

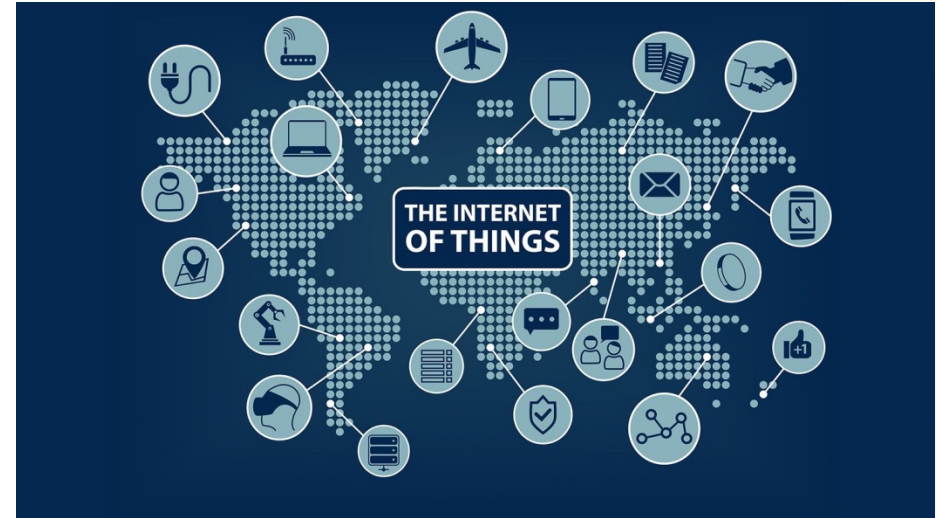


## The big data and information technology revolution in injury prevention: are we lagging behind?

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# BIG DATA



# Background

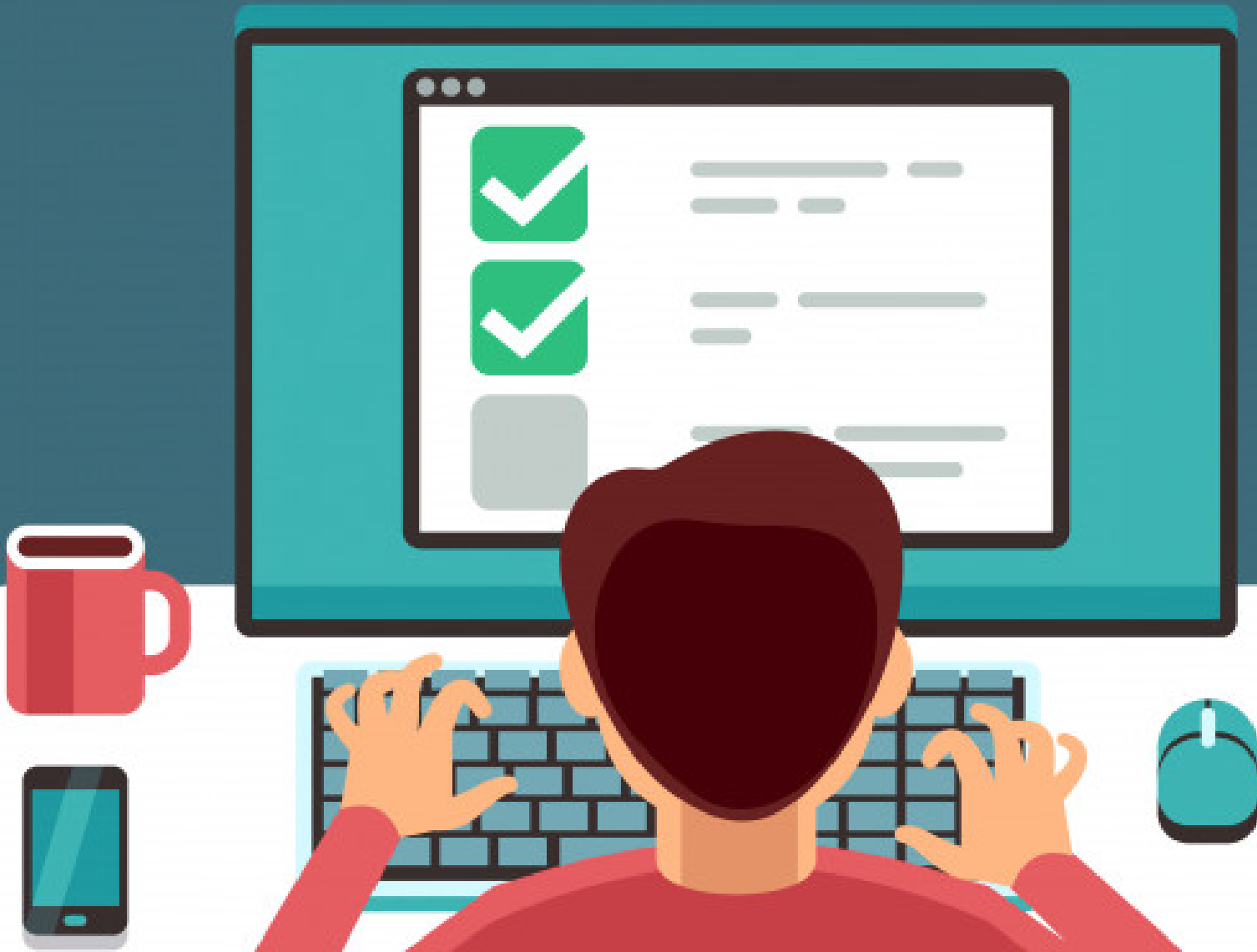
- ICT revolution in daily life, mobile technology changing rapidly
  - Sensors leading to smart housing, cars, clothing
  - Wearable devices, physical activity trackers
  - Implantables
  - Big data, machine learning
- What about the use of information technology in health research in general and injury research in particular?

