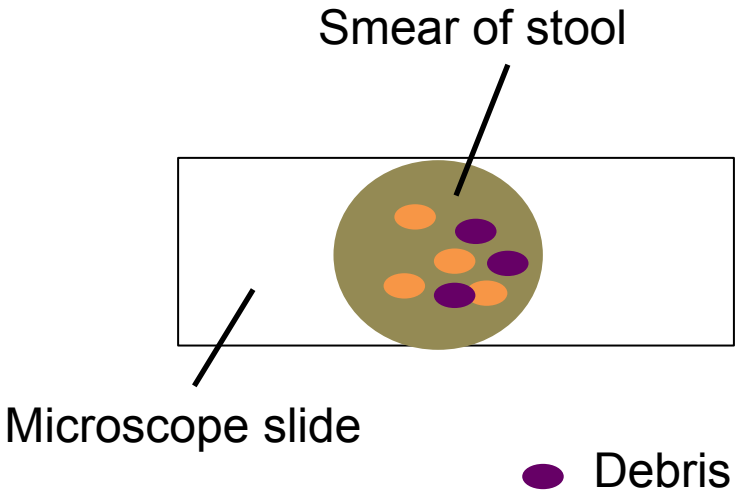


McMaster

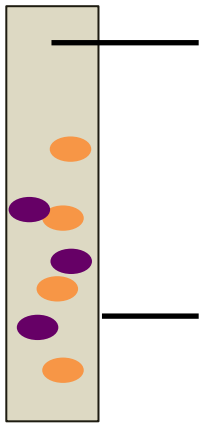
FECPAK^{G2}

Principle

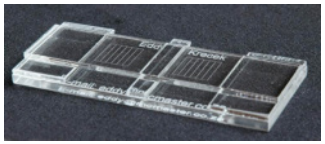
Smear



Flotation



McMaster



Kato-Katz thick smear

FLOTAC

Mini-FLOTAC

FECPAK^{G2}

Principle

Smear

- All eggs detectable

Flotation

- Only eggs with a density ≤ density solution

Principle

Smear

- All eggs detectable
- Few steps / equipment

Flotation

- Only eggs with a density ≤ density solution
- Multiple steps / equipment

Kato-Katz thick smear

McMaster

Mini-FLOTAC

FECPAK^{G2}

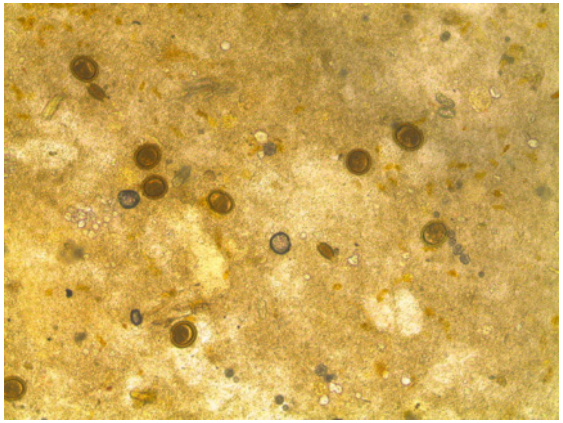
Principle

Smear

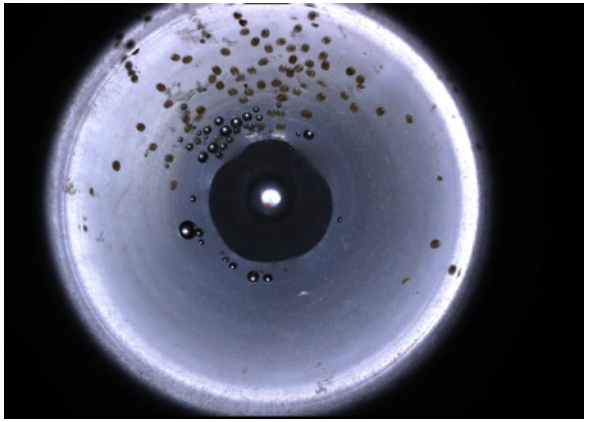
- All eggs detectable
- Few steps / equipment
- Microscopic view not clear

Flotation

- Only eggs with a density ≤ density solution
- Multiple steps / equipment
- Clear microscopic view



Kato-Katz thick smear



FECPAK^{G2}

Principle

Smear

- All eggs detectable
- Few steps / equipment
- Microscopic view not clear
- ‘dry’ homogenization
- Limited amount of stool sampled / examined

Flotation

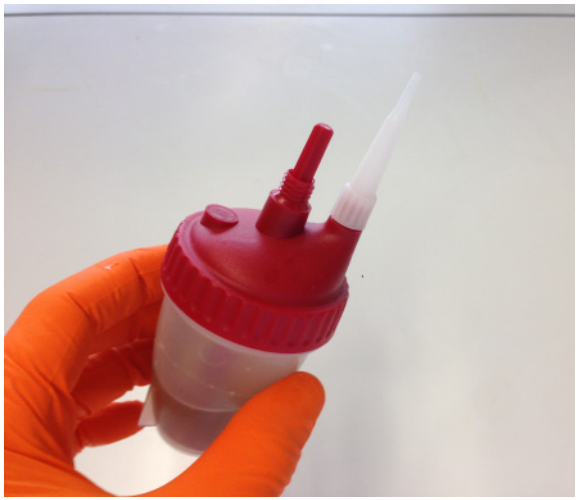
- Only eggs with a density ≤ density solution
- Multiple steps / equipment
- Clear microscopic view
- Homogenization in liquid phase
- Sampling / examination of large volumes of stool

