# The Trøndelag Health Study (HUNT); HUNTing for good sample quality over 30 years

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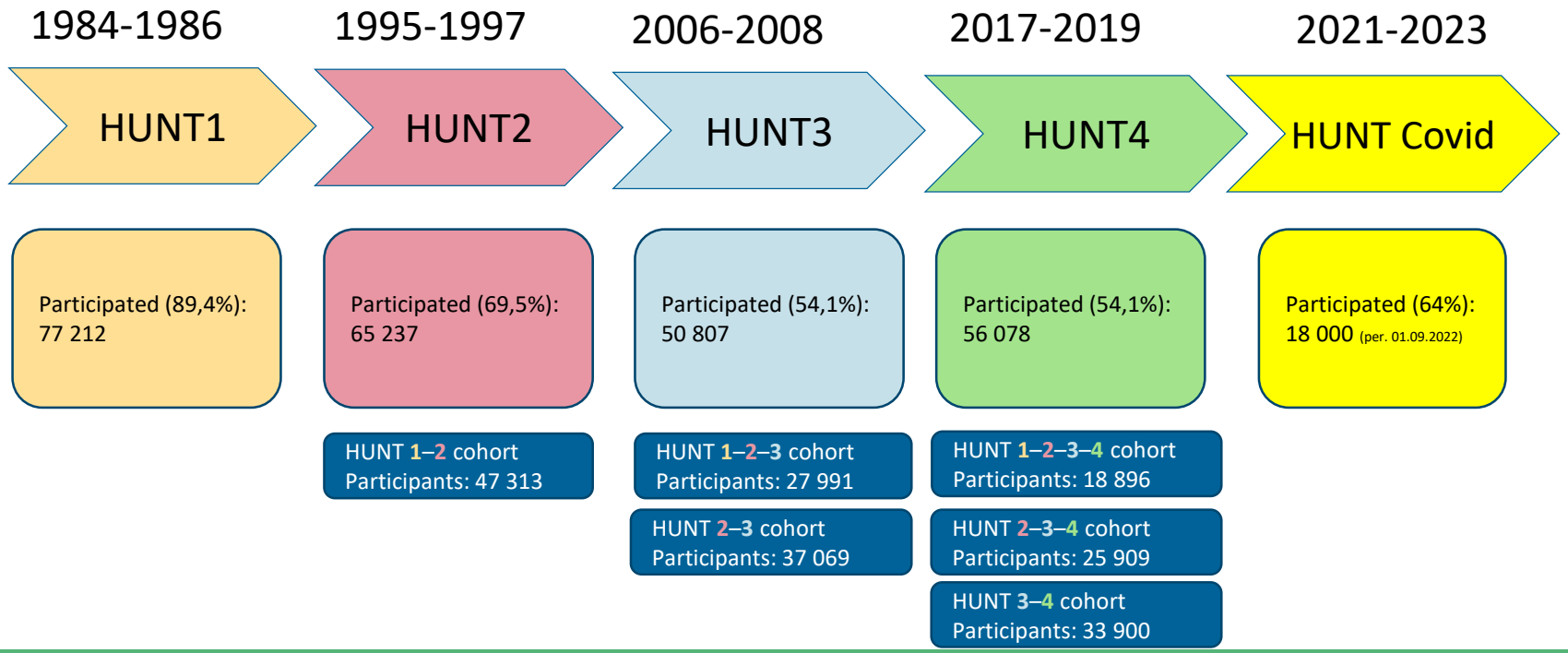
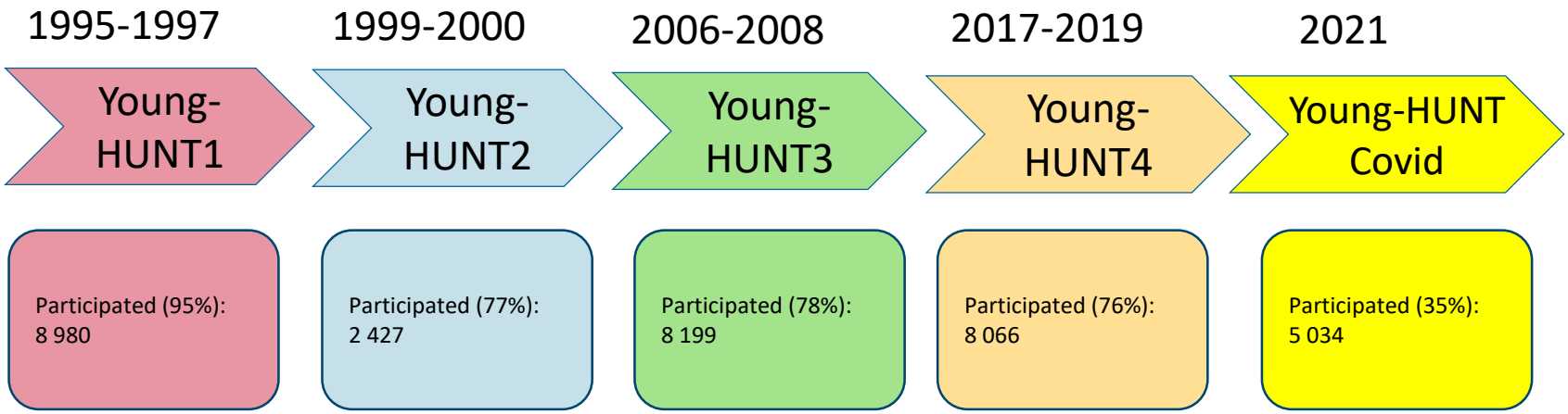
# The HUNT Study - a longitudinal population health study in Norway