# Goal and content

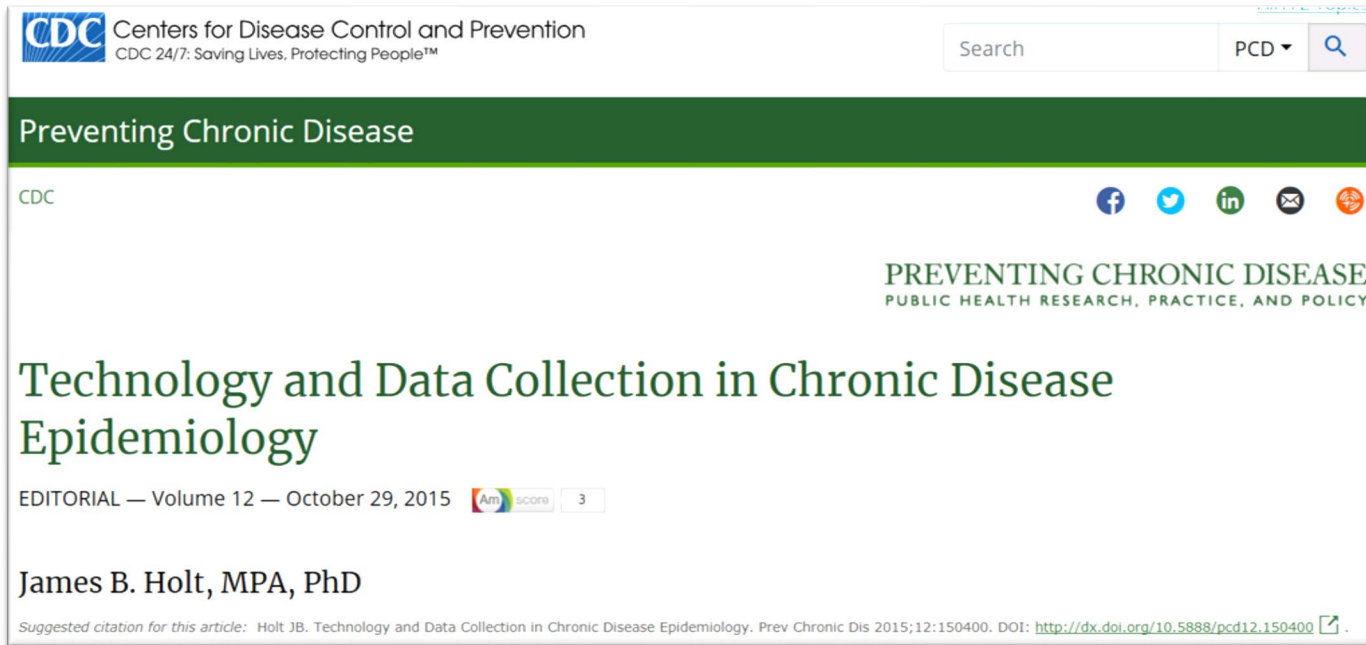
Are we using and taking advantage of these developments in injury research already?

