FACULTY OF VETERINARY MEDICINE
accredited by EAEVE

DEPARTMENT OF INTERNAL MEDICINE, REPRODUCTION AND POPULATION MEDICINE
VETERINARY EPIDEMIOLOGY

WHY IS BIOSECURITY IMPORTANT AND HOW CAN IT HELP TO IMPROVE PRODUCTIVITY AND REDUCE AMU

Prof. Jeroen Dewulf

GHENT UNIVERSITY

biocheck.ugent

1

Bio-what ?

BIOSECURITY

=

The application of a set of **management**, **behavioural** and **physical** measures designed to reduce the risk of **introduction**, **establishment** and **spread** of pathogenic agents **to, within and from** an animal population.

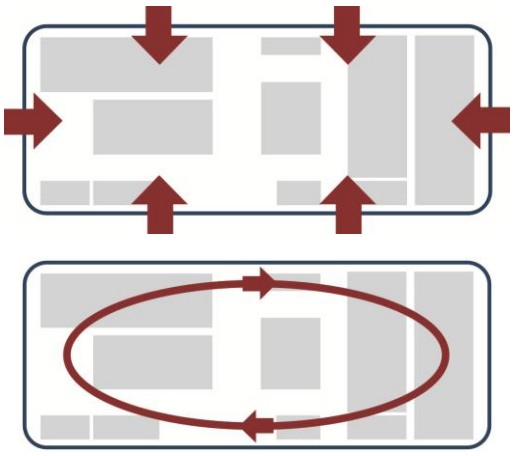
GHENT UNIVERSITY

biocheck.ugent

2

EXTERNAL biosecurity
= reduce introduction

INTERNAL biosecurity
= reduce spread



GHENT UNIVERSITY

vbiocheck .ugent

3

BIOSECURITY is (should be) the basis of any disease control program

GHENT UNIVERSITY

vbiocheck .ugent

4

Is biosecurity important?

Epidemic diseases

Endemic and zoonotic diseases

Sustainability

Reduction of antimicrobial use

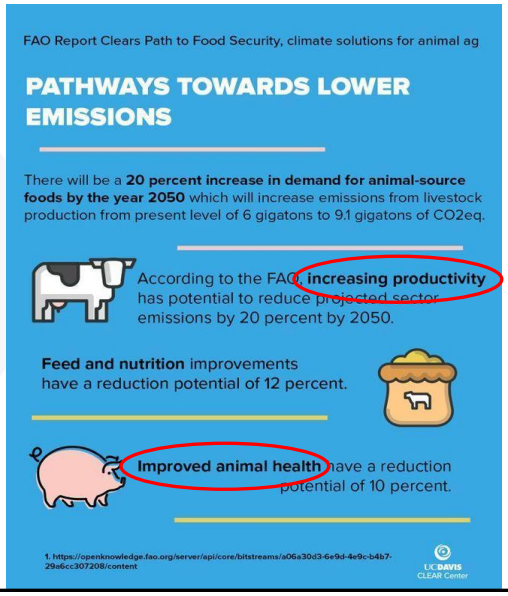
Biosecurity helps to address of all of these challenges

GHENT UNIVERSITY

biocheck .ugent

5

Is biosecurity important?



GHENT UNIVERSITY

biocheck .ugent

6

Principles of biosecurity

GHENT UNIVERSITY

biocheck.ugent

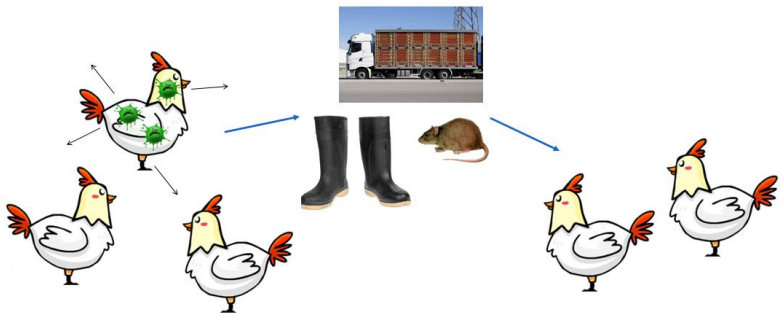
7

PRINCIPLES OF BIOSECURITY

1) Separation of infectious and susceptible animals

→ avoid both direct and indirect contact!

(all-in/all-out, working lines, hospital pen, …)



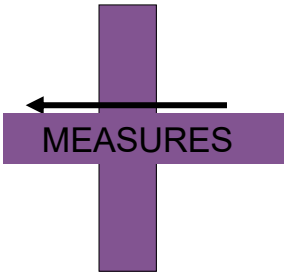
GHENT UNIVERSITY

biocheck.ugent

8

PRINCIPLES OF BIOSECURITY

CLEAN
(susceptible animals)



DIRTY
(direct and indirect sources of infection)