Special features

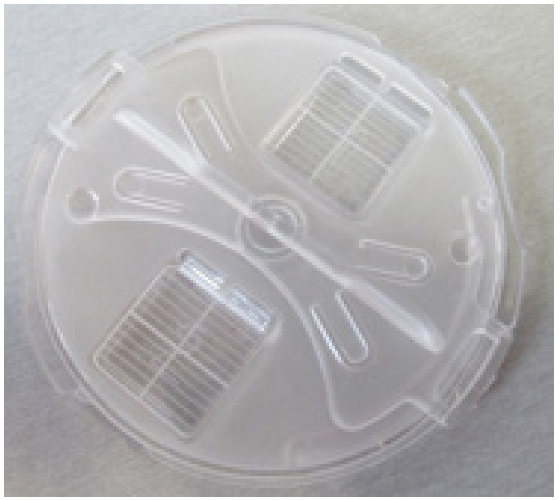
- (Mini-)FLOTAC

FLOTAC: Examination up to 1 gram of stool

Fill-FLOTAC: sample collector – homogenization – filtration – filling device



Mini-FLOTAC: Examination up to 1/10 gram of stool



PROTOCOL

FLOTAC: new multivalent techniques for qualitative and quantitative copromicroscopic diagnosis of parasites in animals and humans

Giuseppe Cringoli[1], Laura Rinaldi[1], Maria Paola Maurelli[1] & Jürg Utzinger[2]

UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

PROTOCOL EXTENSION

The Mini-FLOTAC technique for the diagnosis of helminth and protozoan infections in humans and animals

Giuseppe Cringoli[1], Maria P Maurelli[1], Bruno Levecke[2], Antonio Bosco[1], Jozef Vercruysse[2], Jürg Utzinger[3,4] & Laura Rinaldi[1]

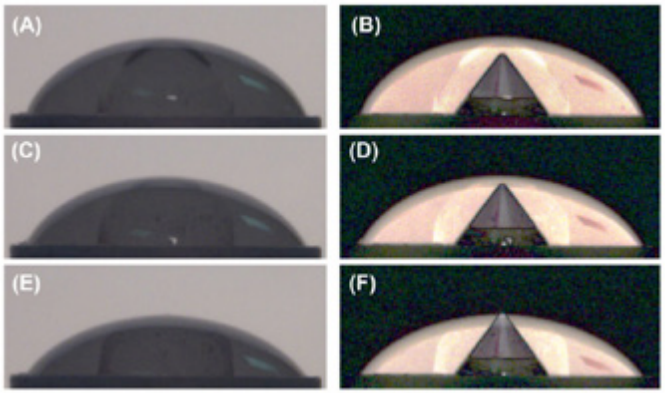
Special features

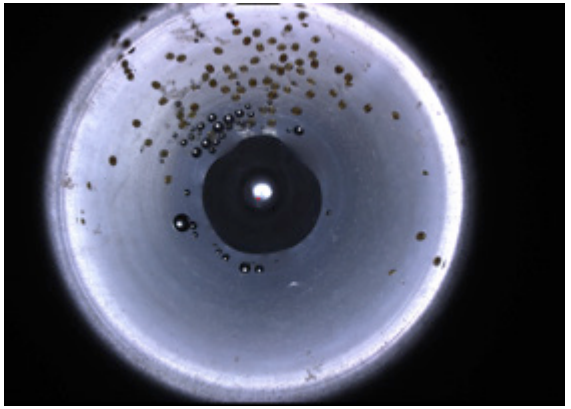
- FECPAK^{G2}

Cassette: accumulation of eggs 1 microscopic view

Linkage of metadata & reporting

Micro I: Imaging and storage of images





MENIXIS

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TECHNOLOGY IN ACTION

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Te Whare Wānanga o Otāgo
NEW ZEALAND

Diagnostic performance

- Lack of sensitivity

Rank	*Ascaris*	*Trichuris*	Hookworm
1	FLOTAC	FLOTAC	FLOTAC
2	Mini-FLOTAC	3-sample KK	Mini-FLOTAC
3	3-sample KK	2-sample KK	3-sample KK
4	2-sample KK	2-slide KK	2-sample KK
5	2-slide KK	1-slide KK	2-slide KK
6	1-slide KK	McMaster	1-slide KK
7	McMaster	Mini-FLOTAC	McMaster

95 - 100%

85 -94%

75 - 84%

<75%

Diagnostic performance

- Sensitivity ≈ function of amount of stool examined

Rank	*Ascaris*	*Trichuris*	Hookworm
1	1	1	1
2	1/10	1/8	1/10
3	1/8	1/12	1/8
4	1/12	1/12	1/12
5	1/12	1/24	1/12
6	1/24	1/50	1/24
7	1/50	1/10	1/50