- Innovative data collection
- Innovative data processing
- Literature on health research
- Practical examples from Consumer Safety Institute
- Successes and difficulties

# Data collection



# Review of literature I



- Successful application in environmental studies (smartphone use: photo's, GPS, video's): standing water, fast food, trash
- Infectious diseases outbreak studies, crowdsourced data collection



# Review of literature II



The screenshot shows the BMC (BioMed Central) website interface. At the top, it says 'BMC Part of Springer Nature' with a search bar. The main header is 'International Journal of Behavioral Nutrition and Physical Activity'. Below this, there are navigation links: 'Home', 'About', 'Articles', and 'Submission Guidelines'. The article title is 'Global positioning system: a new opportunity in physical activity measurement'. The authors are 'Ralph Maddison' and 'Cliona Ni Mhurchu'. The publication details are 'International Journal of Behavioral Nutrition and Physical Activity 6, Article number: 73 (2009)'. There are links for 'Download', 'Citation', and 'Metrics'. The article has '20k Accesses', '103 Citations', and '0 Altmetric'.

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International Journal of Behavioral Nutrition and Physical Activity

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Review | [Open Access](#) | Published: 04 November 2009

**Global positioning system: a new opportunity in physical activity measurement**

[Ralph Maddison](#) & [Cliona Ni Mhurchu](#)

International Journal of Behavioral Nutrition and Physical Activity 6, Article number: 73 (2009) | [Download](#)

[Citation](#)

20k Accesses | 103 Citations | 0 Altmetric | [Metrics >>](#)

- Widely used in health studies, sports: physical activity but also routes taken
- Guidelines on how to use, analyze and interpret data is needed to prevent researchers to make same mistakes

# Evaluation of multifactorial intervention among elderly

- TOM pilots Veen vd Eurosafe 2019: balance, nutrition, social support, mobility:
  - wearable device to measure physical activity (steps and sit-stand transitions): ultimate goal to predict falls
  - not enough data, not sufficiently used
    - wearing comfort too low
    - no immediate feedback
    - too strict requirements for 'daily average' or 'weekly average'





# I-pads and online questionnaires instead of paper at hospital / ED

- Who still uses paper questionnaires?
- In hospitals in NL no e-mail addresses of emergency patients available, letters are sent → low response on online questionnaire
- Flyers and I-pads available in waiting room but low response → better if research personnel is present?
- ED visit for injuries: no long-term relationship, but one-off visit, not always in patients' 'own' hospital