- The Trøndelag Health Study (HUNT) is Norway's largest collection of health data from a population. Data and samples are obtained through four population surveys - the first one starting in 1984 and the last one ending in 2019.
- Nearly 250,000 people from the county of Trøndelag have participated with questionnaire, interview data and clinical measurements. Almost 110,000 participants have submitted biological samples.

# Timeline, HUNT surveys



# Young-HUNT, 13-19 years



# What is collected?

- **Data**! All stored in HUNT databank and HUNT Cloud
- And **biological samples**, stored in HUNT Biobank:
  - HUNT1: Only serum among those with known diabetes
  - HUNT2: Serum and fullblood (DNA)
  - HUNT3 and HUNT4: Full scale biobanking; blood samples, urine, saliva, feces etc.
  - HUNT Covid: Blood samples and feces samples
  - Young-HUNT: Buccal smears and saliva (DNA)

# HUNT Research Centre

- HUNT Biobank
- HUNT Databank
- HUNT Cloud
  - HUNT Cloud was established in 2013 to elevate the collection, accessibility and exploration of large scale information
  - Genetic data (≈ 600 000 SNPs each participant)


HUNT Cloud provides high-trust and flexible cloud computing for scientific explorations.

# The things we like most about HUNT

- Many have participated two, three and even four times.
- The age range of participants is from 13 years and up. The HUNT Study also contains a relatively large group of 80+ and even 90+ participants.
- A large amount of health information is collected for each participant, which makes The HUNT Study suitable for a broad range of research topics.
- All information is linked to the Norwegian Personal Identification Number → link to Norwegians registries.
- Strict rules for how data can be used or linked are followed to secure privacy protection.

