Improving institutional memory on the use of data from VetSTAT for estimating antimicrobial exposure risks

Workshop on evaluation of data and information sharing in One Health initiatives

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Vibe D. Andersen
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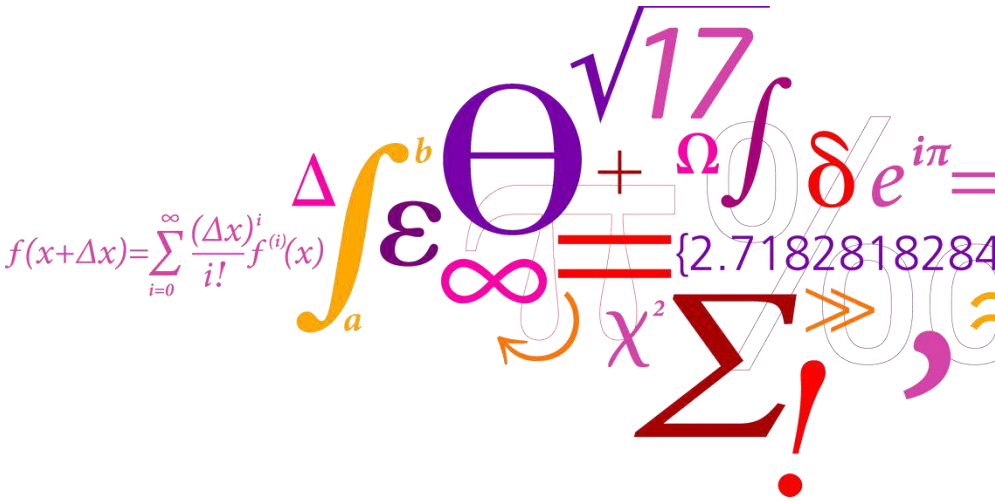
DTU Food
National Food Institute



Study group for the use of veterinary antibiotics data in research

DTU Food
National Food Institute


UNIVERSITY OF COPENHAGEN



DTU Vet
National Veterinary Institute


Group name – we don't have one

- SPIDER (Study grouP on antIbiotics Data in rEseaRch)
- SINISTER (Studying veterInary aNtIbioticS daTa for rEseaRch)
- VEGAN (Vetstat Exploration Group for Antibiotic consumption)
- GRAvID (GRoup for AntIbiotic Data)
- SUGAR (StUdy Group for Antibiotic data in Research)
- SANDRA (Studying ANtibiotics Data in ReseArch)
- VISIGOth (Vetstat exploratIon and SharIng GrOup)
- SIESTA (SufferIng with vEtSTAt)
- SAD (Stuck with Antibiotics Data)

The beginning

Møde mellem phd-studerende der arbejder med VetStat

Anna Camilla Birkegård

Sent: Mon 23/06/2014 10:56

To: Vibe Dalhoff Andersen; Rasmus Kenneth Bojsen; Leonardo de Knegt; Mette Ely Fertner; amanda@sund.ku.dk; nhd@sund.ku.dk

Hej

Jeg har sammen med et par andre phd-studerende fra DTU snakket om, at det kunne være en god idé at holde et møde mellem os, der arbejder med VetStat i forskning.

How to get useful information out of Vetstat and how to best estimate antibiotic consumption

Camilla

- First meeting October 8, 2014
- Presentation of projects to each other
- What do I need from Vetstat?
- How does it fit into my project?

Vetstat

UNIVERSITY OF COPENHAGEN

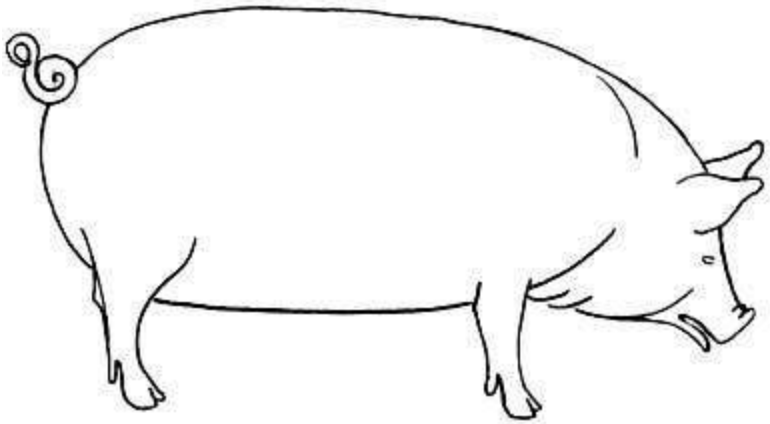
VetStat

The Danish system for surveillance of use of medicine in livestock

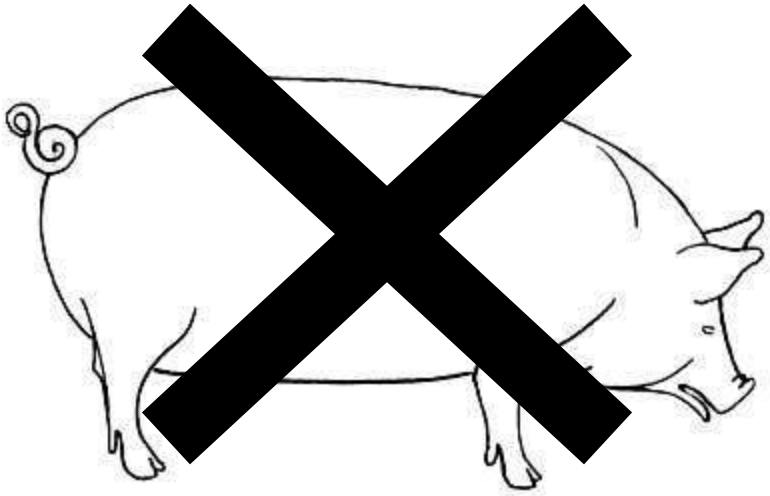
- Funded by the Danish Ministry of Food, Agriculture and Fisheries
- Since 2000




This slide belongs to Hans Houe. If you find it, please return.



Whenever you convert reality into data, you lose context



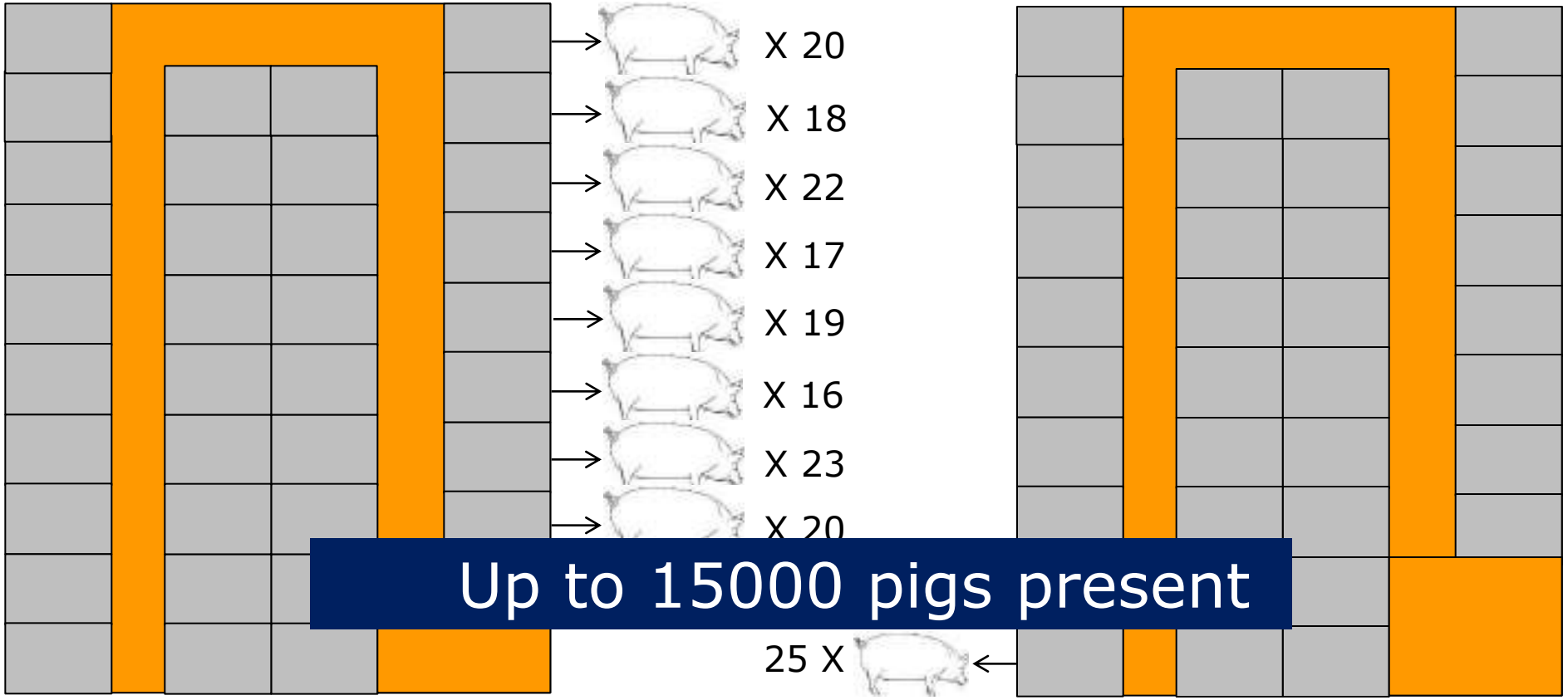
Name	Address	Age (days)	Category	Eats less	Smells meds	Diarrhea	Eye Infection
Astolfo	Lyngbyvej 307	45	weaner	?	?	Y	?