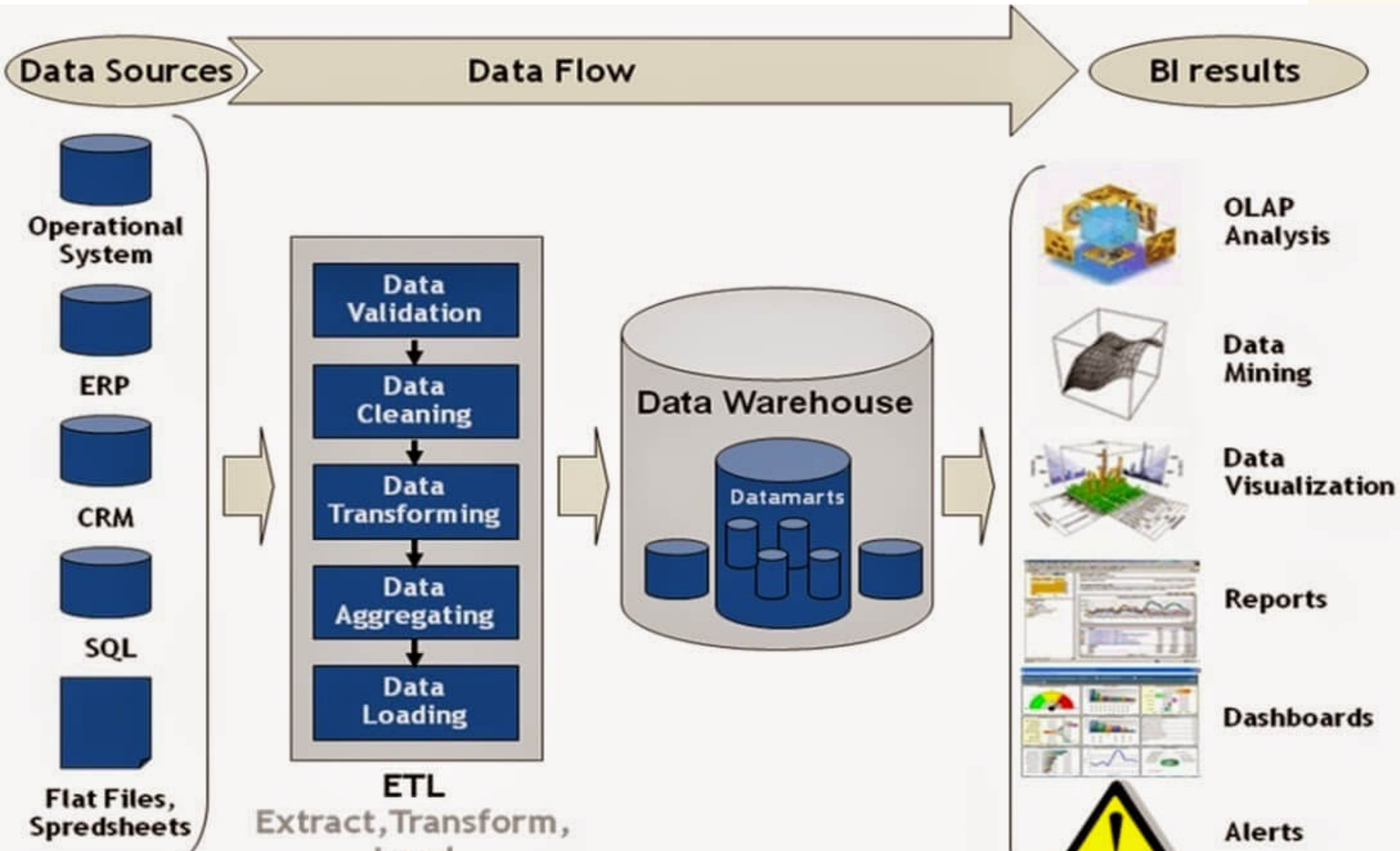
# Apps on smartphone

- Cohort studies: apps can be installed to measure behaviour:
  - (type of) physical activity
  - dangerous use of smartphone (music, whatsapp, sms)
  - sleeping patterns
  - car or cycling speed
  - weather conditions
  - dangerous locations
- Injury research:
  - patient / case control studies
  - extract data afterwards?
  - privacy ? consent?