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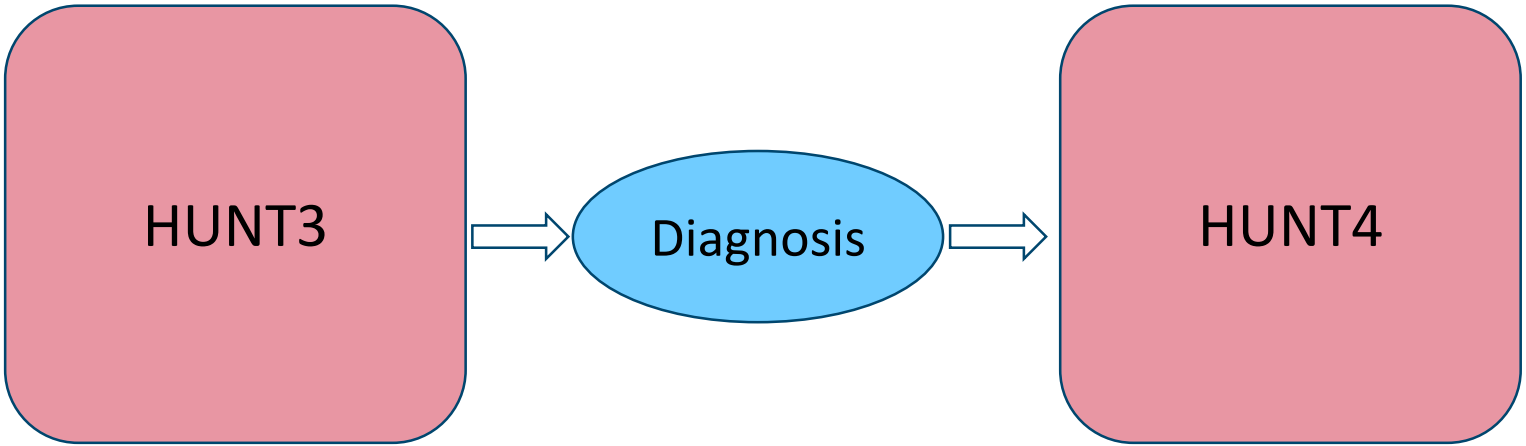
# The search for early biomarkers

- We often have data and biological material before a diagnosis is given, meaning that the research for early biomarkers is possible



# But, all research..

- Demands good sample quality!

# Sample quality

- What is sample quality?
- What affects the quality?
- Why is it important?
- What are our main worries?
  - Variation due to HUNT survey differences, or just time in the freezer that affects the results?
  - Historical samples (already 30 years ago since HUNT2 in the 90s..)
  - We are dependent on the inhabitants that voluntary participate, and that the samples and data collected are securely handled, have high quality and is valuable for national and international research projects

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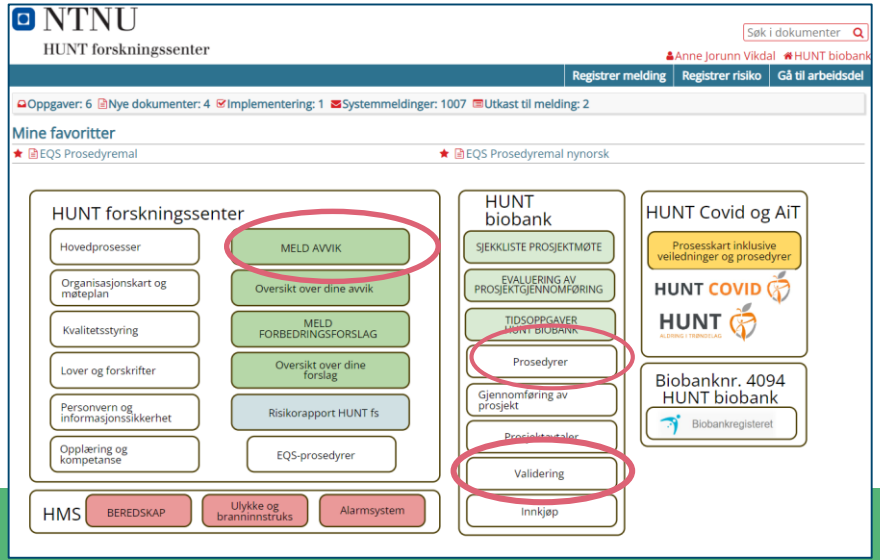
# Quality management and quality systems

- EQS (Extend Quality System)
- SOPs for collection, handling, storage, delivery, analyses etc.
- Validation or verification of critical methods
- Deviation system
- ISO 9001