- Dependent upon herd situation (status, type,…)
- Perform well and consequent

GHENT UNIVERSITY

biocheck .ugent

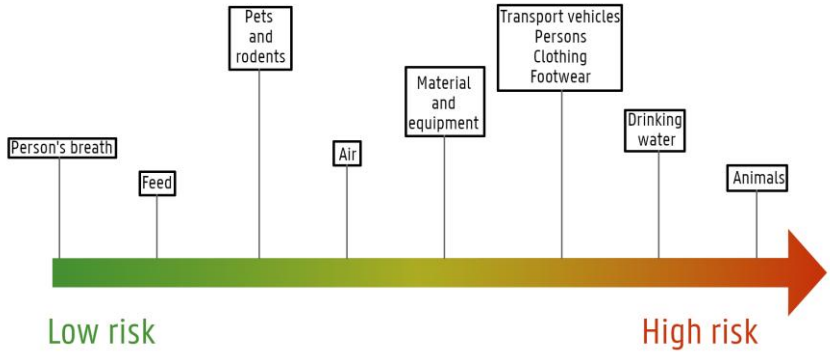
9

Disease	Vertical Transmission	Horizontal transmission	Horizontal spread	Persistance in the environment
Mycoplasma spp.	Yes	Yes	Slow	Low
Salmonella	Yes	Yes	Fast	High
Avian Influenza	?	Yes	Very fast	Low
Newcastle disease	No	Yes	Fast	Low
Infectious laryngotracheitis	No	Yes	Fast	Low
Infectious bronchitis	No	Yes	Fast	Low
Aspergillus	No	No	Environmental contamination	High
Pasteurellosis	No	Yes	Medium	Low
Escherichia coli	No	Yes	Fast	High
Gumboro	No	Yes	Fast	High
Marek disease	No	Yes	Medium	High
Coccidiosis	No	Yes	Fast	High
Clostridium perfringens	No	Yes	Medium	High

10

PRINCIPLES OF BIOSECURITY

2) Not every transmission route is equally important



GHENT UNIVERSITY

biocheck.ugent

11

PRINCIPLES OF BIOSECURITY

3) Reduction of the general infection pressure

→ breaking the infection cycle, reducing the burden on the immune system↓

GHENT UNIVERSITY

biocheck.ugent

12

PRINCIPLES OF BIOSECURITY

Where are biosecurity measures most important?

A. Large herds
B. Small herds
C. Independent of herd size

GHENT UNIVERSITY

biocheck.ugent

13

PRINCIPLES OF BIOSECURITY

4) Size matters

GHENT UNIVERSITY

biocheck.ugent

14

PRINCIPLES OF BIOSECURITY

5. Frequency does matter

'Thousand times a small chance becomes a large chance'

Risk transmission route (p)

Frequency transmission route (n)

$P = 1 - (1-p)^n$

GHENT UNIVERSITY

biocheck .ugent

15

PRINCIPLES OF BIOSECURITY

Assume that the risk of disease introduction to your herd through feed delivery is 1 out of 1000, and the feed delivery truck comes weekly.
What is the annual risk?

GHENT UNIVERSITY

biocheck .ugent

16

PRINCIPLES OF BIOSECURITY

5) Frequency matters

- 'Thousand times a small chance becomes a large chance'
  - Risk transmission route (p)
  - **Frequency transmission route (n)**
- $P = 1 – (1-p)^n$
  - p= 0.1% (1 out of 1000)
  - n= 52 (e.g. weekly)
    - **5,06%**= $1 – (1-0.001)^{52}$

GHENT UNIVERSITY

biocheck .ugent

17

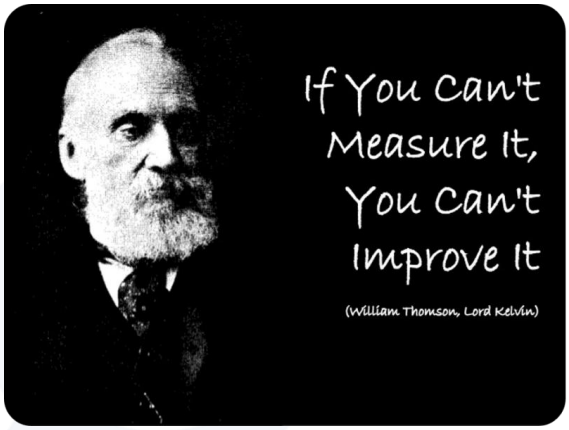
THE 5 PRINCIPLES OF BIOSECURITY

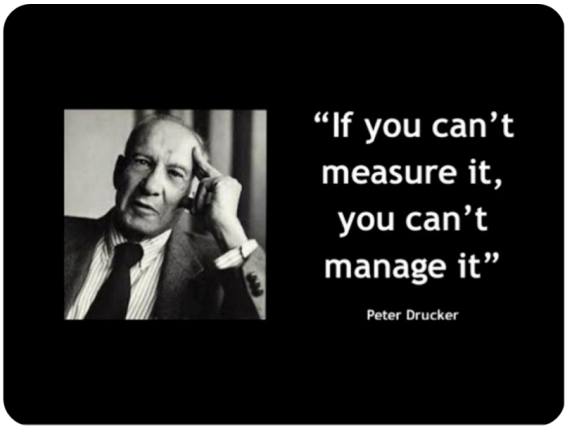
1. Separate infectious and susceptible animals
2. Not every measure is equally important
3. Reduce the general infection pressure
4. Size matters
5. Frequency matters