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# Data processing



# Automatic text recognition

- Many data collected in hospital information systems (open text fields)
- However, difficult to extract data
- Automation of processes is difficult: ICT changes, no priority

# Analyze open text fields by automatic text recognition software in DISS

- Administrative burden of our IDB (DISS) too high for ED personnel to register by means of questionnaires (n=14)
- Demand from local authorities occupied with road safety (n=7), ambulance data
- Merely extraction of open text fields in medical file
- Validity of automatic coding?



# Validation study on automatic text recognition I

Can automatic text recognition software for coding injuries replace manual coding?

*Nijman S, Blatter B, Safety 2018, Bangkok*

“Car driver, collision against tree, high speed accident”

- Desired output:
  - Injury mechanism: contact with object
  - Products involved: car, tree

“Patient found intoxicated, used alcohol and speed”

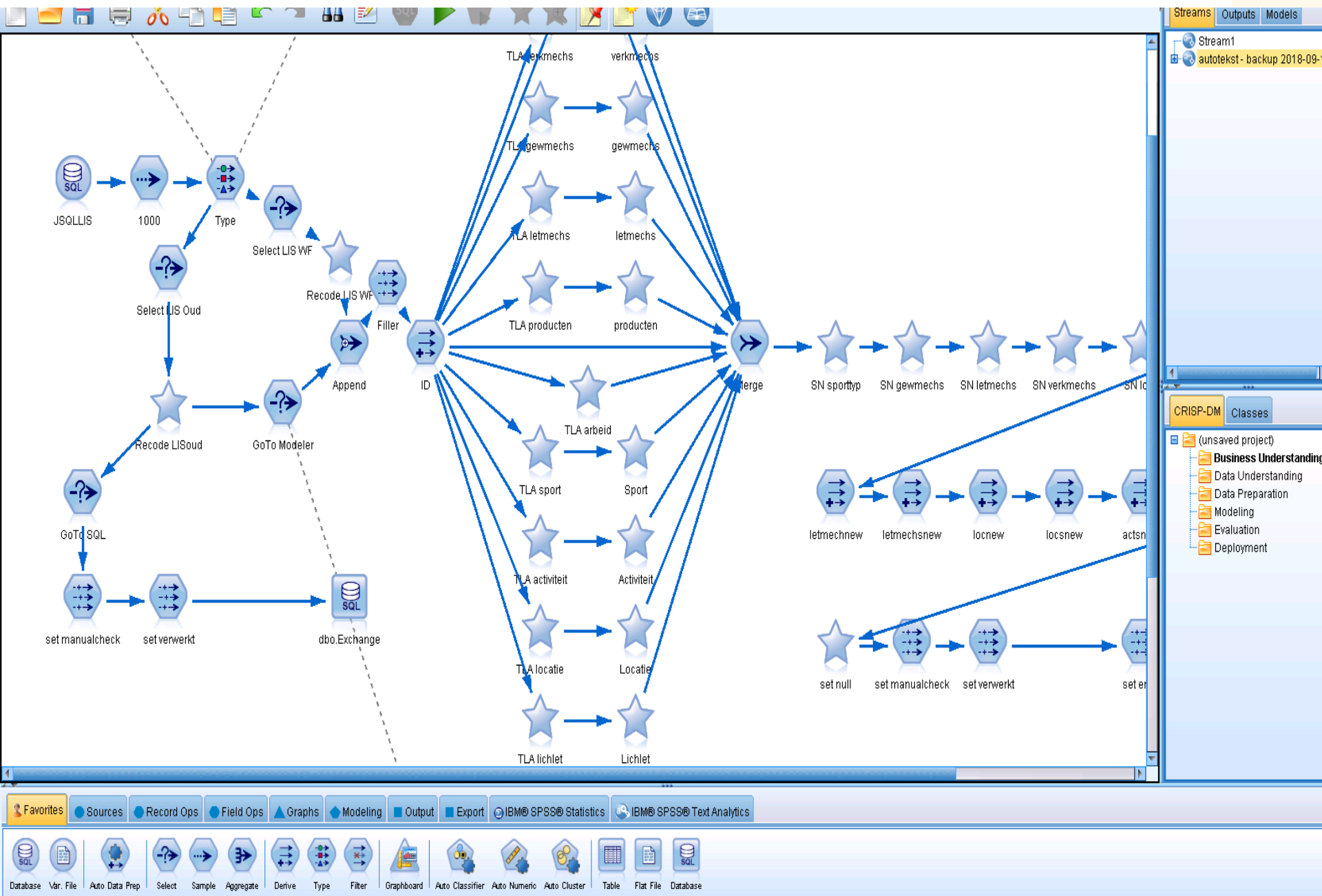
- Desired output:
  - Injury mechanism: chemical mechanism
  - Products involved: alcohol, speed



