External and internal quality of Big Data

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Introduction

- Experience with three large datasets in relation with surveys
- External quality: timeliness, accessibility, relevance, coverage, comparability, accuracy
- Internal quality: reliability, coherence, completeness

1. Evaluation of pharmacy service

- PMC: **P**oly**m**edication **C**heck
- Check on compliance and issues with medication
- Offered by pharmacies
- Paid by health insurance
- On a provisional basis

(Hulliger et al., 2017)

Survey

- Survey among all Swiss pharmacies ($N = 1720$)
- Questionnaire on acceptance of PMC: Acceptance and issues of PMC by pharmacists
- Questionnaire on PMC records (if PMC done): View of pharmacists about effect of PMC and about satisfaction of patients
- Sample: $n = 585$ pharmacies ($r = 0.34$), $n = 345$ PMC records

Health Insurance Data

- Secondary data from three large health insurance companies, covering 3.5 million patients in 2013 (coverage ≈ 0.44).
- Socio-demographic data and medical history data over three years.
- Longitudinal analysis of PMC-patients
- Quasi-experimental analysis with matched non-PMC patients
- Treatment: Persons with PMC
- Control: Samples of matched persons not taking the service using socio-demographic and medical history

Health Insurance Data ctd.

- 1’707 PMC-Patients compared with 14’015 Non-PMC Patients
- Medical history data (e.g. every drug with ATC, quantity, price, date etc., and PMC)
- Response: Hospitalisations, Emergencies, Doctor visits, Expenditures for drugs

Lessons learned

- Survey of pharmacists
  - Low response rate of survey and missing values: Possible non-response bias.
  - Analysis and interpretation of survey straightforward but only viewpoint of pharmacists (proxy for patients).
  - Pharmacists mixed acceptance of PMC.
- Secondary analysis
  - Lack of harmonisation between companies: joint analysis impossible.
  - Coverage of about 44%: possible differences compared with smaller companies.
  - Analysis involved.
  - Significant effect over short period for cost of drugs. Otherwise no clear signal!

2. Imputation of turnover in business census

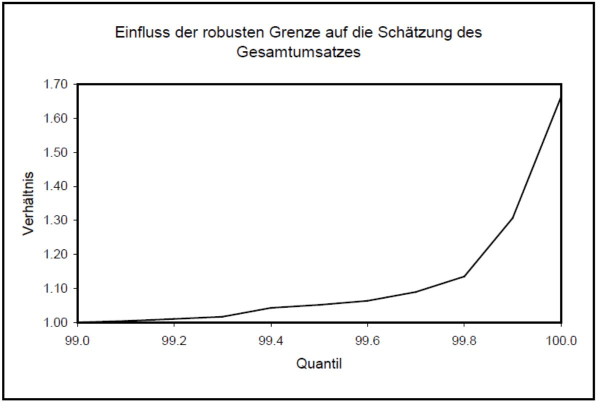
- Swiss business census 1995 (Hüsler and Müller, 2001)
- 277’331 enterprises
- 21% have missing turnover
- Various methods for the imputation (homogeneous groups, regression, robust variants)

Estimates of total GDP in BCHF:

	Lowest version	Highest version
Non-robust methods	550	1450
Robust methods	620	1040

- Standard error with multiple imputation: 10 BCHF
- Different models in different branches needed.
- Macro comparison with national accounts: All above 1000 BCHF excluded.
- For large data sets the problem of outliers and very skew distributions remains.

Figure: Total turnover vs. tuning constant for robustification



Source: Hüsler and Müller (2001)

3. TV-audience measurement

- Top-set box to register TV-audience.
- About 2000 panel members (households).
- Recruitment, instruction, installation, maintenance
- Highly sophisticated and detailed calibration to population.
- TV-audience measurement every 30 seconds (channel, persons).
- Analysis spells: day, week, month, trimester, semester.
- Problem: Are small TV-stations well covered by the audience measurement?

(Kuonen and Hulliger, 2013)

TV-audience measurement ctd.

- TV-audience measurement:
    - Big data in time dimension
    - Small survey in household dimension.
- Missing spells of measurements: Big data may help.
- Small area (households) estimation: Big data useless...?
- Small TV-channels: Rare event - Aggregation over time helps

Quality Overview

	PMC		BZ95	Mediapulse	
Dimension	Survey	Data	Imp.	Panel	Data
Relevance	2	2	3	3	3
Coverage	1	1	3	2	3
Comparability	2	1	3	2	1
Accuracy	2	1	1	1	3
Timeliness	3	2	2	1	3
Punctuality	3	1	2	3	3
Accessibility/Clarity	3	1	2	2	2
Reliability	1	3	3	2	3
Coherence	2	1	3	2	3
Completeness	2	1	2	1	2
Cost	2	3	3	1	1

(1=low, 2=middle, 3=high)

Conclusions

- Large datasets have the same problems of bias as any survey: coverage, non-response, robustness
- The bigger the data the larger the problems of comparability (definitions).
- Rare events may be captured by big data.
- Triangularisation may shed light on complex phenomena.
- Not the size of data makes the quality but how targeted the data is collected.

Bibliography

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