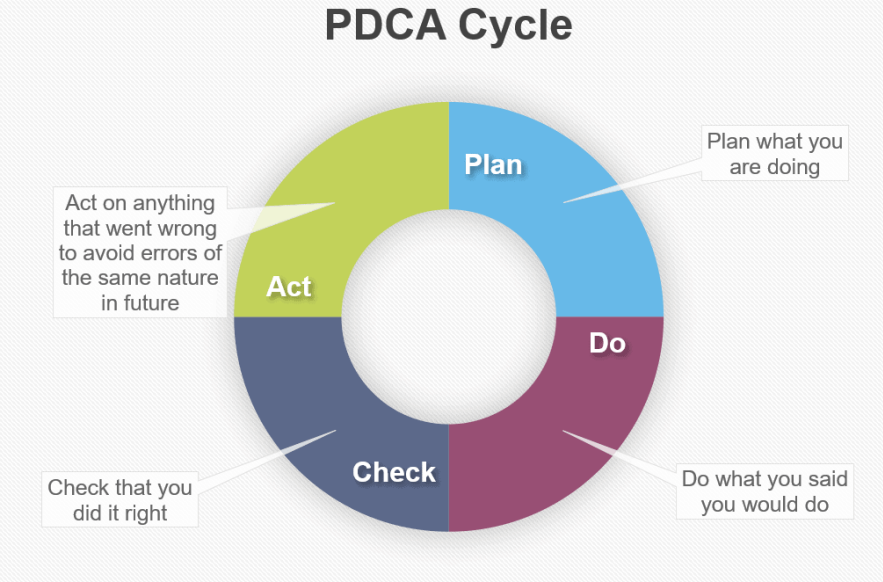
kiwa certified ISO 9001

NORWEGIAN ACCREDITATION MSYS 004



# PDCA – Plan, Do, Check, Act

ISO 9001

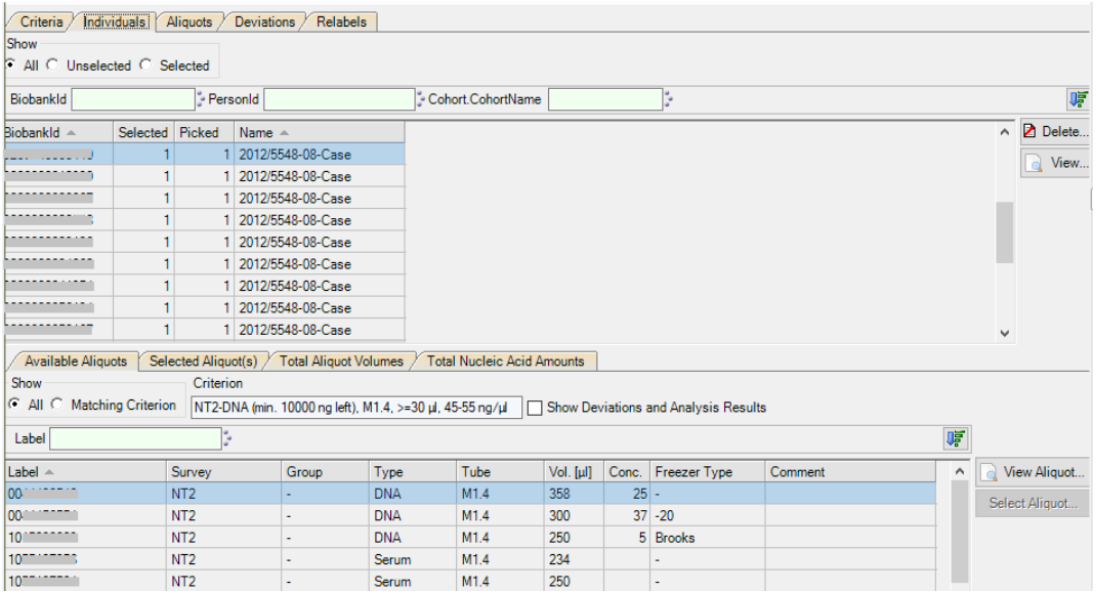



1. **P**lan what you are doing
2. **D**o what you said you would do
3. **C**heck that you did it right
4. **A**ct on anything that went wrong to avoid errors of the same nature in future

QMS International

# Laboratory information system, Hubris

- HUNT Biobank use Hubris (Dataphor)
- All samples with related information
- Pick-lists
- Deviations on aliquots
- Etc.