95 - 100%

85 -94%

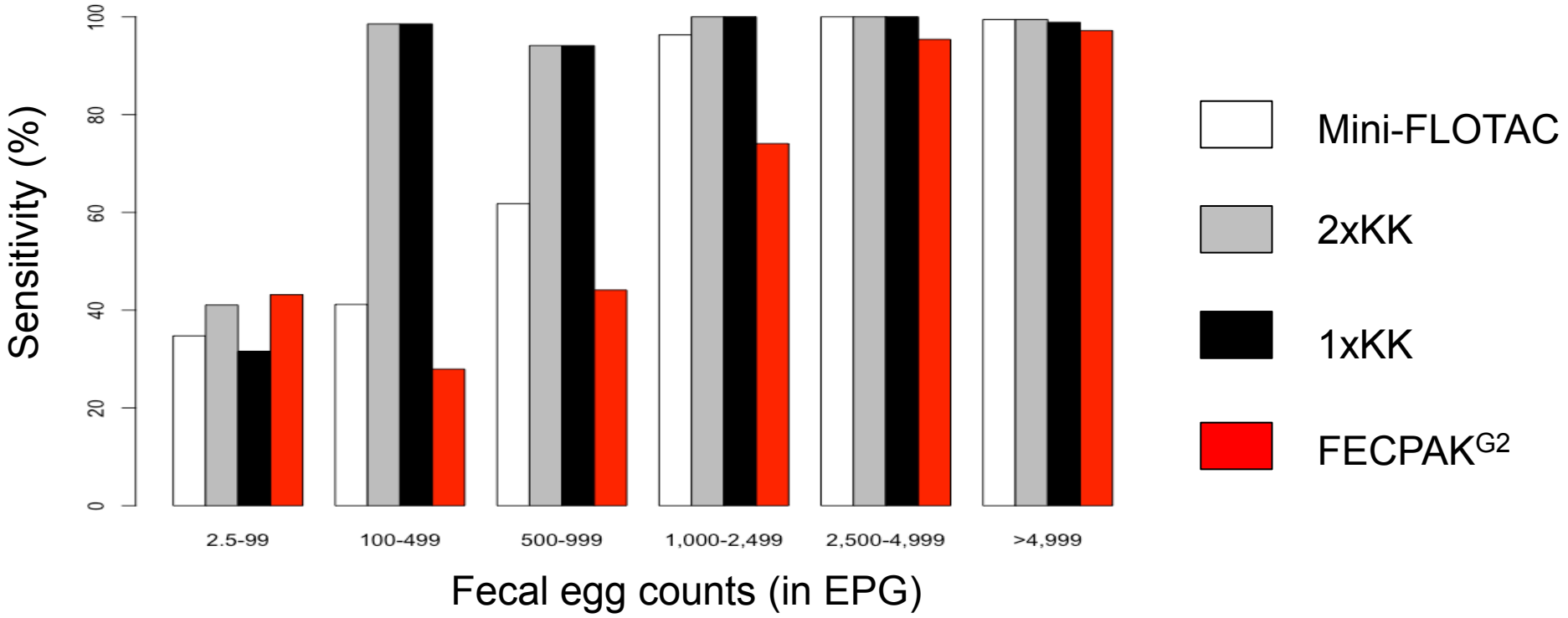
75 - 84%

<75%

FECPAK^{G2} allows to examine 1/33

Diagnostic performance

- Sensitivity ≈ function of egg excretion

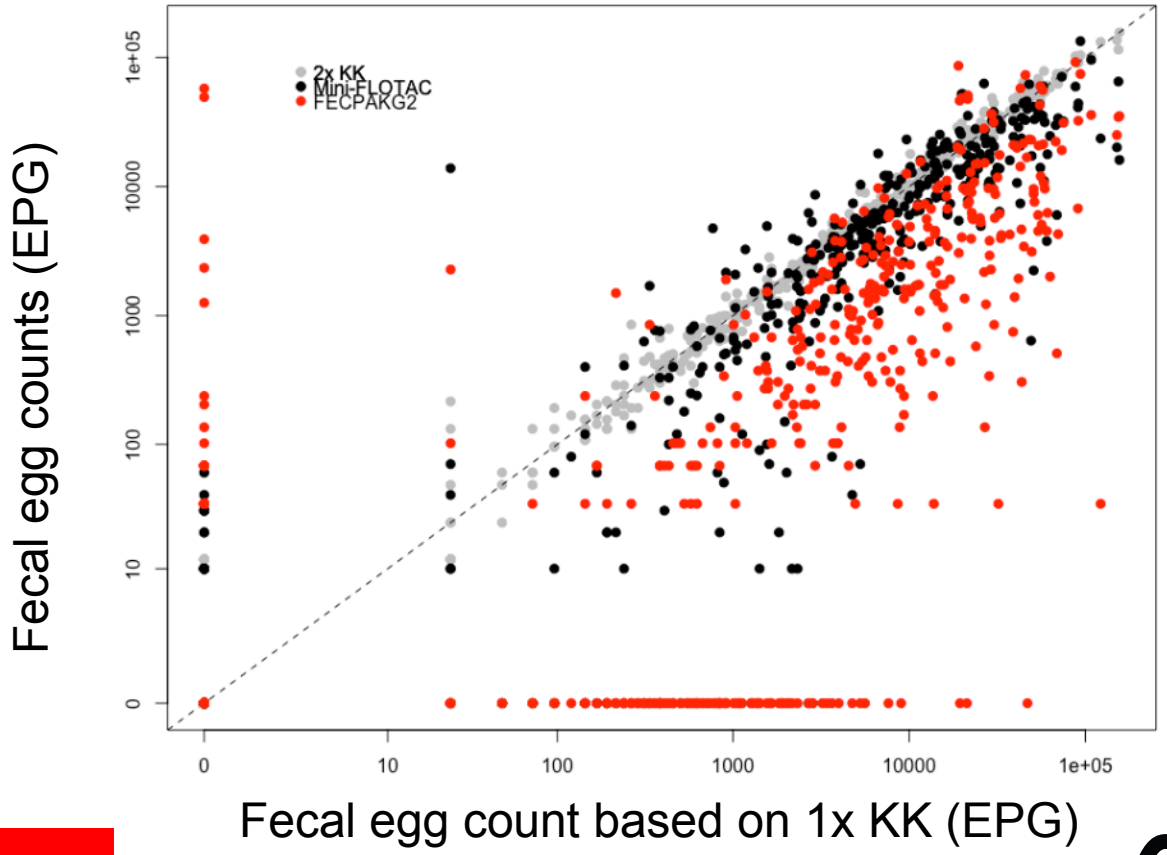


Ascaris

star worms

Diagnostic performance

- Pronounced differences in FECs



Ascaris

star worms

Estimated cost per sample

Technique	Cost equipment	Cost process	Total
1x Kato-Katz	1.11	0.27 – 0.60	1.38 – 1.71
McMaster	1.41	0.37 – 0.38	1.78 – 1.79
Mini-FLOTAC	1.44	0.58 – 1.58	2.02 – 3.02
FLOTAC	2.48	0.96	3.54
FECPAK^{G2}	3.85	0.74	4.59

Note 1: Estimates based on certain assumptions
Note 2: FECPAK^{G2} includes data entry, data analysis, reporting and

Suppliers

Kato-Katz

VESTERGAARD
IMPACTING PEOPLE

Combined 康百得 深圳市康百得生物科技有限公司
SHENZHEN COMBINED BIOTECH CO.,LTD.

Instituto de Tecnologia em Imunobiológicos
Bio-Manguinhos

CDC
CHINESE CENTER FOR DISEASE CONTROL AND PREVENTION
NATIONAL INSTITUTE OF PARASITIC DISEASES

CM

McMaster

CHALEX CORPORATION
VETSLIDES.COM

FEC SOURCE

FOCAL POINT

Vetlab Supplies
Specialists in Veterinary Laboratory Supplies

Hausser Scientific
Products You Can Count On!