GHENT UNIVERSITY

biocheck .ugent

18

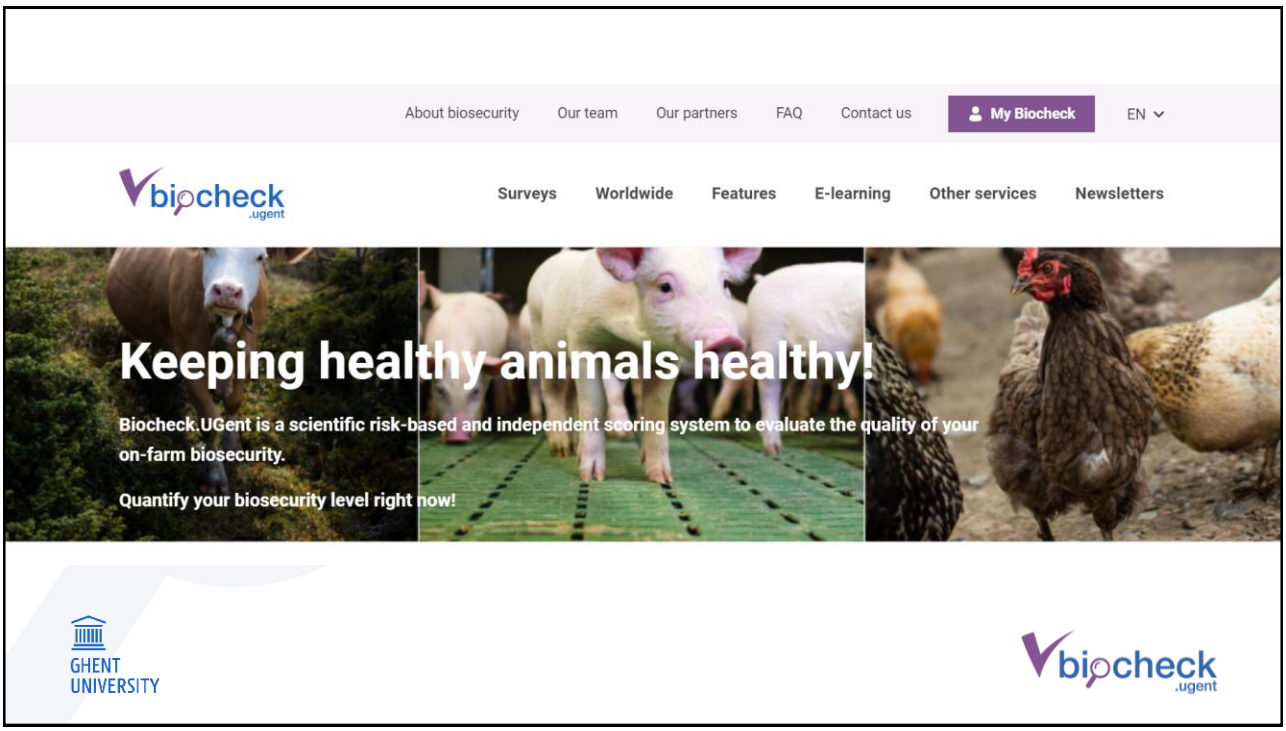




GHENT UNIVERSITY

biocheck .ugent

19



GHENT UNIVERSITY

biocheck .ugent

20

BIOCHECK.UGENT

Platform to help increase biosecurity levels

Data-driven recommendations

With the goal to keeping healthy animals healthy

www.biocheckgent.com



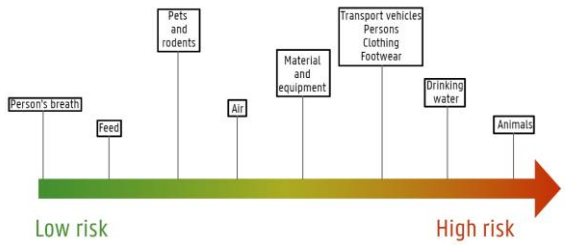

GHENT UNIVERSITY

biocheck .ugent

21

BIOCHECK.UGENT

Risk based scoring system



Weighted scores

Based on scientific research

Risk for transmission: direct vs. indirect contact

Free for use www.biocheckgent.com




GHENT UNIVERSITY

biocheck .ugent

22

BIOCHECK.UGENT

Pig

- → Pigs indoor Preferred
- → Pigs indoor Old version
- → Pigs outdoor
- → Pig backyard/small-scale

Cattle

- → Veal calves
- → Beef cattle
- → Dairy cattle
- → Dairy-source beef cattle production

Small ruminants

- → Small ruminants dairy
- → Small ruminants meat

Poultry

- → Free range broilers
- → Free range layers
- → Ducks
- → Backyard poultry
- → Laying hens
- → Broilers
- → Turkeys
- → Breeders

GHENT UNIVERSITY

biocheck .ugent

23

GHENT UNIVERSITY

BIOCHECK.UGENT

ID: 20388/691653/w2_1/F
Entry date: 2019-03-10 13:22:08
Identification:

PIG

Nr	Description	Score	Country average	Global average
External biosecurity				
A	Purchase of animals and semen	100 %	88 %	89 %
B	Transport of animals, removal of manure and dead animals	41 %	70 %	70 %
C	Feed, water and equipment supply	27 %	38 %	50 %
D	Personnel and visitors	41 %	64 %	68 %
E	Vermin and bird control	50 %	64 %	67 %
F	Environment and region	60 %	53 %	64 %
	Subtotal External biosecurity:	***57 %***	***66 %***	***70 %***
Internal biosecurity				
A	Disease management	40 %	56 %	67 %
B	Farrowing and suckling period	64 %	59 %	56 %
C	Nursery unit	36 %	65 %	66 %
D	Fattening unit	N/A	72 %	67 %
E	Measures between compartments and the use of equipment	39 %	44 %	48 %
F	Cleaning and disinfection	20 %	48 %	59 %
	Subtotal Internal biosecurity:	***38 %***	***55 %***	***58 %***
N/A = Not applicable	**Total:**	**48 %**	**61 %**	**64 %**