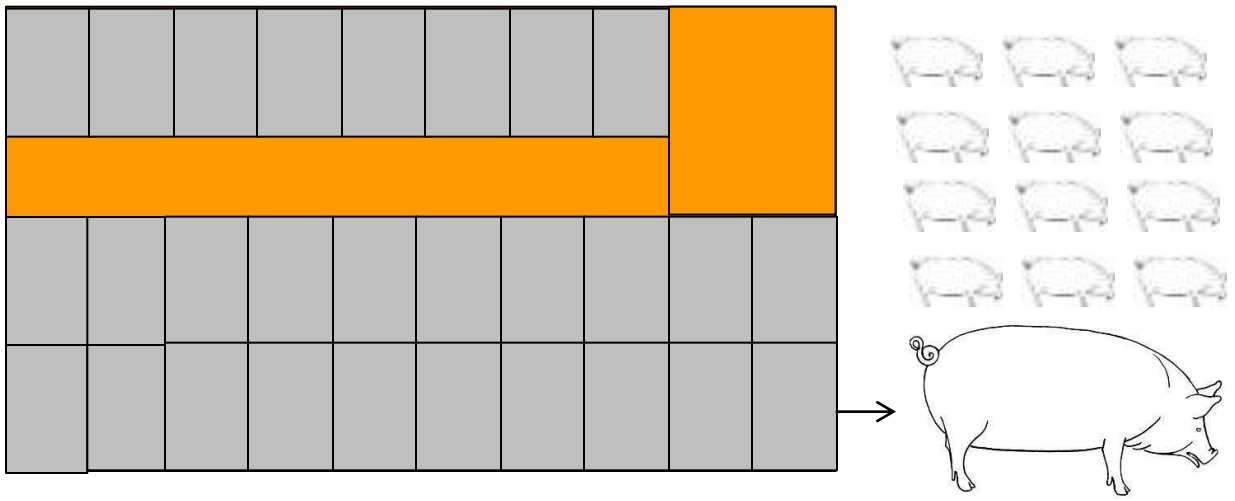
Name	Category	Product	Dose	Adm. Route	Time	Date
As						
As						
As						
As						
As						
As						
As						
As						
Astolfo	Weaner	Curamox Vet	2mL	IM injection	7:30	06/05/16
Astolfo	Weaner	Curamox Vet	2mL	IM injection	19:15	06/05/16
Astolfo	Weaner	Curamox Vet	2mL	IM injection	7:00	07/05/16
Astolfo	Weaner	Curamox Vet	2mL	IM injection	18:45	07/05/16
Astolfo	Weaner	Curamox Vet	2mL	IM injection	6:45	08/05/16
Astolfo	Weaner	Curamox Vet	2mL	IM injection	19:20	08/05/16

Name	Category	Product	Dose	Adm. Route	Time	Date
Astolfo	Weaner	Borgal Vet	2mL	IM injection	8:05	06/05/16
Astolfo	Weaner	Borgal Vet	2mL	IM injection	8:02	07/05/16
Astolfo	Weaner	Borgal Vet	2mL	IM injection	8:00	08/05/16
Astolfo	**Slaughterpig**	Borgal Vet	2mL	IM injection	7:50	09/05/16
Astolfo	**Slaughterpig**	Borgal Vet	2mL	IM injection	8:20	10/05/16
Astolfo	**Slaughterpig**	Borgal Vet	2mL	IM injection	7:45	11/05/16
Astolfo	**Slaughterpig**	Borgal Vet	2mL	IM injection	7:55	12/05/16