(Mini)-FLOTAC

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FEDERICO II

FECPAK^{G2}

Techion Group Ltd
TECHNOLOGY IN ACTION

Which one to use?

No one is perfect – a hybrid?

Feature	Option
Sampling large parts of stool	FLOTAC
Homogenization in liquid phase	Fill-FLOTAC
Few steps / equipment	Kato-Katz
All eggs detectable	Kato-Katz
Large amount of stool examined	FLOTAC
All eggs in one microscopic view	FECPAK^{G2}
Images from eggs	FECPAK^{G2}
Downstream storage of images, analysis and reporting	FECPAK^{G2}

Is it all about sensitivity?

- How do we report data?

Number of stool samples	Number of Kato-Katz slides	Sensitivity	Cure rate (%)	Egg reduction rate (%)
2	2		55.7	72.7
2	1		59.3	74.0
1	2		65.5	75.1
1	1		70.3	75.2

Effect of sampling and diagnostic effort on the assessment of schistosomiasis and soil-transmitted helminthiasis and drug efficacy: a meta-analysis of six drug efficacy trials and one epidemiological survey

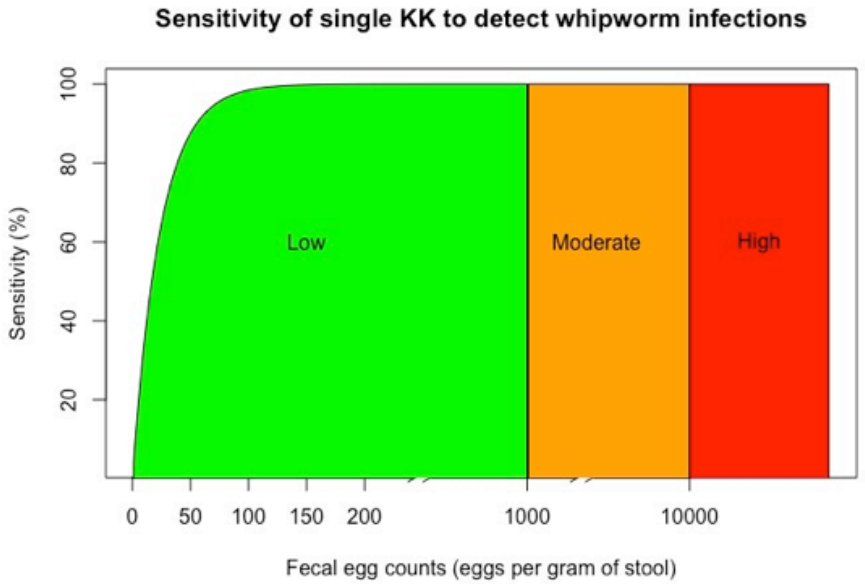
BRUNO LEVECKE[1]*, SIMON J. BROOKER[2], STEFANIE KNOPP[3,4,5], PETER STEINMANN[4,5], JOSE CARLOS SOUSA-FIGUEIREDO[6], J. RUSSELL STOTHARD[7], JÜRG UTZINGER[4,5] *and* JOZEF VERCRUYSSE[1]

Is it all about sensitivity?

- What do we want to achieve?

elimination as a public-health problem

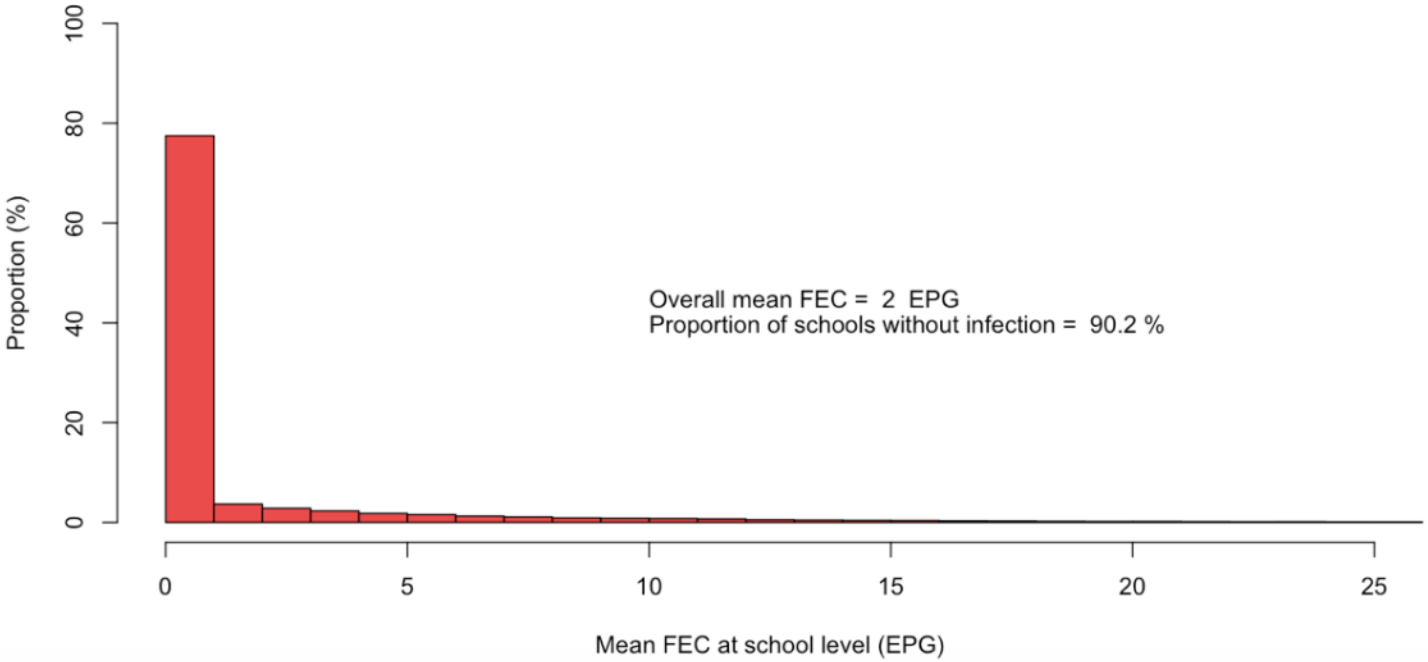
For operational purposes, WHO defines STH as a public-health problem when more than 1% of the at-risk population has infection of moderate or high intensity and its control requires the delivery of one or more public health interventions. Elimination of STH as a public-health problem refers to elimination of the morbidity caused by the infections in children. The goal is not to eliminate the parasites but to reduce the morbidity they cause to levels that can be controlled through routine health-care or school-based services.