GHENT UNIVERSITY

24

Quantification of biosecurity status on farm level

↳ Comparing scores between different herds

↳ Comparing scores between different countries

↳ Comparing scores in time

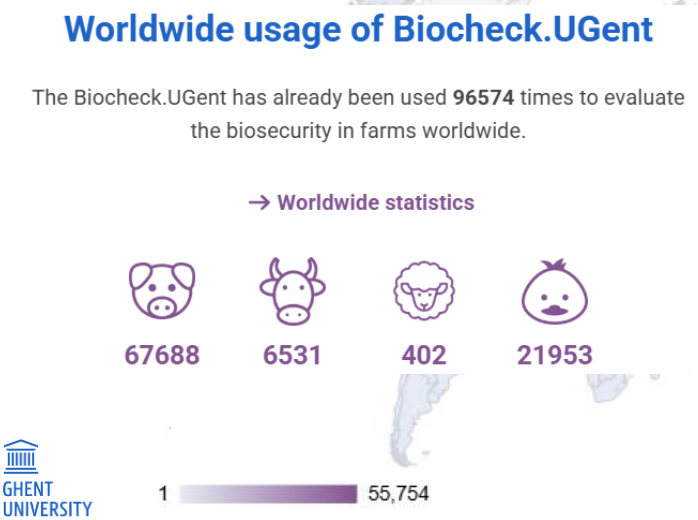
↳ Taking different risks into account

GHENT UNIVERSITY

biocheck .ugent

25

WORLD LARGEST DATABASE ON BIOSECURITY



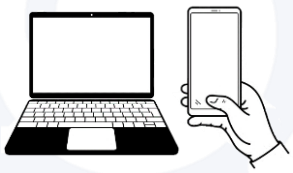
GHENT UNIVERSITY

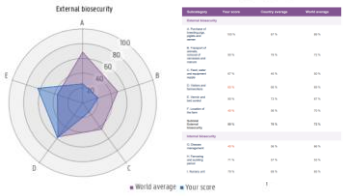
National implementation in
- Belgium (pig, poultry)
- Ireland (pig, poultry)
- Finland (cattle, pig)
- Italy (pig)
- Czech Republic (pig, poultry, cattle)
- Luxemburg (cattle, pig, poultry)
- UK (Pigs)
- Shotland (Pigs)
- …

26

BIOCHECK IS A DECISION SUPPORT SYSTEM

User input → Comparative scoring → Feedback & coaching





Personalized dashboards

Visualize progress

GHENT UNIVERSITY

biocheck .ugent

27

CYCLE OF IMPROVEMENT

biocheck .ugent

Measure → Recommend → Support → Implement → Measure

GHENT UNIVERSITY

biocheck .ugent

28

Better biosecurity

Lower antimicrobial use

Lower antimicrobial resistance

GHENT UNIVERSITY

biocheck.ugent

29

Impact of biosecurity

The Veterinary Journal 198 (2013) 508–512

Contents lists available at ScienceDirect

The Veterinary Journal

journal homepage: www.elsevier.com/locate/tvjl

Relationship between biosecurity and production/antimicrobial treatment characteristics in pig herds

M. Laanen [a,*], D. Persoons [a,b], S. Ribbens [c], E. de Jong [c], B. Callens [a], M. Strubbe [c], D. Maes [a], J. Dewulf [a]

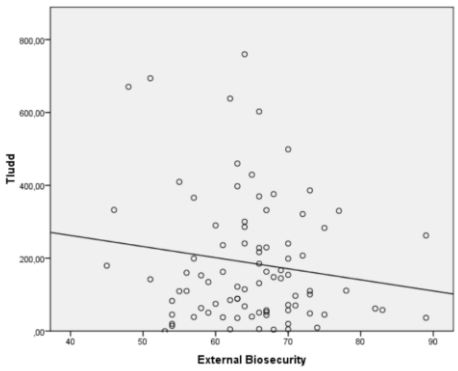
[a] Unit of Veterinary Epidemiology, Department of Reproduction, Obstetrics and Herd Health, Faculty of Veterinary Medicine, Ghent University, 9820 Merelbeke, Belgium
[b] Pharma.be, Belgian Association for the Pharmaceutical Industry, 1170 Brussels, Belgium
[c] Animal Health Care Flanders, 9000 Drongen, Belgium

GHENT UNIVERSITY

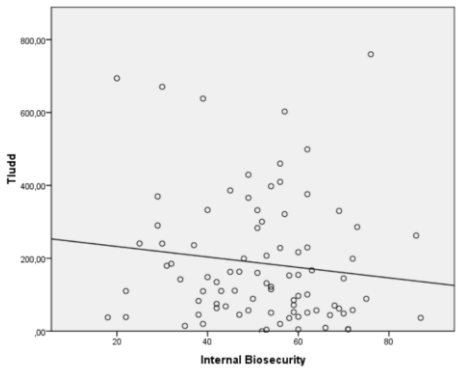
biocheck.ugent

30

Biosecurity vs antimicrobial use



Pearson r = -0,15, p = 0,17



Pearson r = -0,12, p = 0,25

GHENT UNIVERSITY

biocheck .ugent

31

Impact of biosecurity

ELSEVIER

Preventive Veterinary Medicine
Volume 217, August 2023, 105968

Quantitative and qualitative analysis of antimicrobial usage and biosecurity on broiler and Sonali farms in Bangladesh

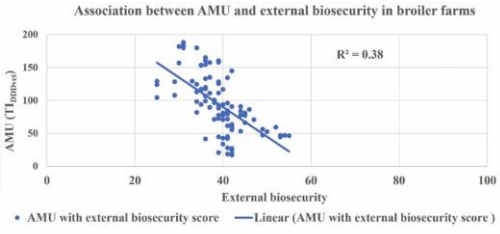
Nelima Ibrahim [a b], Ilias Chantziaras [a], Md. Abu Shoieb Mohsin [e], Filip Boyen [c], Guillaume Fournié [d f g], Sk Shaheenur Islam [b], Anna Catharina Berge [a], Nele Caekebeke [a], Philip Joosten [a], Jeroen Dewulf [a]