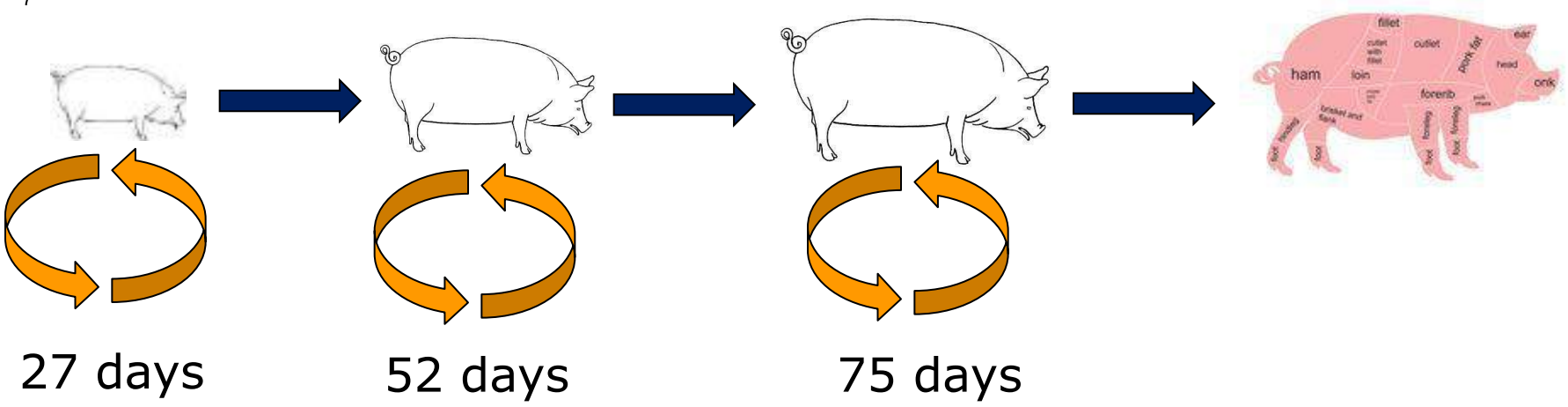
Flock medication

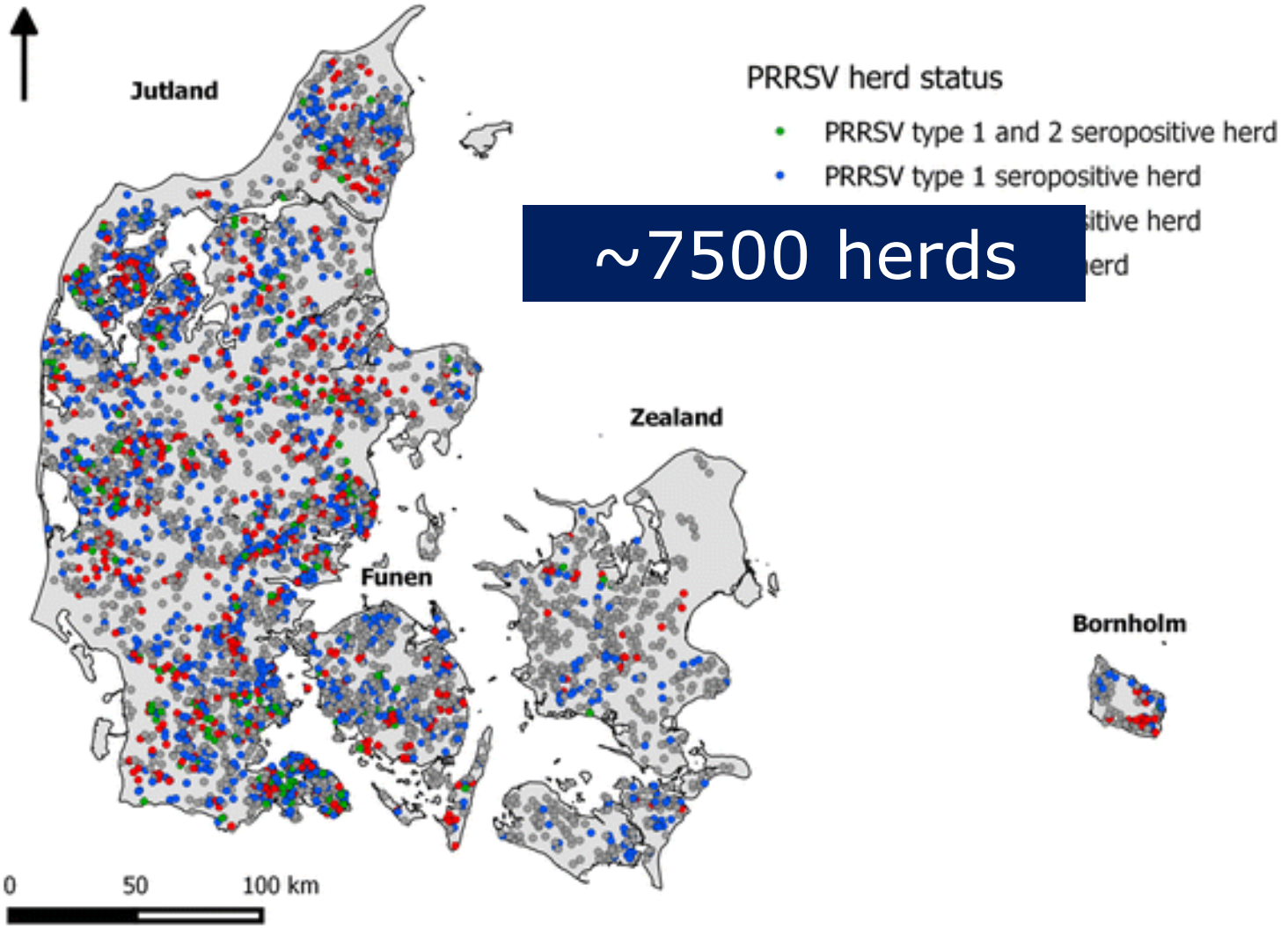
Name	Category	Product	Dose	Adm. Route	Time	Date
Astolfo						
Astolfo						
Astolfo						
Ingolf	Weaner		2mL	IM inje	8:05	06/05/16
Ingolf	Weaner		2mL		8:02	07/05/16
Miranda	W					06/05/16
Miranda	Weaner			IM injection		07/05/16
Belinda	Weaner		2mL		8:05	06/05/16
Belinda	Weaner	Borgal Vet	2mL		8:02	07/05/16
Belinda		Borgal Vet	2mL	IM inj	8:00	08/05/16
Belinda	**Slaughterpig**	Borgal Vet	2mL	IM injection	7:50	09/05/16
Belinda	**Slaughterpig**	Borgal Vet	2mL	IM injection	8:20	10/05/16
Belinda	**Slaughterpig**	Borgal Vet	2mL	IM injection	7:45	11/05/16
Belinda	**Slaughterpig**	Borgal Vet	2mL	IM injection	7:55	12/05/16


X 20
X 18
X 22
X 17
X 19
X 16
X 23
X 20
Up to 15000 pigs present
25 X



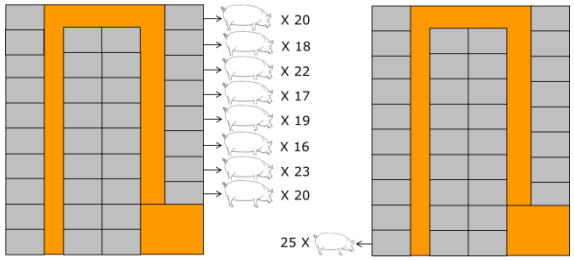
Complete rotation
~5.5 months

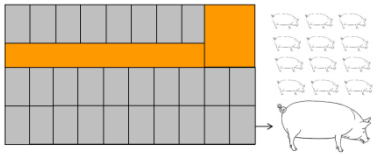


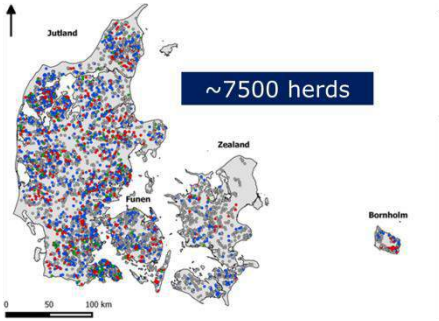


Map reference: Spatial analysis and temporal trends of porcine reproductive and respiratory syndrome in Denmark from 2007 to 2010 based on laboratory submission data - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/287643555_fig2_Fig-2-PRRSV-herd-status-distribution-from-2007-to-2010-including-only-herds-submitting [accessed 20 Apr, 2016]

Name	Category	Product	Dose	Adm. Route	Time	Date
Astolfo						
Astolfo	Romeo	Weaner	Borgal Vet	2mL	IM injection	8:05	06/05/16
Astolfo	Romeo	Weaner	Borgal Vet	2mL	IM injection	8:02	07/05/16
Ingolf	Weaner	Borgal Vet	2mL	IM injection	8:05	06/05/16
Ingolf	Weaner	Borgal Vet	2mL	IM injection	8:02	07/05/16
Miranda	Weaner	Borgal Vet	2mL	IM injection	8:05	06/05/16
Miranda	Weaner	Borgal Vet	2mL	IM injection	8:02	07/05/16
Belinda	Weaner	Borgal Vet	2mL	IM injection	8:05	06/05/16
Belinda	Weaner	Borgal Vet	2mL	IM injection	8:02	07/05/16
Belinda	Weaner	Borgal Vet	2mL	IM injection	8:00	08/05/16
Belinda	**Slaughterpig**	Borgal Vet	2mL	IM injection	7:50	09/05/16
Belinda	**Slaughterpig**	Borgal Vet	2mL	IM injection	8:20	10/05/16
Belinda	**Slaughterpig**	Borgal Vet	2mL	IM injection	7:45	11/05/16
Belinda	**Slaughterpig**	Borgal Vet	2mL	IM injection	7:55	12/05/16





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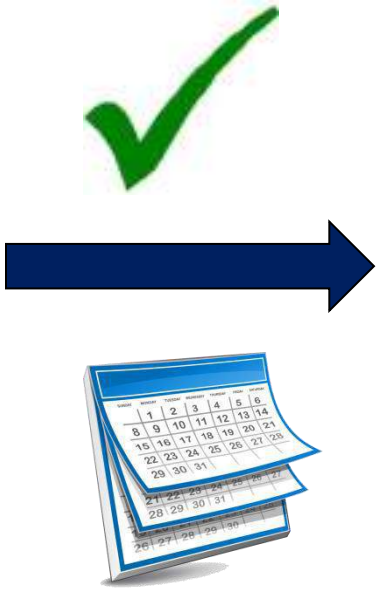
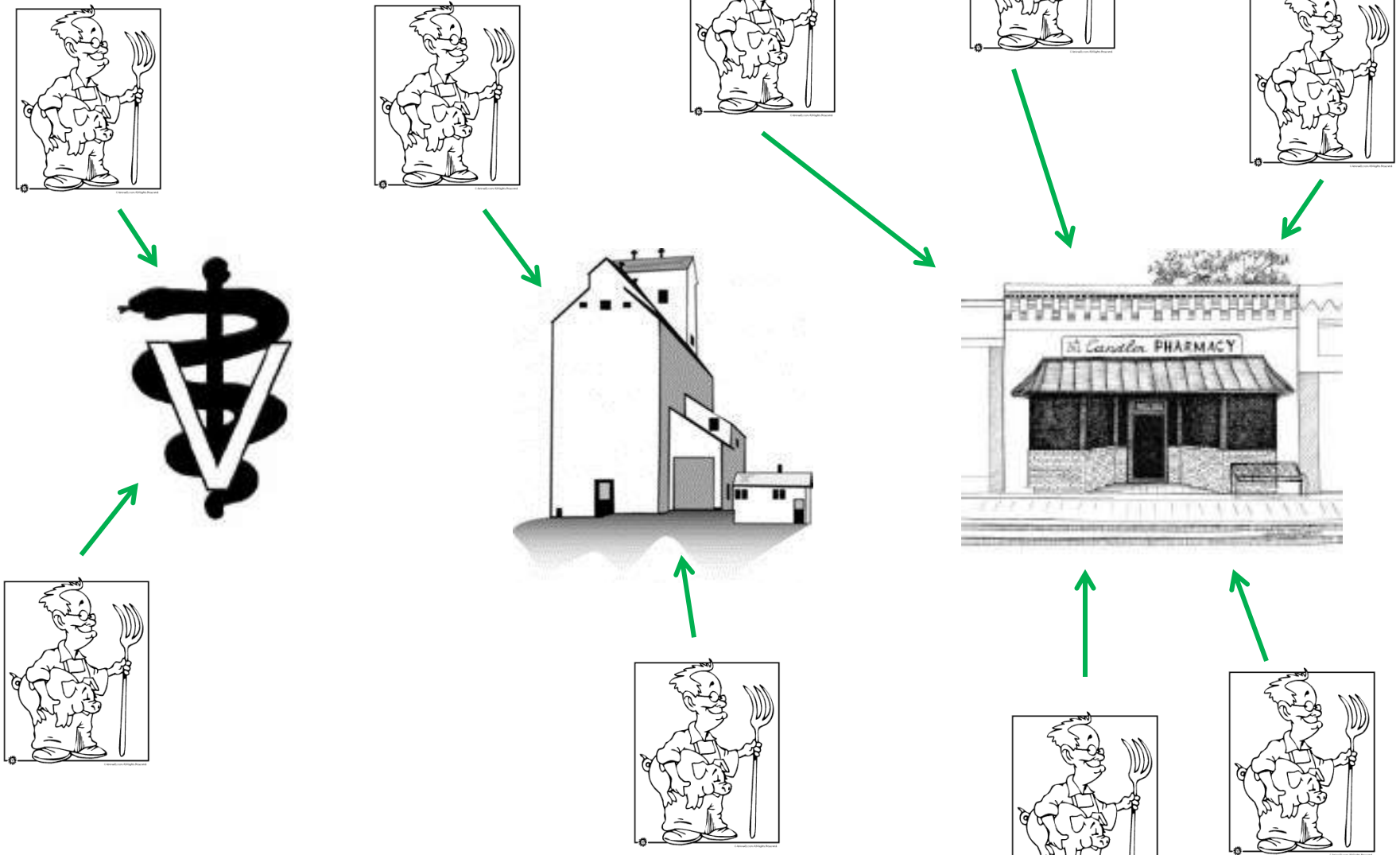
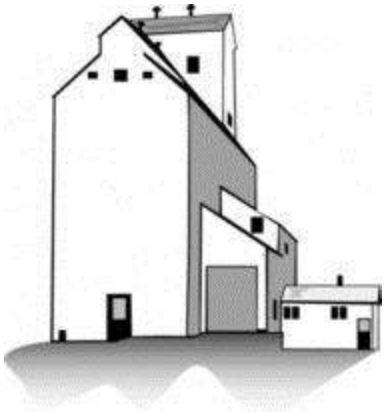