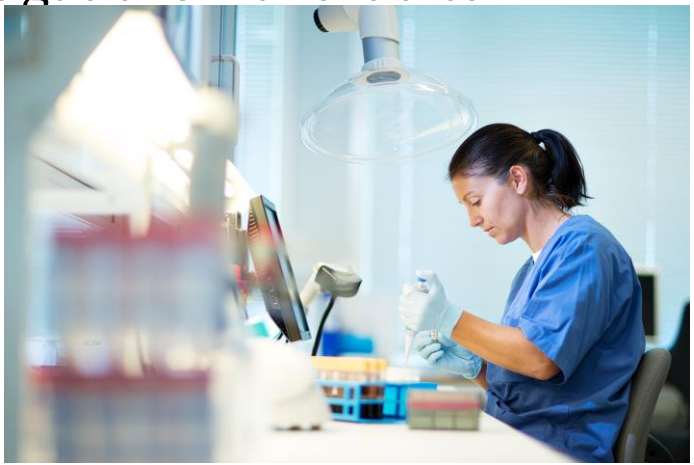


# Not only collection, but also handling and delivery

- > 250 PhD degrees based on the HUNT Study
- The last three years (2019-2021) delivery of about 230 000 biological samples from the biobank to research projects
- Available robots and instruments in the biobank
- Stable and competent personnel
- Important for sample quality!

# Having available instruments make quality studies in-house easy and possible

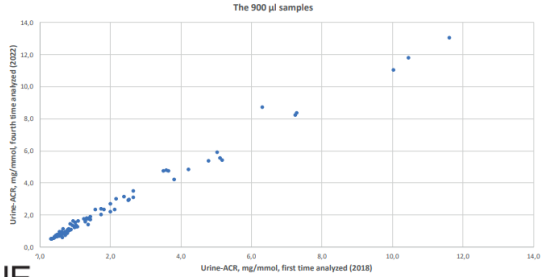
- To optimise sample collection quality, we need to pay attention to markers useful for quality assessment
- Having available instruments for such investigations make it often easier to do in-house studies

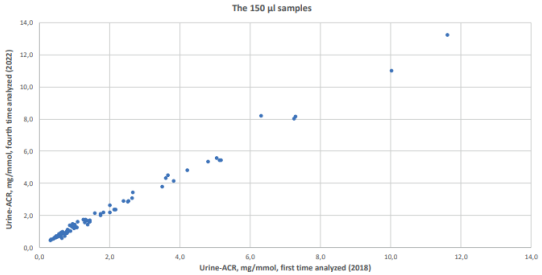


# Also, having available samples!

- Stored samples in the biobank can be reanalysed
- For example, repeated measurements in
  - serum
  - urine
  - DNA

LONG-TERM STABILITY OF URINE SAMPLES AT HUNT BIOBANK




THE LONG-TERM STABILITY STUDY OF SERUM SAMPLES STORED AT HUNT BIOBANK - AN UPDATE

Fig. 2a: Effects of freeze/thaw cycles over 10 time points (Panel 1) estimated by marginal means of 17 samples