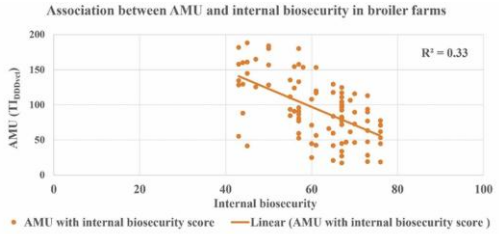
GHENT UNIVERSITY

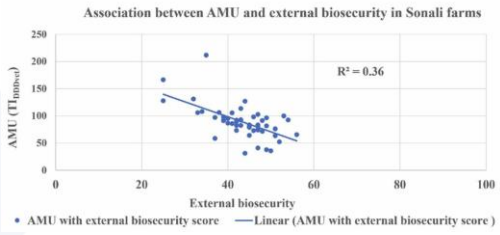
biocheck .ugent

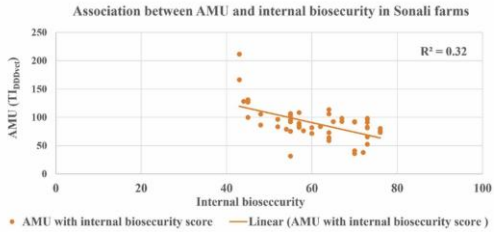
32

Impact of biosecurity









GHENT UNIVERSITY

biocheck .ugent

33

Impact of biosecurity

Article

Impact of Biosecurity on Production Performance and Antimicrobial Usage in Broiler Farms in Cameroon

Stephane D. Ziebe [1,†], Ronald Vougat Ngom [1,*,†], Adonis M. M. Akoussa [1], Henry P. Bogning [2] and Henriette A. Zangue [3]

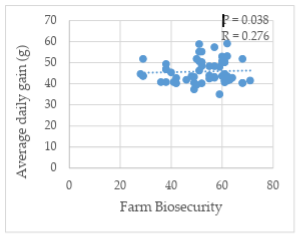
Abstract: The broiler industry is the most developed livestock sector in Cameroon. This study aimed to evaluate the relationship between biosecurity implementation with production performance and antibiotic usage in broiler farms in Cameroon. Data concerning biosecurity, production performance (average daily gain or ADG, mortality rate, feed conversion ratio or FCR, and performance index or PI), and antimicrobial usage (AMU) were collected in 57 farms in the Adamawa and North regions. The average total biosecurity score of broiler farms was 52/100. ADG (46.54 ± 5.18 g versus 43.80 ± 4.16 g), FCR (1.59 ± 0.61 versus 1.75 ± 0.58), mortality rate (2.47% versus 6.65%), and PI (339.21 ± 105.79 versus 268.22 ± 101.09) were statistically better in farms with good biosecurity. The majority of antibiotics used (55.2%) were classified as critically important for human medicine, with 83.9% of antibiotics underdosed/overdosed. No correlation was found between biosecurity and AMU, although there was a trend towards reduced use in farms with good biosecurity. The misuse of antibiotics will result in an increased development of antimicrobial resistance, which can be transmitted to humans. This study highlights the importance of biosecurity in improving poultry performance and reducing AMU. Continuous training

GHENT UNIVERSITY

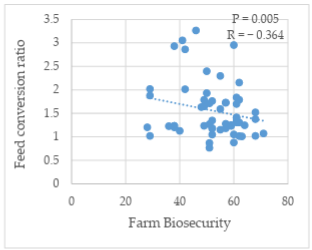
biocheck .ugent

34

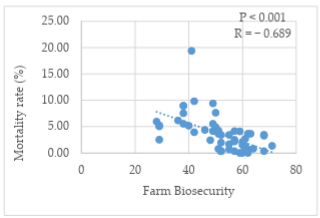
Impact of biosecurity



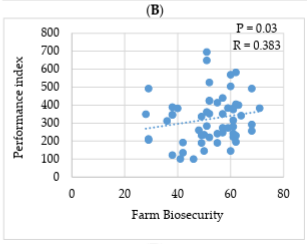
(A)



(B)



(C)



(D)

GHENT UNIVERSITY

biocheck .ugent

35

Impact of biosecurity

Quantitative assessment of biosecurity on conventional broiler farms in Pakistan

Qamer Mahmood [1,*], Ilias Chantziaras [1], Shafique Ur Rehman [2], Mudassar Nazar [3], Jeroen Dewulf [1]

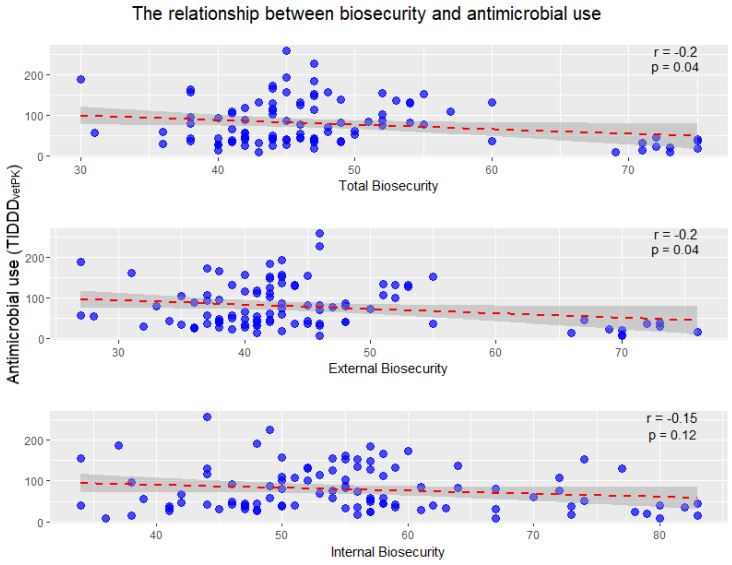
Submitted to Preventive Veterinary Medicine