Centralized spots





> 95% of dispensed drugs

Information provided: what was purchased

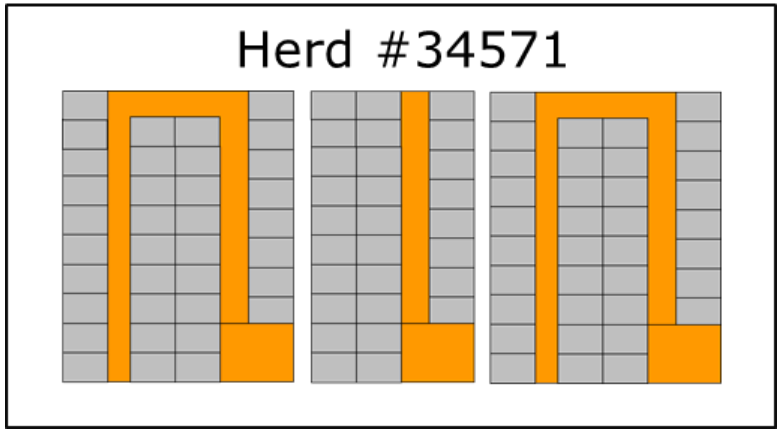
Species

Age group

Diagnostic group

Drug

Amount in packages



So… although most people look for

Treatment patterns

Welfare indicators

AB consumption

- Age group
- Herd
- Period

Records of purchases of drugs made to fill a prescription from a veterinarian

Each prescription is made by an identifiable vet to an identifiable herd, for use in a certain species and age group, and due to a certain diagnostic group.

Slide 1 ←

Important !

Differences between practices

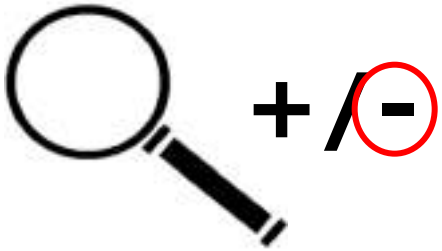
Differences between vets

1½ year since practice

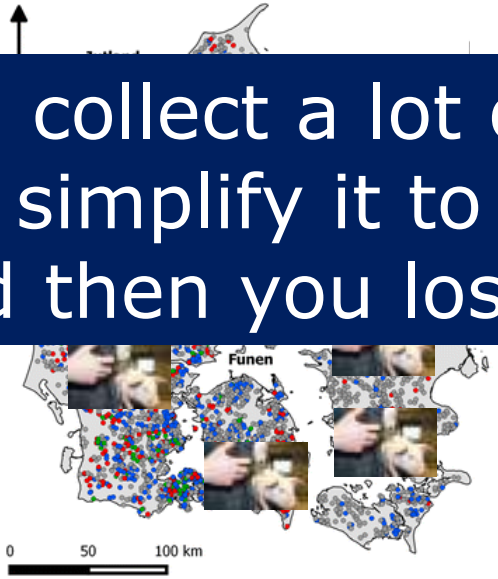
General rules are difficult, but…

Approaches used by vets and farmers for disease diagnostic, treatment and prevention in different age groups

- Different vets, different clinical approaches
  - Same basis
  - Individual variations
- Different farmers
  - Individual ways to follow instructions ”precisely”
- Pigs
  - Pigs in an age group not exactly the same age in days
  - Not exactly the same weight either
  - Don’t eat exactly same amount of feed / medication



You can collect a lot of data, but you need to simplify it to be able to store it, and then you lose the context.



Pig photo: Farmers Weekly (http://www.fwi.co.uk)

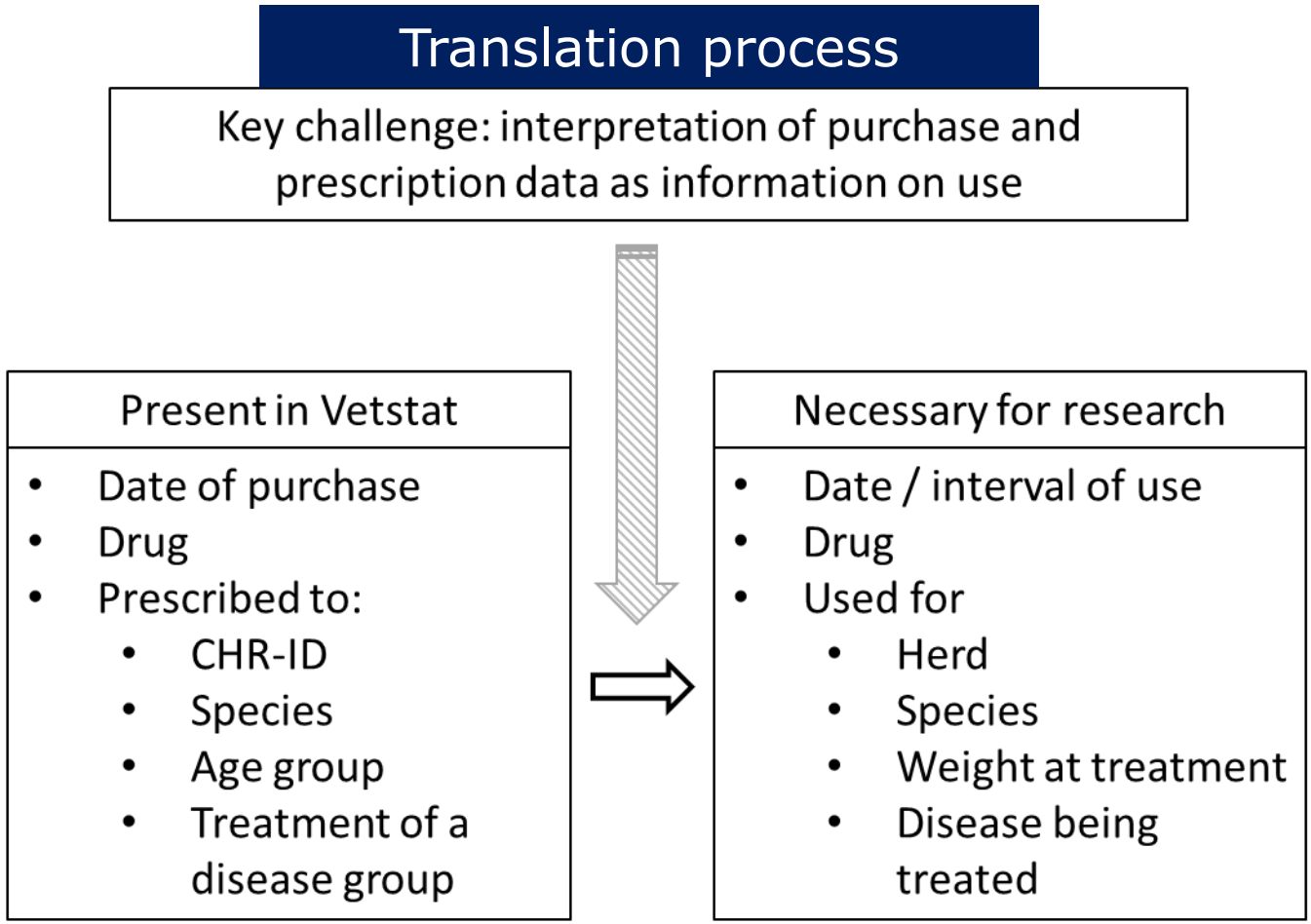
Group objectives

- ~~Evaluate Vetstat as a surveillance system~~
- ~~Find inconsistencies or flaws~~
- ~~Quantitative data quality assessments using a sample of herds~~

"Our audience is not Vetstat managers, but Vetstat users."