Levecke et al., unpublished data

Different ways to Rome?

- Detect *Ascaris* infections in a district with 95% probability



Levecke et al., unpublished data

Different ways to Rome?

- Detect *Ascaris* infections in a district with 95% probability

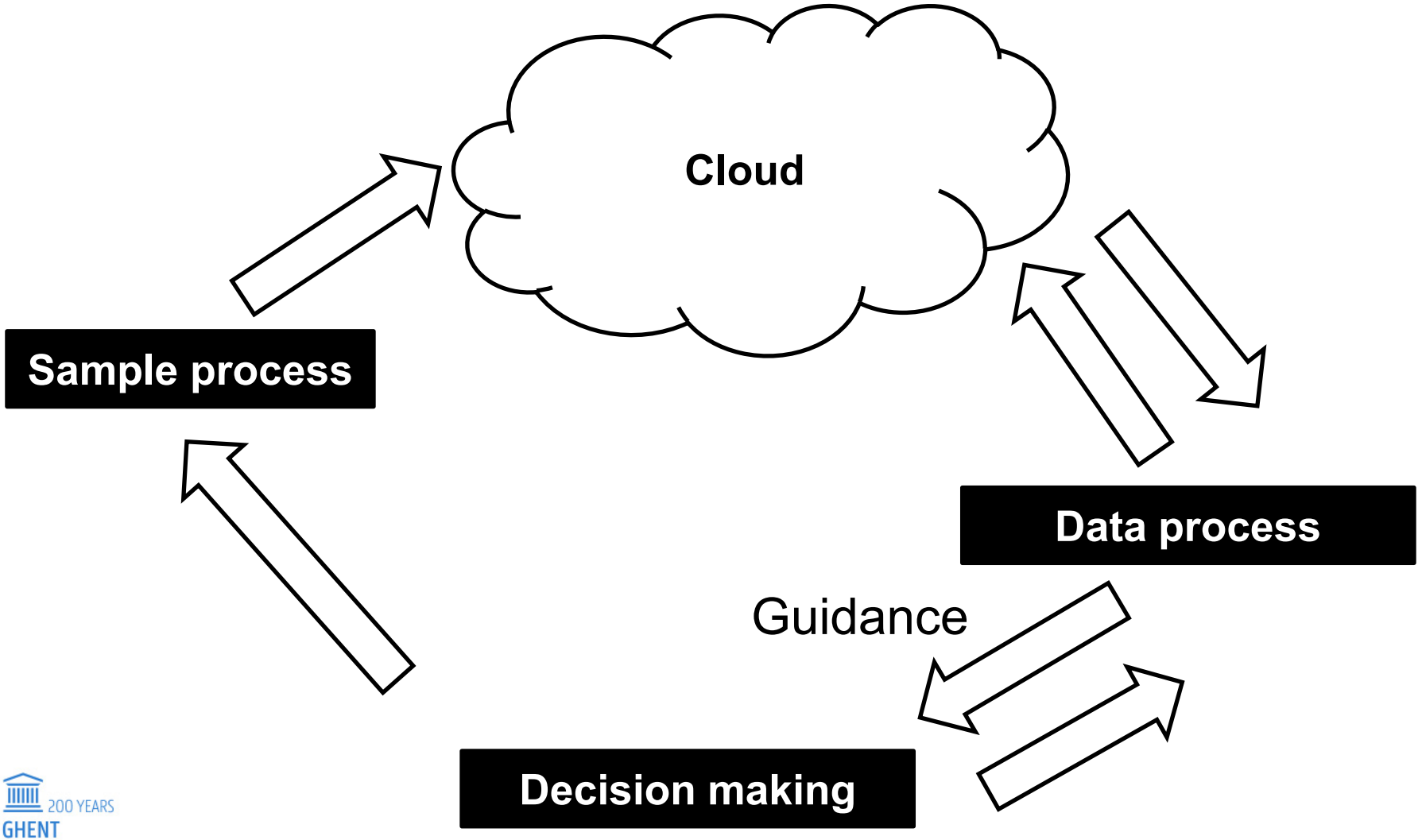
Method	Number of schools	Number of children	Total number of children	Time (days)
FLOTAC	45	24	1,080	109
Mini-FLOTAC	45	31	1,395	112
1x Kato-Katz	45	36	1,620	114
McMaster	45	41	1,845	107

Levecke et al., unpublished data

What is priority for R&D?