GHENT UNIVERSITY

biocheck .ugent

36

Impact of biosecurity



GHENT UNIVERSITY

biocheck .ugent

37

Impact of biosecurity

Zoonoses AND PUBLIC HEALTH

Explore this journal >

Original Article

Reducing Antimicrobial Usage in Pig Production without Jeopardizing Production Parameters

M. Postma ✉, W. Vanderhaeghen, S. Sarrazin, D. Maes, J. Dewulf

GHENT UNIVERSITY

biocheck .ugent

38

Total biosecurity: + 11,9%

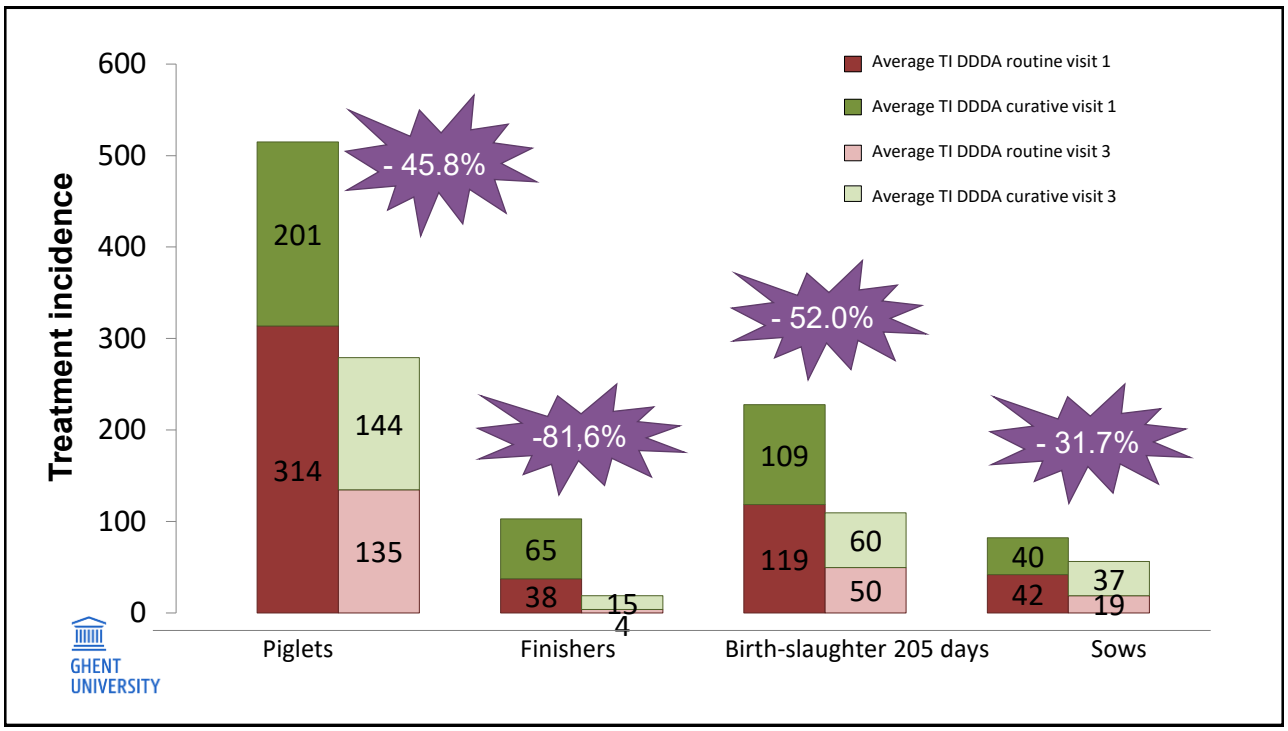
Internal biosecurity: + 18,8%

External biosecurity: + 6,6%

GHENT UNIVERSITY

biocheck .ugent

39



40

Production results

	VISIT	MEAN	DIFFERENCE	P-VALUE
Weaned piglets per sow per year	Initial	26.4	+1,1	<0.01
	Follow up	27.5		
Daily weight gain fatteners	Initial	667.5	+7,7	0.01
	Follow up	675.2		
Mortality in fatteners (%)	Initial	3.2	-0,6	0.04
	Follow up	2.6		

GHENT UNIVERSITY

Postma et al, 2017

41

41

ADVANCE ACCESS

IMMUNOLOGY, HEALTH, AND DISEASE

Biocheck.UGent: A quantitative tool to measure biosecurity at broiler farms and the relationship with technical performances and antimicrobial use

P. Gelaude,*[1] M. Schlepers,* M. Verlinden,† M. Laanen,* and J. Dewulf*

*Unit of Veterinary Epidemiology, Department of Reproduction, Obstetrics and Herd Health, Faculty of Veterinary Medicine, Ghent University, 9820 Merelbeke, Belgium; and †Department of Pathology, Bacteriology and Poultry Diseases, Faculty of Veterinary Medicine, Ghent University, 9820 Merelbeke, Belgium

ABSTRACT The Biocheck.UGent scoring system has been developed to measure and quantify the level of system and accompanying questionnaire can be filled in for free at www.Biocheck.UGent.be. The obtained

GHENT UNIVERSITY

biocheck .ugent

42

Counseling 13 broiler farms to improved biosecurity and reduced AMU

	Before	After	Change
External biosecurity	64	69	+5
Internal biosecurity	73	77	+4
Mortality first week	1,08	1,27	+0,19%
Total mortality	3,54	3,05	-0,49%
Average daily weight gain	57	57	+0
Feed conversion	1,8	1,7	-0,1
Performance index	318	332	+14
Antimicrobial use (TI)	**192**	**136**	**-29%**