- Not there to "fix" the system → not broken!
- Cleaning data and selecting herds → basic step in every study
- Errors and inconsistencies → vary between extractions

Group objectives



Group objectives

Correct

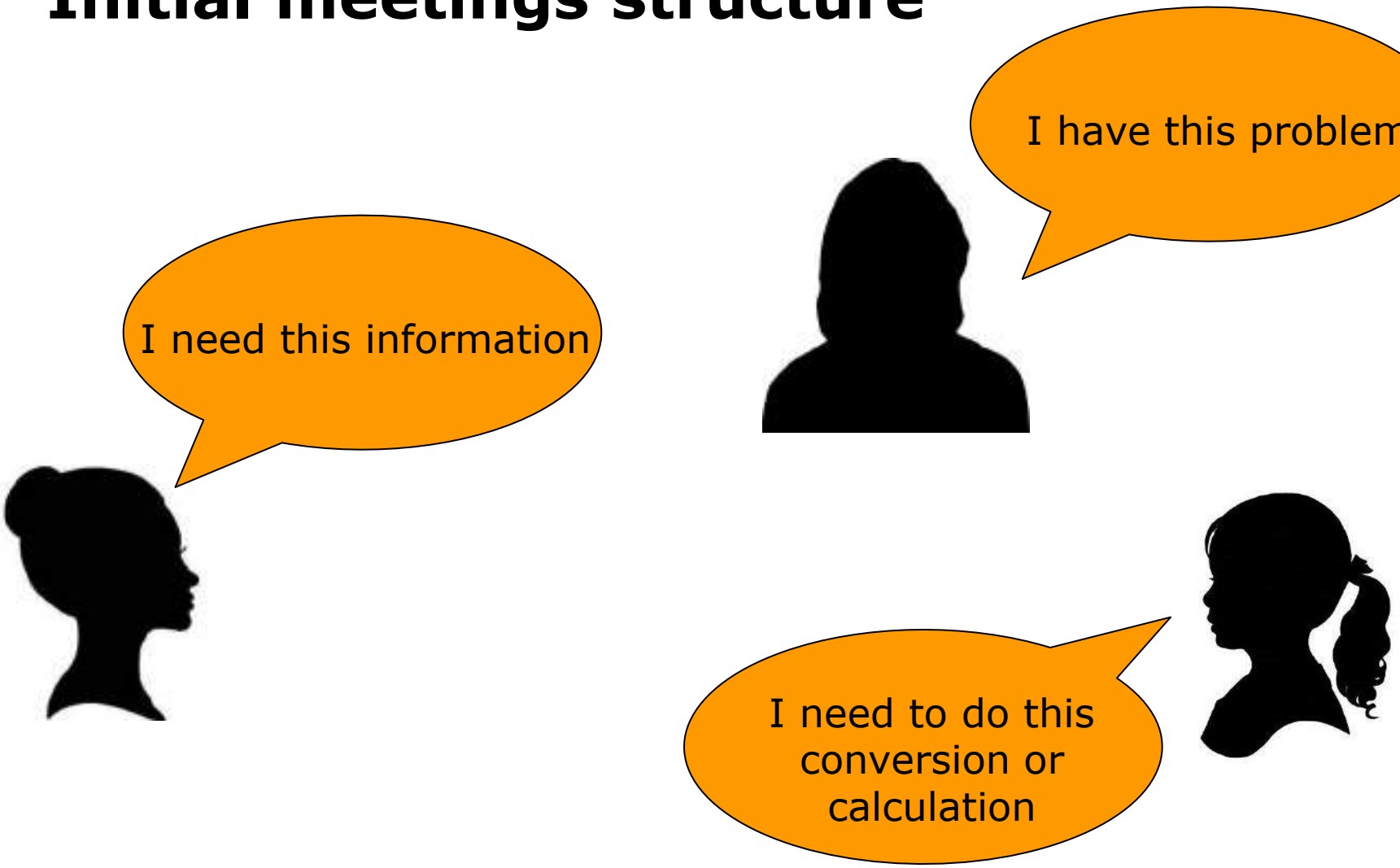
Comparable

Reproducible

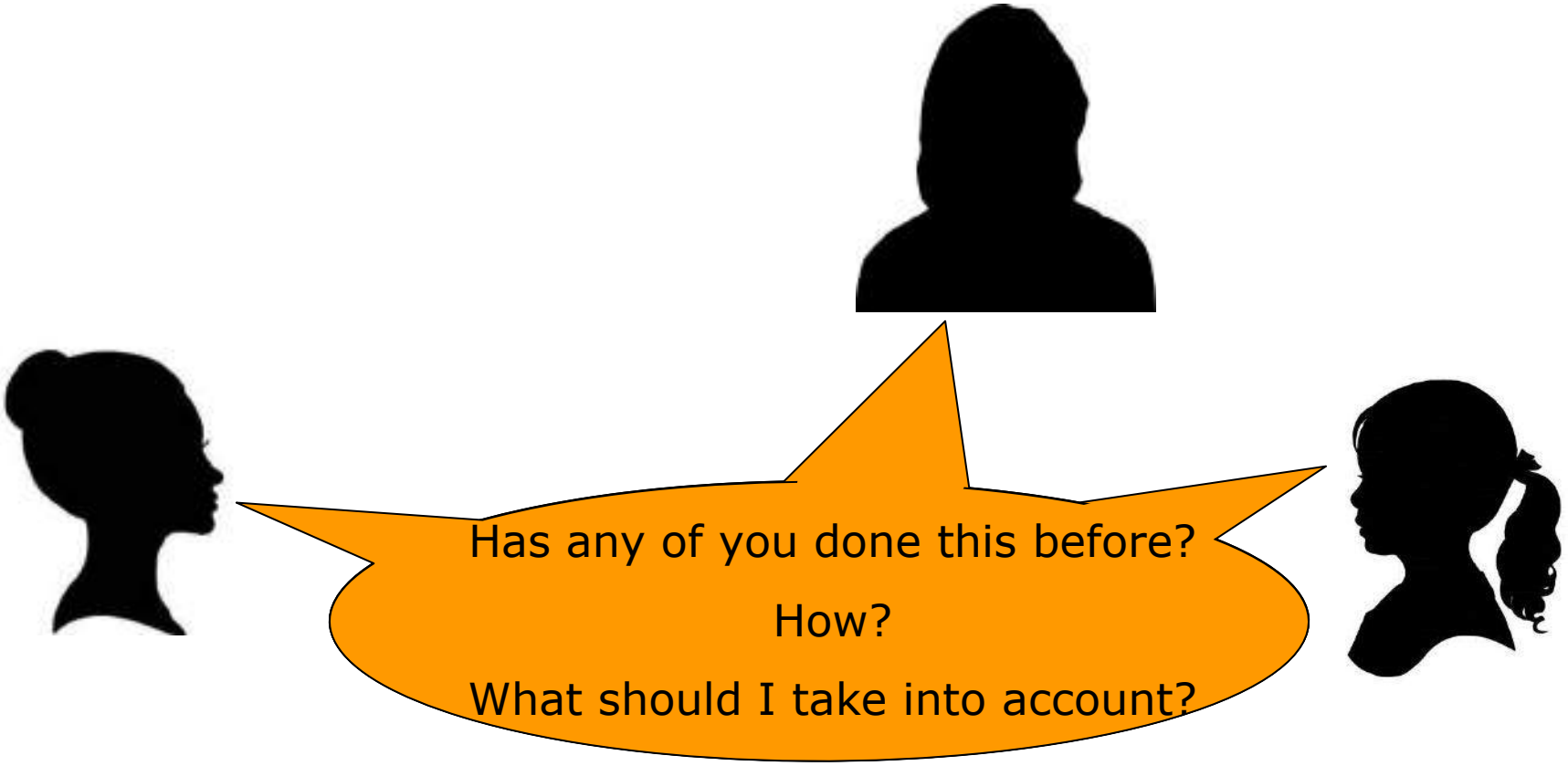
National Food Institute, Technical University of Denmark

Researcher images by Jorge Cham in ”Piled Higher and Deeper” (www.phdcomics.com)