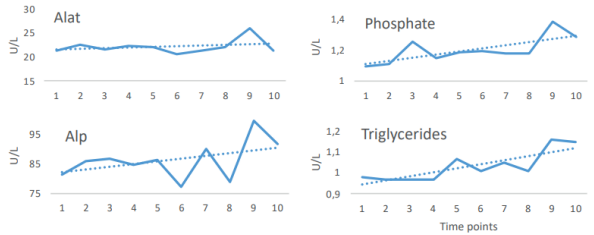
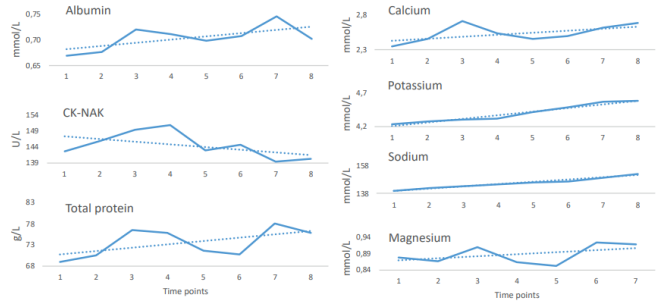



Fig. 2b: Effects of freeze/thaw cycles over 7-8 time points (Panel 2) estimated by marginal means of 59 samples

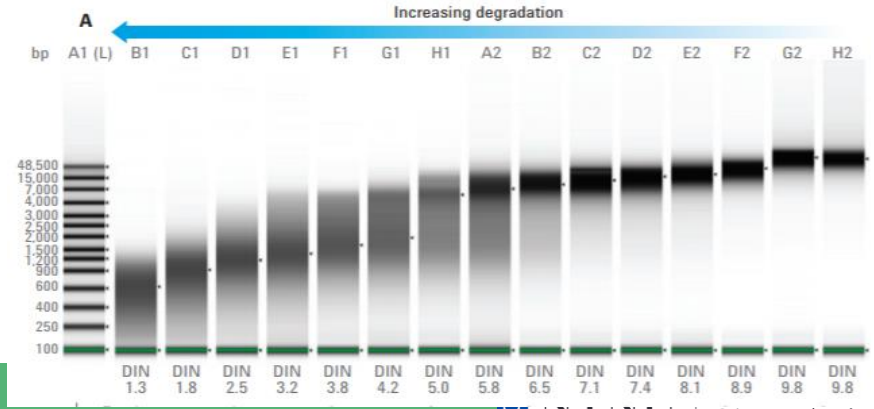


# Quality of stored DNA-samples, 1

- We deliver out many DNA-samples, and some are getting old
- We set up a study to investigate if DNA is affected by storage, and if so, dependent on:
  - Time
  - Concentration
  - Method of DNA-extraction

# Quality of stored DNA-samples, 2

- Measurement of concentration and quality of a number of samples by in-house instruments;
  - *NanoDrop and DropSense96* (spectrophotometric) – concentration and ratio A260/280
  - *Biomek PicoGreen* (fluorescens) – concentration
  - *TapeStation* – fragmentation (DNA Integrity Number/DIN)



# Temperature and sample quality

- What temperature? We have available
  - Ambient temperature
  - -20 °C
  - -80 °C (-70 °C)
  - -196 °C
- What sample type?
- For how long?
- How about freeze / thaw?

# Dialogue with the researchers about stored samples

- It might be that stored samples in our biobank are not always suitable for a given research topic
- Stability of the analytes
- Demands of “fresh” samples
- Demands of samples that have not been thawed before
- The dialogue in advance is important to ensure good research and correct results, and avoid use of samples that are not suitable for the project

# New-fashion analyses, sample types and sample quality demands in already stored samples

- Gut microbiome analyses
- Small molecules in serum, DNA etc.
- Proteomics
- Metabolomics
- Methylation
- Are samples from the 90s/00s/10s of good enough quality?

C&EN American Chemical Society

# Where are we going

- Analysis facilities more often demands samples of high quality
  - DIN-values
  - Samples that have not been thawed
  - Testing before analysis
- The analysis is getting more and more expensive
- Sample quality is getting more and more important

# Conclusion

- At HUNT Biobank there are systematic processes in place to ensure quality and integrity of the large long-term preserved biobank collection.
- This also includes optimized solutions for data storage and delivery through HUNT Databank and HUNT Cloud.
- Data and sample quality is a key factor for all biobanks, and the use of our samples in the future.

# Thank you!

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www.hunt.no