GHENT UNIVERSITY

43

antibiotics

MDPI

Article

Coaching Belgian and Dutch broiler farmers aimed at antimicrobial stewardship and disease prevention

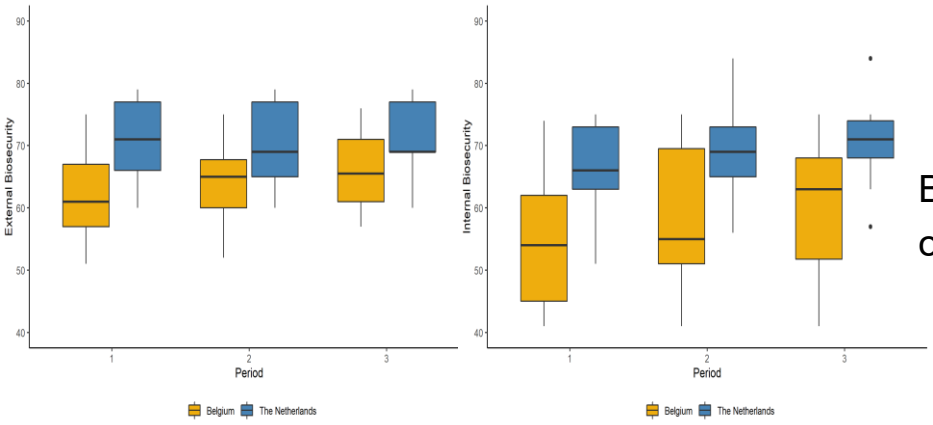
Nele Caekebeke [1,*], Moniek Ringenier [1], Franca J. Jonquiere [2], Tijs J. Tobias [2], Merel Postma [1], Angelique van den Hoogen [2], Manon A.M. Houben [3], Francisca C. Velkers [2], Nathalie Sleeckx [4], Arjan Stegeman [2], and Jeroen Dewulf [1], on behalf of the i-4-1-Health Study Group

GHENT UNIVERSITY

biocheck .ugent

44

IMPACT OF BIOSECURITY



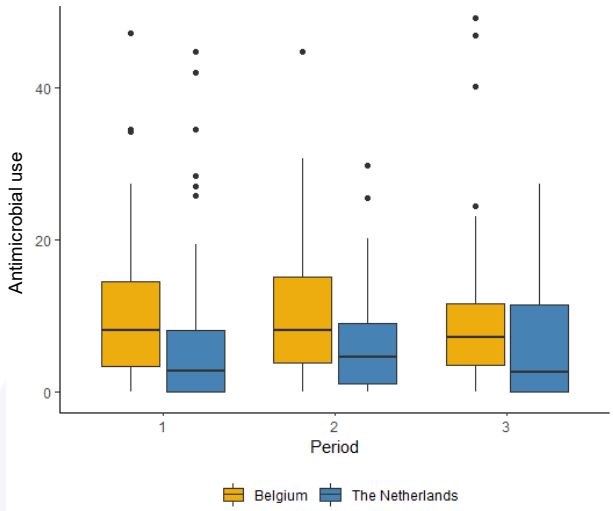
Biosecurity + 7% on average

GHENT UNIVERSITY

biocheck .ugent

45

Reduced antimicrobial usage



-7% on average

No negative effects on production parameters

biocheck .ugent

46

antibiotics

MDPI

Review

Can improved farm biosecurity reduce the need for antimicrobials in food animals? A Scoping Review

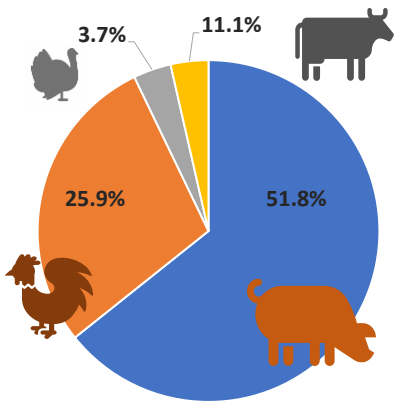
Pankaj Dhaka [1,2,*], Ilias Chantziaras [1,*], Deepthi Vijay [3], Jasbir Singh Bedi [2], Iryna Makovska [1], Evelien Biebaut [1] and Jeroen Dewulf [1]

GHENT UNIVERSITY

vbiocheck.ugent

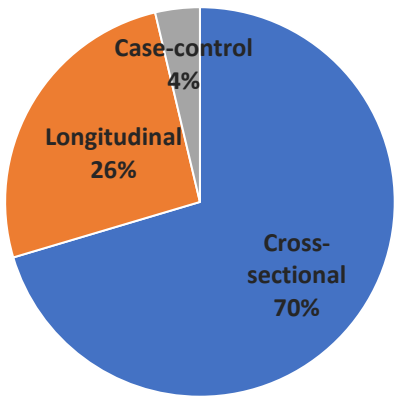
47

Species distribution



Two studies included both pigs and poultry farms

Study types



GHENT UNIVERSITY

48

Association between farm biosecurity and AMU

- **51.8% (14/27) studies**
  ↑ farm biosecurity : ↓ AMU
- **18.5% (5/27) studies**
  ↑ farm management : ↓ AMU
- **2 studies**
  ↑ coaching & awareness: ↓ AMU
- **1 study**
  ↑ biosecurity : ↓ AMU : ↑ farm economics

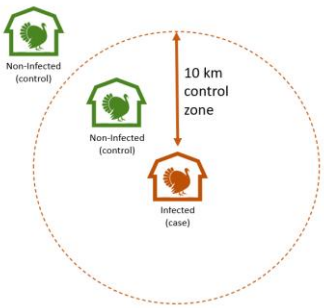
5 studies: farm biosecurity & AMU → Uncertain or spurious association