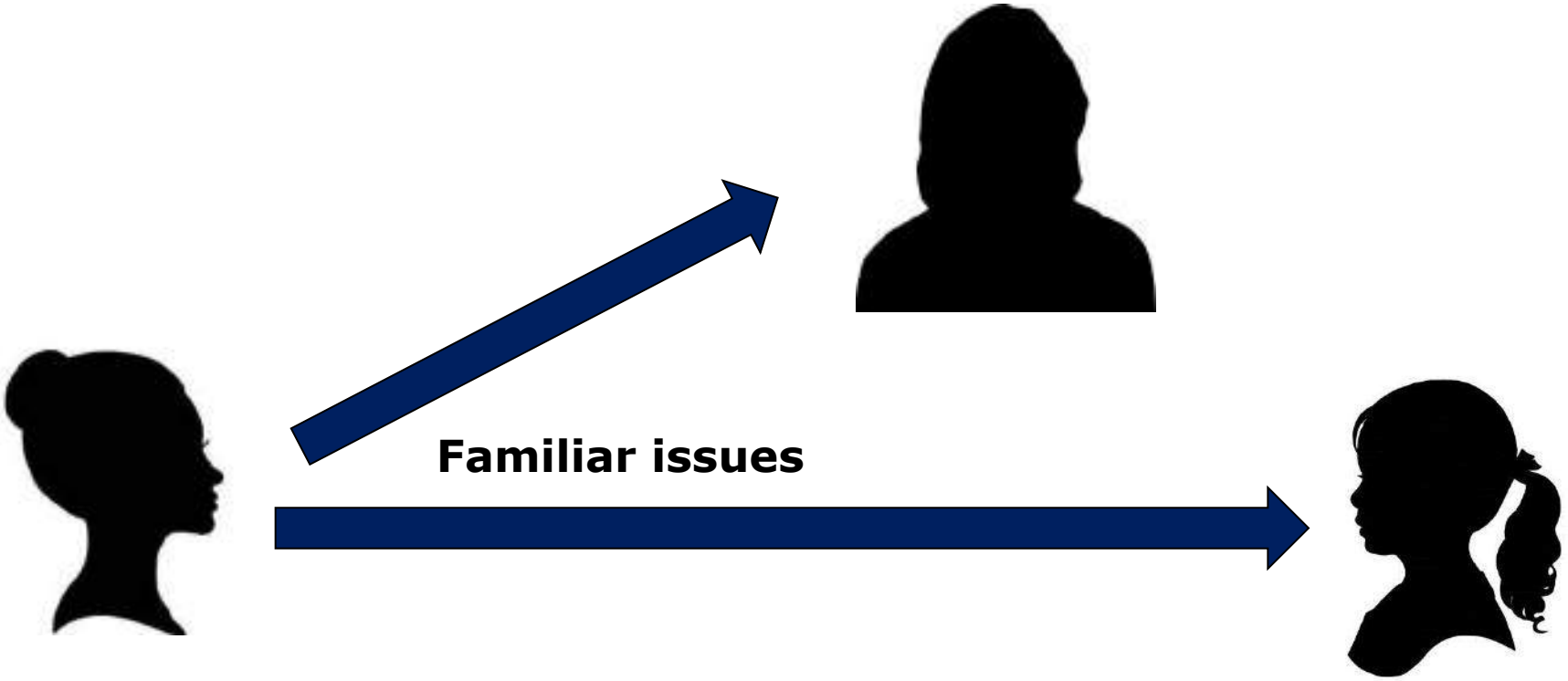
Initial meetings structure



Initial meetings structure



Initial meetings structure



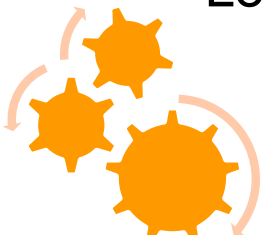
Initial meetings structure

New issues

- Database documentation
- Variable X: what does it mean?
- In which context was it collected?
- Which legislation does it refer to?

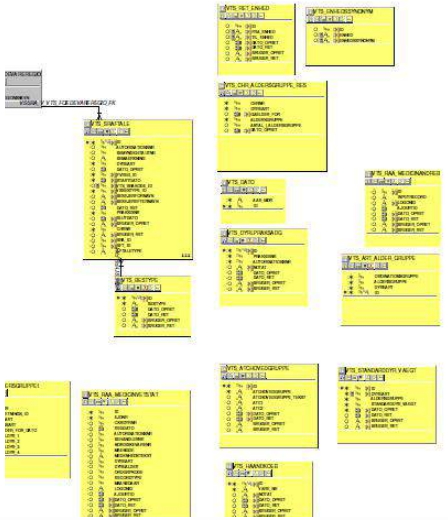
Database documentation

- Exists
- It’s good and complete
- Not very accessible



Loads of time spent on figuring out

- Database structure
- Meaning of variables



BEK nr 193 af 14/02/2011 (Gældende) — **Udskriftsdato: 5. november 2015**

Ministerium: Ministeriet for Sundhed og Forebyggelse
Journalnummer: Indenrigs- og Sundhedsmin., Lægemiddelstyrelsen, j.nr. LMS 2011020235

Senere ændringer til forskriften
BEK nr 43 af 18/01/2012

Bekendtgørelse om indberetning af oplysninger til lægemiddelstatistik

I medfør af § 11, stk. 1, nr. 7, § 58, stk. 4, og § 61 d, stk. 2, i lov om apoteksvirksomhed, jf. lovbekendtgørelse nr. 855 af 4. august 2008, som ænd
nr. 1180 af 12. december 2005 om lægemid
nr. 797 af 17. august 2009 om indberetning

BEK nr 533 af 27/05/2014 (Gældende) — **Udskriftsdato: 26. oktober 2015**

Ministerium: Fødevareministeriet
Journalnummer: Fødevaremin., Fødevarestyrelsen, j.nr. 2014-15-31-00024

Senere ændringer til forskriften
BEK nr 1443 af 17/12/2014

Bekendtgørelse om dyrlægers anvendelse, udlevering og ordinering af lægemidler til dyr[1)]

National Food Institute, Technical U

Researcher images by Jorge Cham

Database documentation

- Only available in Danish
- ~30% of MSc and ~50% of PhD:90 nationalities (DTU)
- Not very practical as a viable research tool
- Other countries look up to Vetstat as reference for their own systems
- One Health sharing perspective

Group spirit

- Information sharing

Easier for people using or being inspired by Vetstat now

lem

More likely that people can understand and reproduce it

Facilitates data sharing in the future.

- Make it public
- Circulate
- Create materials in English

Tak Fødevarestyrelsen!

Group output 1: manuscript

- "Improving institutional memory on challenges and methods for estimation of pig herd antimicrobial exposure based on data from the Danish Veterinary Medicines Statistics Program (VetStat)"
- 11 selected challenges and solutions to overcome them
- Solutions based on group consensus
- Challenges divided in three sections

Group output 1: manuscript

Data quality and system structure

- Challenge 1: Lack of consistency between datasets extracted at different time points
- Challenge 2: Incorrect values in supplementary data
- Challenge 3: Prescriptions divided into more than one entry
- Challenge 4: Negative entries
- Challenge 5: Incorrect identification number of prescribing veterinarian

Group output 1: manuscript

Antimicrobial exposure estimation

- Challenge 6: Incorrect animal species, age group or disease group identification code
- Challenge 7: Discrepancies between registered and actually treated age and disease group
- Challenge 8: Time lag between date of purchase and date of use

Group output 1: manuscript

Calculation of Animal Daily Doses and data handling

- Challenge 9: Product identification for ADD calculations
- Challenge 10: Doubling the purchased amount for combination products when calculating active ingredient
- Challenge 11: Standardize the amount of antimicrobials purchased at herd level

Challenges vs. Errors

- Challenge 3: Prescriptions divided into more than one entry

  Different drug batches must be in different rows

  Affects estimates based on number of prescriptions

- Challenge 4: Negative entries

  Retractions of prescriptions entered in the system

  Main issue: over- or underestimation in time slices

Challenge 10: Doubling the purchased amount for combination products when calculating active ingredient

ID	UDLEVERINGSDATO	APOTEK_NR	VARE_ID	PAKNINGSANTAL	ALGR_ID	ORGR_ID	DYREART	CHR_NR
16898617	02JAN2013:00:00:00	10400	13672	5	55	11	15	28400
16898626	02JAN2013:00:00:00	10400	13672	3	55	11	15	28400
16900484	02JAN2013:00:00:00	81000	13672	12	55	10	15	29622
16898538	02JAN2013:00:00:00	10400	13672	30	55	10	15	98941
16900357	02JAN2013:00:00:00	81000	13672	10	55	10	15	97591

vare_id	VARE_TEKST	PAKNINGSSTOERRELSE	ENHED_PAKNING	MAENGDE	ENHED_MAENGDE	ATC_KODE	VDIS_ID
13672	BORGAL VET.	1	htgl.	100.000	ml	QJ01EW13	4