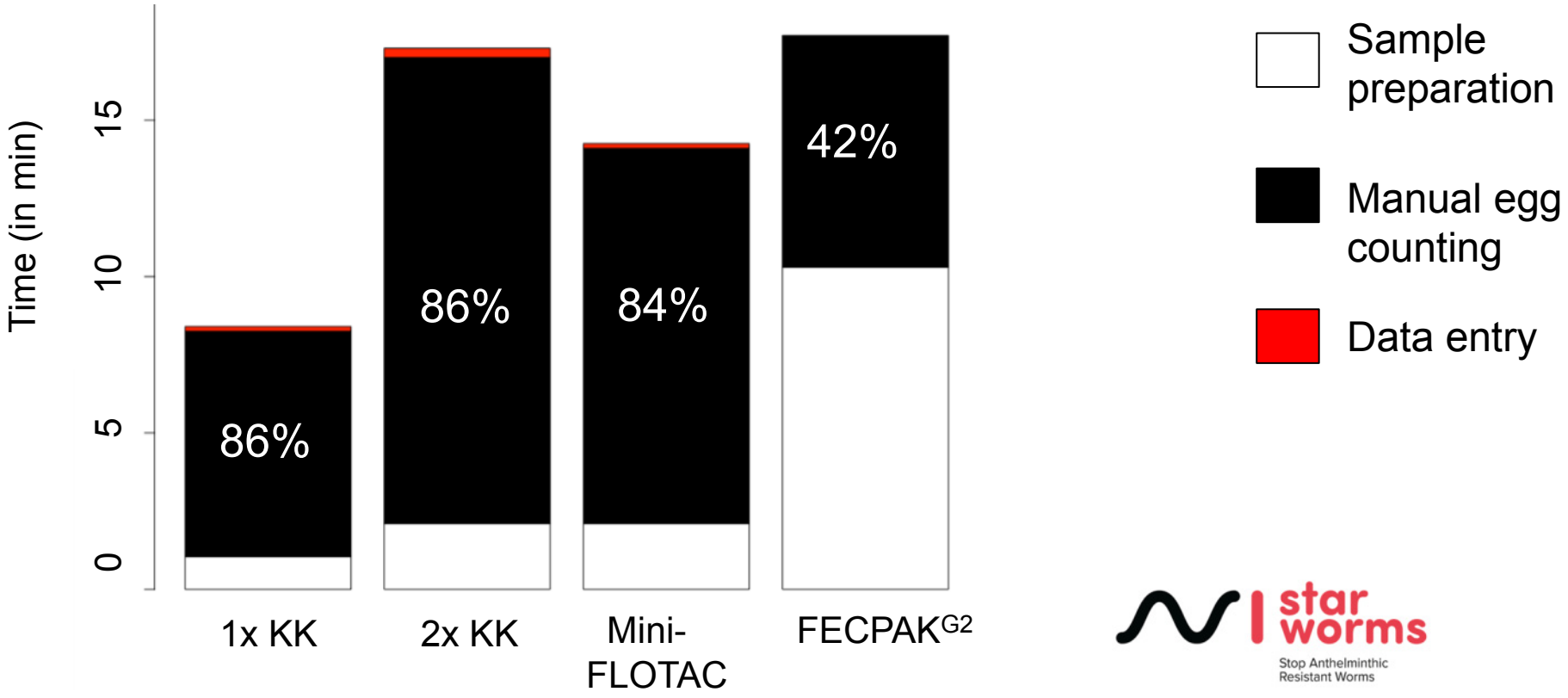
- Complete package
- Automated egg counts
- Quality control

Complete package



Automated egg counting

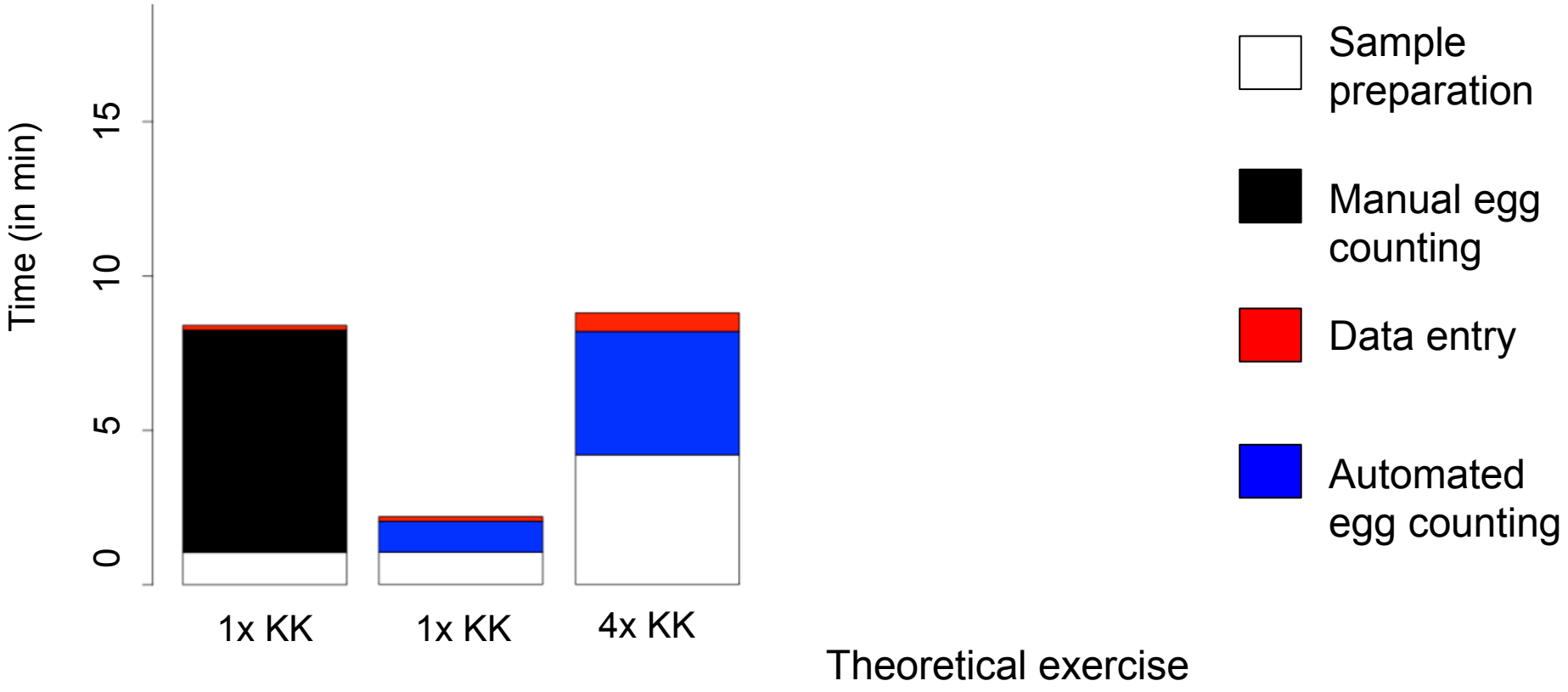
- Counting eggs most time consuming



star worms
Stop Anthelminthic Resistant Worms

Automated egg counting

- More stool could be examined



How to guarantee the quality?