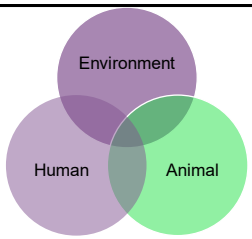
GHENT UNIVERSITY

49

TURKEYS

Université de Montréal





Identify *risk factors and biosecurity* practices impacting HPAI status of commercial poultry farms
- QC: 97 turkey, broiler, layer, breeder, ducks/geese farms
- ON: 39 turkey farms

Poultry

biocheck.ugent

- → Laying hens
- → Broilers
- → Turkeys
- → Breeders
- → Ducks

Statistics for Turkeys - Canada

External biosecurity		
A. Infrastructure, location and housing		62%
B. Organization of the farm and supply of materials		71%
C. Visitors and farmworkers		48%
D. Purchase of turkey poults		50%
E. Depopulation of adult turkeys		66%
F. Feed and water supply		80%
G. Manure and carcass removal		73%
Subtotal external biosecurity		**64%**
Internal biosecurity		
H. Disease management		81%
I. Measures between compartments		82%
J. Cleaning and disinfection		42%
Subtotal internal biosecurity		**66%**
Total	50	**65%**

number of completed surveys: 72

50

HPAI Case-Control Study in Turkey

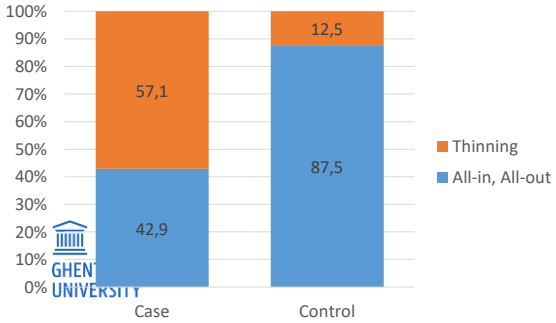
Preliminary Descriptive Results

Biosecurity Scores
Removal of Turkey

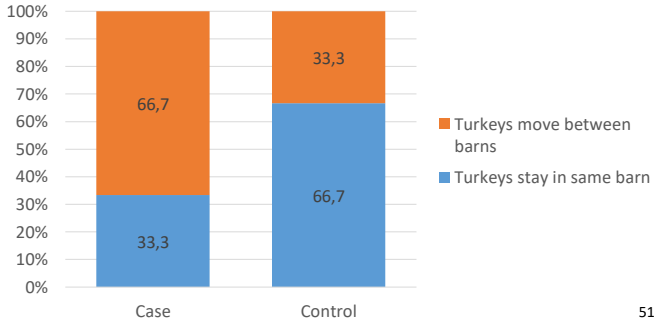
Cases (n=7)	Control (n=16)
67%	74%

Question added to Biocheck

Preliminary Results HPAI case-control study in Turkey in Québec - **Shipment to slaughter**

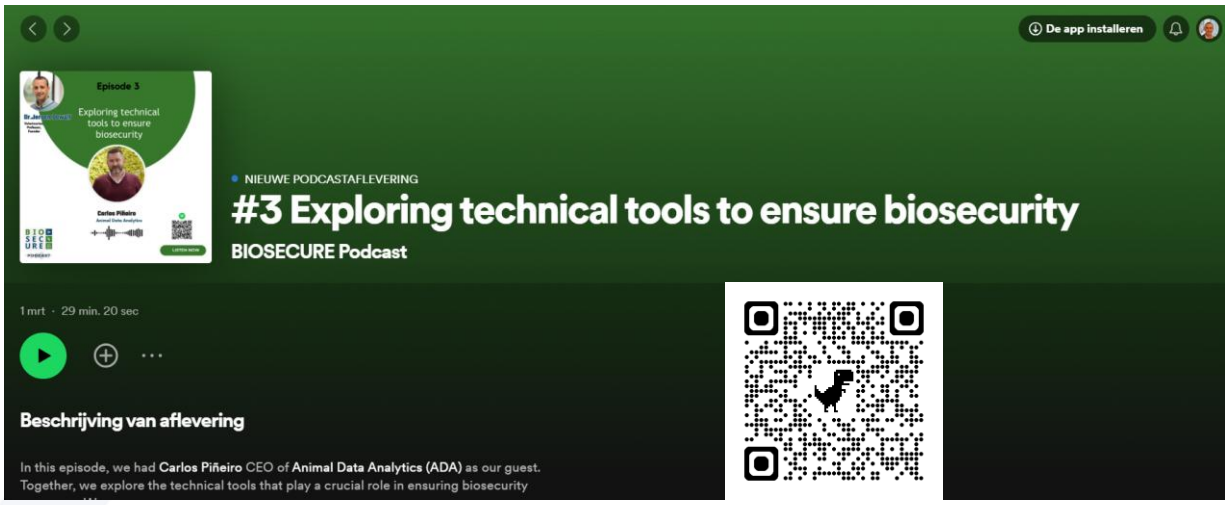


Preliminary Results HPAI case-control study in Turkey in Québec - **Movements of birds within premises**



51

51



Scan me!

52

FACULTY OF VETERINARY MEDICINE
accredited by EAEVE

Jeroen Dewulf
Full Professor

FACULTY OF VETERINARY MEDICINE
GHENT UNIVERSITY

E Jeroen.dewulf@ugent.be

T +32 9 264 75 43

www.ugent.be

Ghent University

jkdewulf

GHENT UNIVERSITY

Vbiocheck.ugent

53