ID	VARE_ID	AKTS_ID	STYRKE	ENHED_STYRKE	ENHED_PR_ENHED
6251	13672	350	200.000	mg	ml
6252	13672	258	40.000	mg	ml

ID	AKTIVT_STOF	VSANTIBIO_ID
258	Trimethoprim	11
350	Sulfadoxin	11

APOTEK_NR	VARE_ID	PAKNINGSANTAL	ALGR_ID	ORGR_ID	DYREART	CHR_NR	reg_id	VARE_TEKST	AKTIVT_STOF
10400	13672	3	55	11	15	28400	16898626	BORGAL VET.	Sulfadoxin
10400	13672	3	55	11	15	28400	16898626	BORGAL VET.	Trimethoprim

Challenges vs. Errors

- Challenge 3: Prescriptions divided into more than one entry
- Challenge 4: Negative entries
- Challenge 10: Doubling the purchased amount for combination products when calculating active ingredient

System artifacts

Challenges vs. Errors

- Challenge 8: Time lag between date of purchase and date of use

Loss of context

Challenges vs. Errors

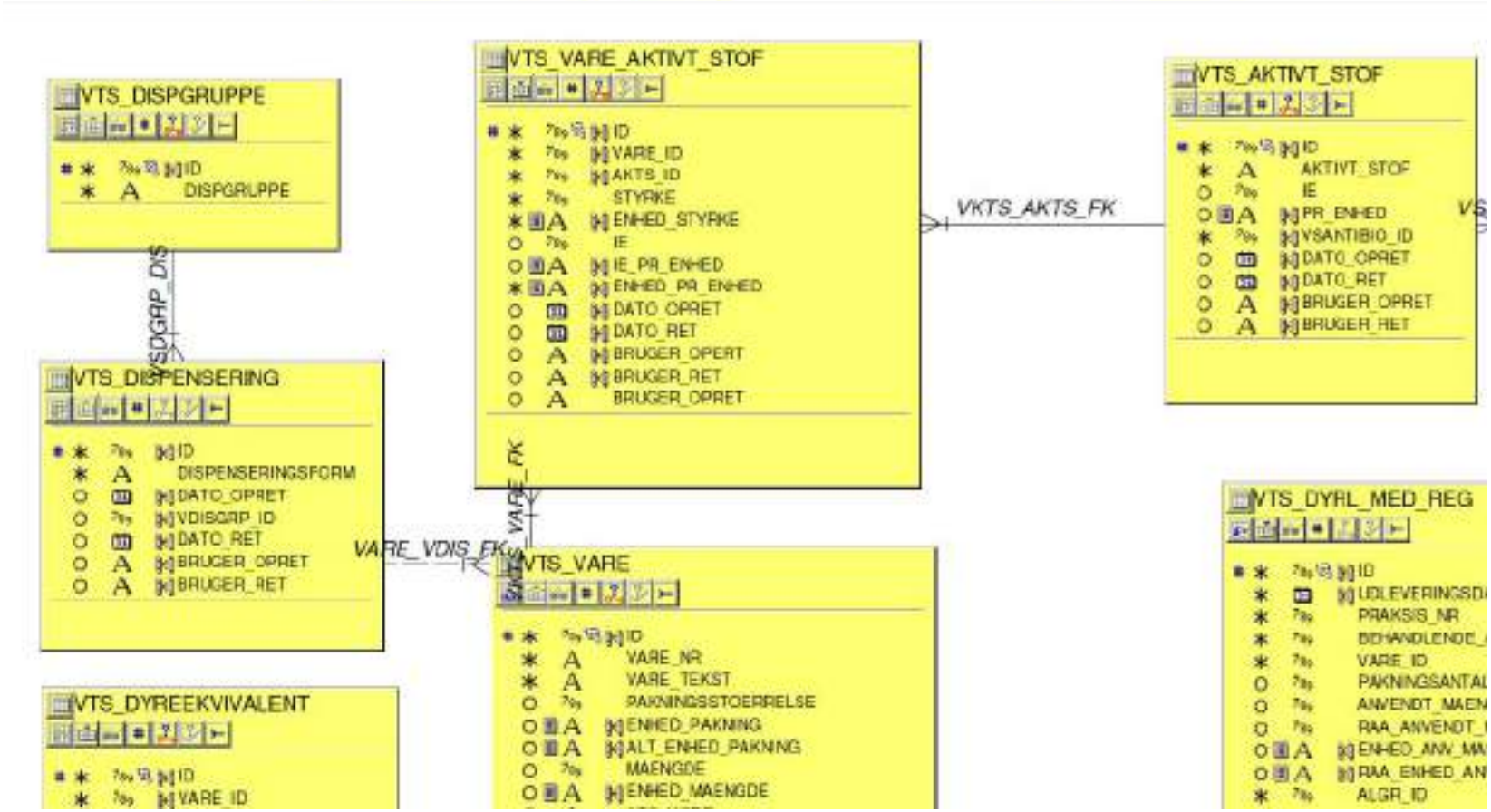
- Challenge 11: Standardize the amount of antimicrobials purchased at herd level
  - Population data not available in Vetstat
  - CHR and trade database are independent systems

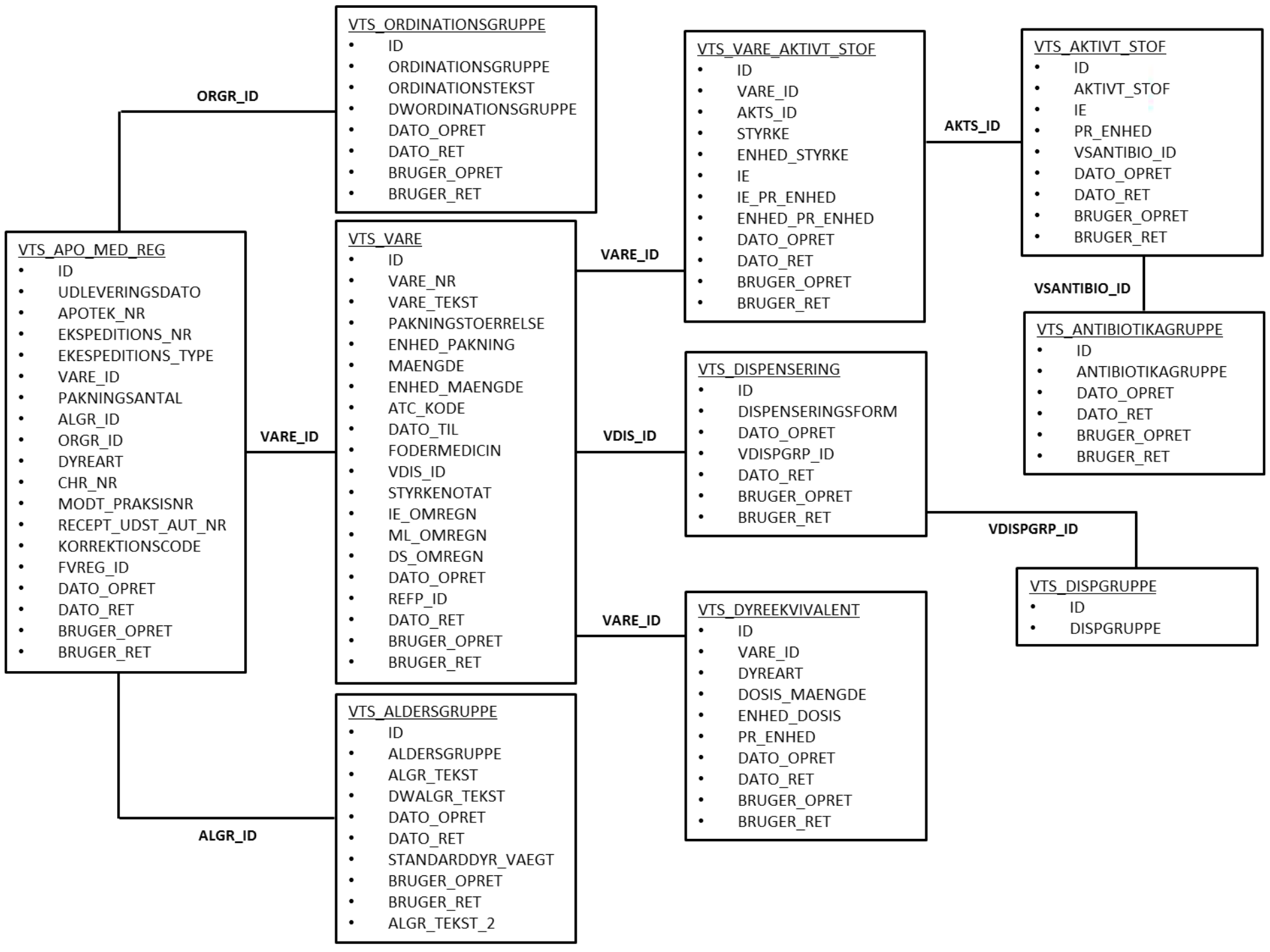
Matching with complementary data source

Group output 2: database diagrams

- Original diagram is still more complete
  - Good for database people
  - Complete assessment of the system
- Our "for dummies" version
  - More straightforward
  - Easier to find variables and links between datasets
  - Easier if you're only working with pigs and pharmacy-bought antibiotics