- Current quality control = poor
  - Re-examination of 10% slides

Speich *et al. Parasites & Vectors* (2015) 8:82
DOI 10.1186/s13071-015-0702-z

RESEARCH Open Access

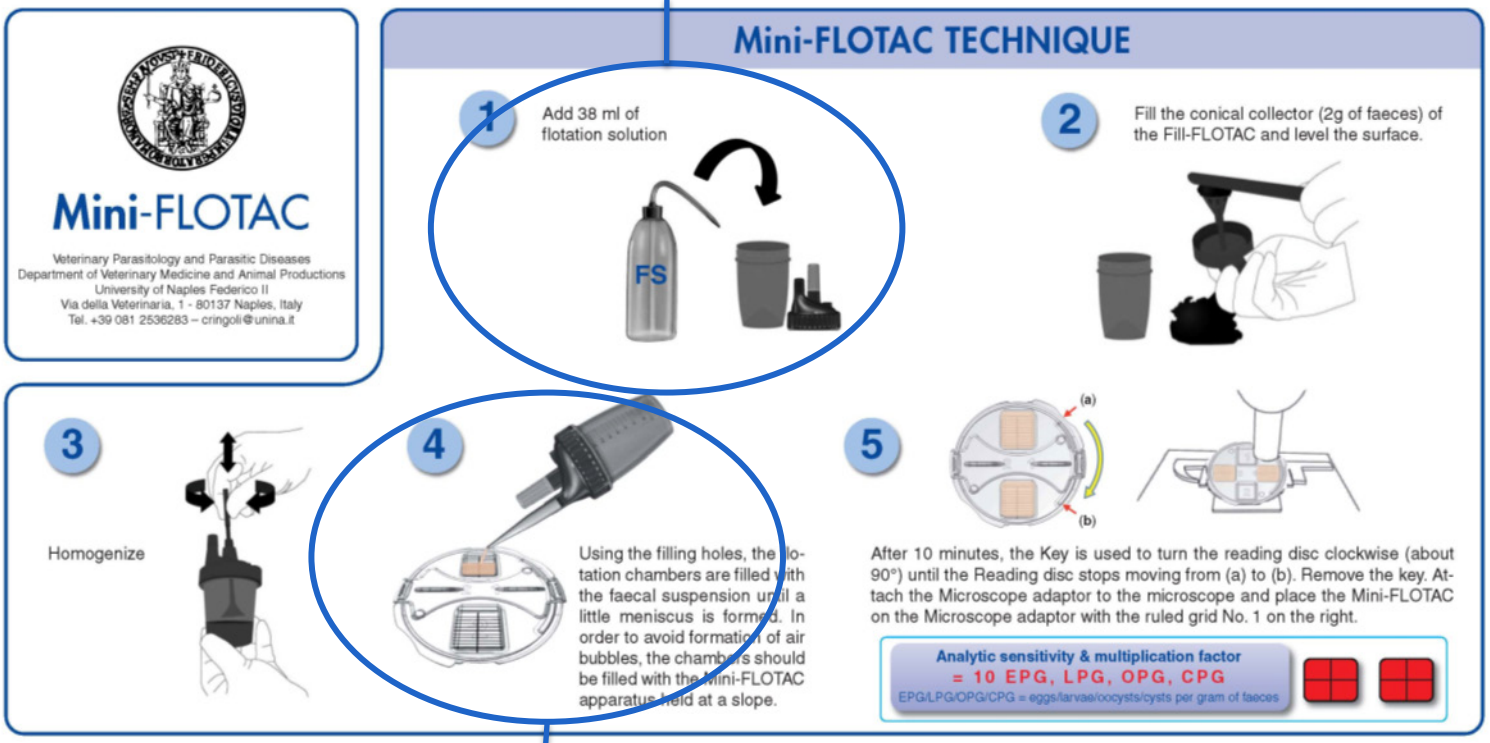
Quality control in the diagnosis of *Trichuris trichiura* and *Ascaris lumbricoides* using the Kato-Katz technique: experience from three randomised controlled trials

Benjamin Speich[1,2], Said M Ali[3], Shaali M Ame[3], Marco Albonico[4], Jürg Utzinger[2,5] and Jennifer Keiser[1,2*]

- False negatives/positives
- Difference in egg counts
  - ≥10 eggs when ≤ 100 eggs
  - ≥20% when ≥ 100 eggs

How to guarantee the quality?