# Validation study on automatic text recognition II

- We taught the system (IBM Modeler) from scratch how to code information on accidents and injuries by means of different nodes
- All possible words were classified into libraries and the system was taught how to interpret sentences
- Data from one year, 100% manually checked
- Comparison: IBM Modeler out – manual check out

# Nodes with coding instructions



# Results of validation study

## Injury mechanism - after manuel check autotext

Injury mechanism autotext	Fall	Contact with object	Contact with person or animal	Foreign body	Threat to breathing	Chemical mechanism	Thermal mechanism	Electricity, radiation, explosion	Physical over-exertion	Unspecified
Fall	42.500	1.009	289	12	8	33	16	3	216	147
Contact with object	1.979	13.370	182	104	8	44	27	9	85	140
Contact with person or animal	779	366	3.219	18	0	15	1	1	66	78
Foreign body	41	88	32	790	1	75	6	1	1	18
Threat to breathing	10	8	6	13	68	3	0	0	0	11
Chemical mechanism	156	68	8	10	0	1.469	3	1	14	38
Thermal mechanism	35	30	0	2	1	85	401	4	3	9
Electricity, radiation, explosion	5	10	2	1	0	3	4	69	2	1
Physical over-exertion	182	64	45	2	1	2	3	1	868	67
Unspecified	2.544	2.711	864	167	19	1.221	89	14	726	3.720
Total	48.231	17.724	4.647	1.119	106	2.950	550	103	1.981	4.229

% true	88%	75%	69%	71%	64%	50%	73%	67%	44%	88%
% unkown	5%	15%	19%	15%	18%	41%	16%	14%	37%	
% false	7%	9%	12%	14%	18%	9%	11%	19%	20%	12%

**Total true** 81% of the cases was coded correctly for injury mechanism by autotext recognition software

Injury mechanism autotext	Fall	Contact with object	Contact with person or animal
Fall	42.500	1.009	289
Contact with object	1.979	13.370	182
Contact with person or animal	779	366	3.219
Foreign body	41	88	32
Threat to breathing	10	8	6
Chemical mechanism	156	68	8

81% coded correctly

# Machine learning

- Already satisfactory but 100% manual check
- Switch to new version of IBM Modeler is much work
- Is machine learning an alternative for nodes with coding instructions? Many commercial providers  
*scientific study of algorithms and statistical models that computer systems use to perform a specific task **without using explicit instructions**, relying on patterns and inference instead*
  - Are we still in control?
  - New / changed categories?

Machine learning not the same as automatic coding

# Conclusions

- Endless possibilities and opportunities of apps, sensors
- Use in injury research still limited
- More cohort studies (and case control studies) in injury research
- Share (innovative) methods more across research fields, open source applications make it possible
- Privacy and user friendliness are impeding factors
- Make use of abundance of existing data: experiment!



If not.. YES we will lag behind