Group output 2: database diagrams




VTS_ORDINATIONSGRUPPE
ID
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ORDINATIONSTEKST
DWORDINATIONSGRUPPE
DATO_OPRET
DATO_RET
BRUGER_OPRET
BRUGER_RET
ORGR_ID
VTS_APO_MED_REG
ID
UDLEVERINGSDATO
APOTEK_NR
EKSPEDITIONS_NR
EKESPEDITIONS_TYPE
VARE_ID
PAKNINGSANTAL
ALGR_ID
ORGR_ID
DYREART
CHR_NR
MODT_PRAKSISNR
RECEPT_UDST_AUT_NR
KORREKTIONSCODE
FVREG_ID
DATO_OPRET
DATO_RET
BRUGER_OPRET
BRUGER_RET
VARE_ID
VTS_VARE
ID
VARE_NR
VARE_TEKST
PAKNINGSTOERRELSE
ENHED_PAKNING
MAENGDE
ENHED_MAENGDE
ATC_KODE
DATO_TIL
FODERMEDICIN
VDIS_ID
STYRKENOTAT
IE_OMREGN
ML_OMREGN
DS_OMREGN
DATO_OPRET
REFP_ID
DATO_RET
BRUGER_OPRET
BRUGER_RET
VARE_ID
VTS_VARE_AKTIVT_STOF
ID
VARE_ID
AKTS_ID
STYRKE
ENHED_STYRKE
IE
IE_PR_ENHED
ENHED_PR_ENHED
DATO_OPRET
DATO_RET
BRUGER_OPRET
BRUGER_RET
AKTS_ID
VTS_AKTIVT_STOF
ID
AKTIVT_STOF
IE
PR_ENHED
VSANTIBIO_ID
DATO_OPRET
DATO_RET
BRUGER_OPRET
BRUGER_RET
VSANTIBIO_ID
VTS_ANTIBIOTIKAGRUPPE
ID
ANTIBIOTIKAGRUPPE
DATO_OPRET
DATO_RET
BRUGER_OPRET
BRUGER_RET
VDIS_ID
VTS_DISPENSERING
ID
DISPENSERINGSFORM
DATO_OPRET
VDISPGRP_ID
DATO_RET
BRUGER_OPRET
BRUGER_RET
VDISPGRP_ID
VTS_DISPGRUPPE
ID
DISPGRUPPE
VARE_ID
VTS_DYREEKVIVALENT
ID
VARE_ID
DYREART
DOSIS_MAENGDE
ENHED_DOSIS
PR_ENHED
DATO_OPRET
DATO_RET
BRUGER_OPRET
BRUGER_RET
ALGR_ID
VTS_ALDERSGRUPPE
ID
ALDERSGRUPPE
ALGR_TEKST
DWALGR_TEKST
DATO_OPRET
DATO_RET
STANDARDDYR_VAEGT
BRUGER_OPRET
BRUGER_RET
ALGR_TEKST_2

Group output 3: variables description table

Microsoft Excel - Variables name and description

	A	B	C	D	
1	Dataset		Variables		
2	Name	English name and description	Name	Name in English	Description(s)
5	VTS_APO_MED_R00	VTS_PHARMACY_RECORD	UDLEVERINGSDATO	PURCHASEDATE	Date in which the purchase was made.
6		Records of sales performed by pharmacies	APOTEK_NR	PHARMACY_NR	Identification number of the pharmacy where the purchase was made.
5			EKSPEDITIONS_NR	PURCHASE_NR	Number of the transaction.
6			EKSPEDITIONS_TYPE	PURCHASETYPE	Variable originating from the pharmacy billing system. Assigns records wh
7			VARE_ID	PRODUCT_ID	Linking variable with dataset VTS_VARE.
8			PAKNINGSANTAL	PACKAGEQUANTITY	Number of packages of the product which were sold. Further detailing of t
9			ALGR_ID	AGE_ID	Linking variable with dataset VTS_ALDERSGRUPPE.
10			ORGR_ID	DISEASE_ID	Linking variable with dataset VTS_ORDINATIONSGRUPPE.
11			DYRSART	ANIMALSPECIES	Species of the animal for which the product was prescribed.
12			CHR_NR	CHR_NR	Identification number of the herd for which the product was prescribed, a
13			MODT_PRAKSISNR	RECEIVING_PRACTICENR	When a product is sold to a veterinarian for in situ use, this variable is fille
14			RECEPT_UDST_AUT_NR	PRESCRIBING_VETERINARIAN_NR	Unique identifier of a veterinarian assigned by DVFA.
15			KORREKTIONSCODE	ASK ERIK	Not in use by Vetstat. Originally used by the pharmacy to assign correction
16			FVREG_ID	FVREG_ID	Not in use. Originally referred to FVST Regions.
17	VTS_ORDINATIONSGRUPPE	VTS_DISEASEGROUP	ORDINATIONSGRUPPE	DISEASEGROUP	Diagnostic group coded as numbers.
18		Diagnostic group of the disease for which the drug has been prescribed	ORDINATIONSTEKST	DISEASEGROUPTEXT	Diagnostic group in text.
19			DWORDINATIONSGRUPPE	DWDISEASEGROUP	Disease group with combined number code and text.
20	VTS_ALDERSGRUPPE	VTS_AGEGROUP	ALDERSGRUPPE	AGEGROUP	Animal age groups coded as numbers.
21		Age groups or production categories of the animals for which the drug has been prescribed	ALGR_TEKST	AGEGROUP_TEXT	Textual description of the age groups. E.g. "sows/piglets", "weaners", "sl
22			DWALGR_TEKST	DWAGEGROUP_TEXT	Age group with combined number code and text.
23			STANDARDDYR_VAEGT	STANDARD_ANIMAL_WEIGHT	Standard weight for a given age group.
24	VTS_VARE	VTS_PRODUCT	VARE_NR	PRODUCT_NR	Identification number of the product. Non-unique, values can be re-used
25		Product information, at label level	VARE_TEKST	PRODUCT_TEXT	Name of the product described in that row.
26			PAKNINGSTOERRELSE	PACKAGESIZE	Number of sub-units foind in one package. E.g. one package may contain s
27			ENHED_PAKNING	PACKAGE_UNIT	Unit of the sub-units contained in the package. E.g. Flask, applicator, envel
28			MAENGDE	AMOUNT	Numeric value for the amount of the preparation contained in each sub-u
29			ENHED_MAENGDE	AMOUNT_UNIT	Unit of the preparation contained in the sub-unit. E.g. ml., grams, etc.
30			ATC_KODE	ATC_CODE	Anatomical Therapeutic Chemical (ATC) classification System code for the
31			DATO_TIL	DATO_TIL	Date until which prescriptions of a registered product will be accepted in (
32			FODERMEDICIN	FOODEMEDICINE	Dicotomous variable. If the product is supposed to be mixed in food, the v
33			VDIS_ID	VDIS_ID	Linking variable with dataset VTS_DISPENSERING.
34			STYRKENOTAT	CONCENTRATIONMEMO	Total solid concentration of active ingredients found in the product, with (
35			IE_OMREGN	IU_CONVERSION	Numerical value of the preparation amount in International Units (IU).
36			ML_OMREGN	ML_CONVERSION	Numerical value of the preparation amount in mL.
37			DS_OMREGN	DS_CONVERSION	Numerical value of the preparation amount in DS
38			RSFP_ID	ASK ERIK	Assigns when the pharmacy hands out another, but similar product to the

Group output 4: networking

- Two universities, three institutes
- Same Vetstat data managemente dialect
- Comfortable to call, ask, discuss and suggest
- Generalizable codes in R and SAS for most approaches
- Soon: postdocs/other jobs
  - Other universities
  - Other institutes
  - Other countries
  - Extend the network
  - Get fresh, outside-view revisions of the approaches

Final messages:

Whenever you convert reality into data, you lose context information.

Every observed value of x is actually $x|\delta$,

where δ is the context in which x was observed.

It can be hard to avoid problems if you're aware of them, but it is nearly impossible if you're not.

Thank you!

DTU Food
National Food Institute


UNIVERSITY OF COPENHAGEN



DTU Vet
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