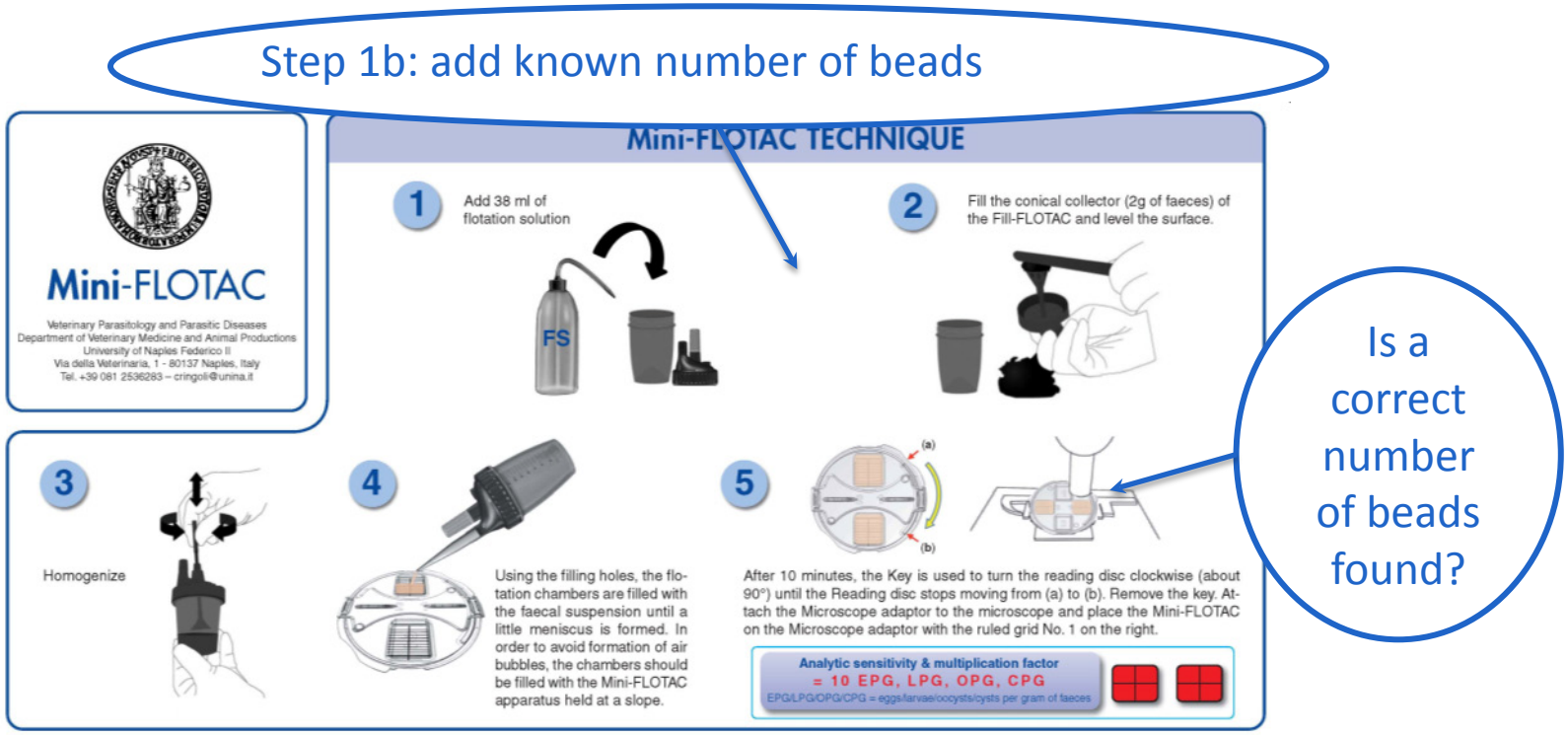
Density of flotation solution



Homogenization suspension prior filling

How to guarantee the quality?

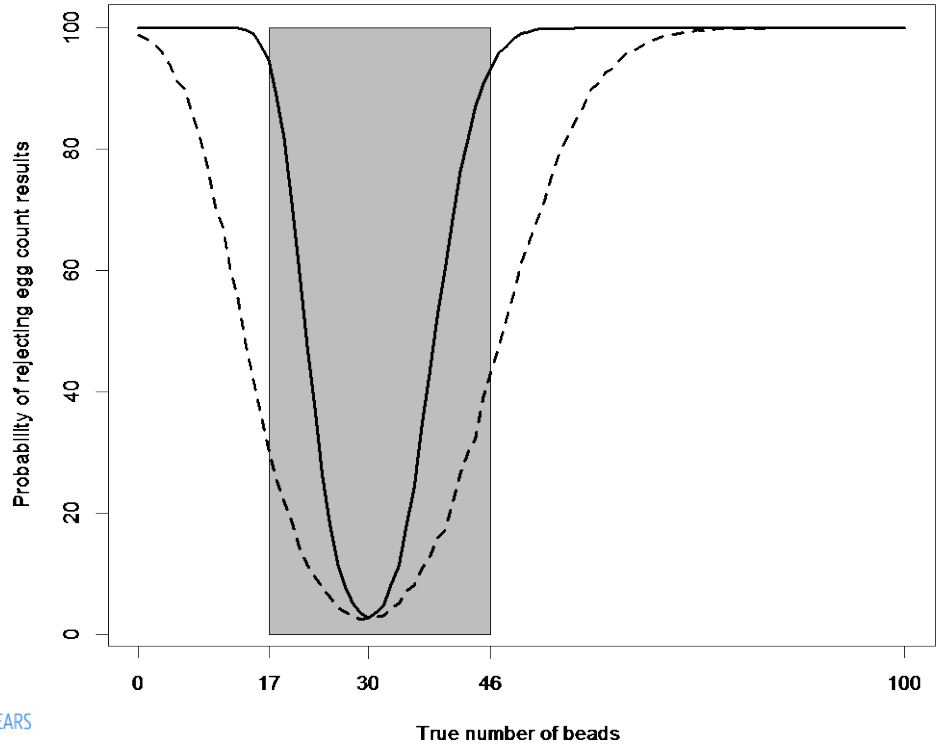
- Complementary methods
  - Internal control + statistical inference



Levecke et al., unpublished data

How to guarantee the quality?

- Complementary methods
  - Internal control + statistical inference

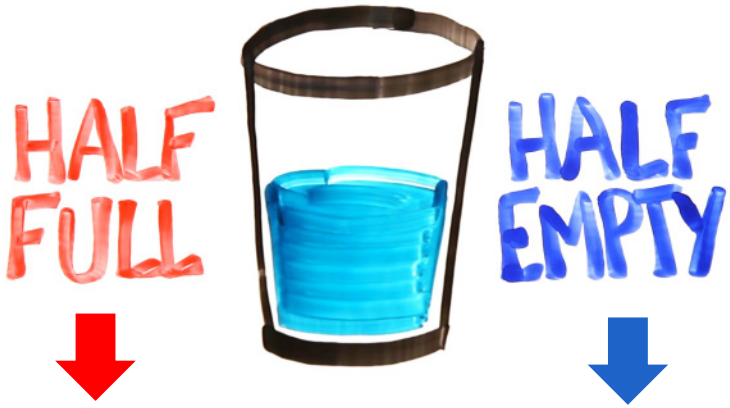


Number of chambers
2 chambers
1 chamber

Levecke et al., unpublished data

How to guarantee the quality?

- Complementary methods
  - Internal control + statistical inference



It is still better than nothing

We should re-design sample processing

Levecke et al., unpublished data

Summary

- No one is perfect – hybrid?
- Who can beat Kato-Katz?
- Should we not think/act beyond dogmas?
- Should we not define how and what we want to measure?
- Is it not more than diagnosis?
- Other priorities for R&D?

Thank you for your attention

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