



# **EHTEL Symposium**

**4/12/2024**

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**Medical Coding <> AI**



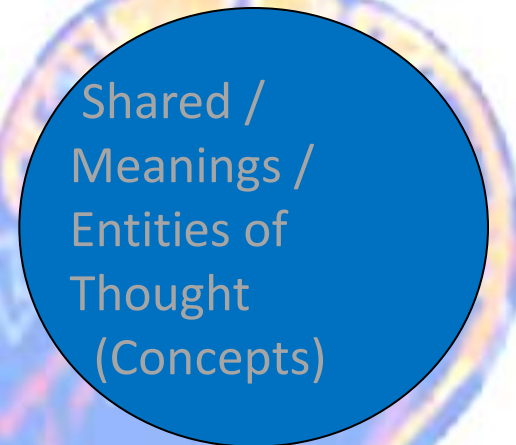
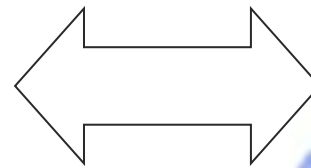
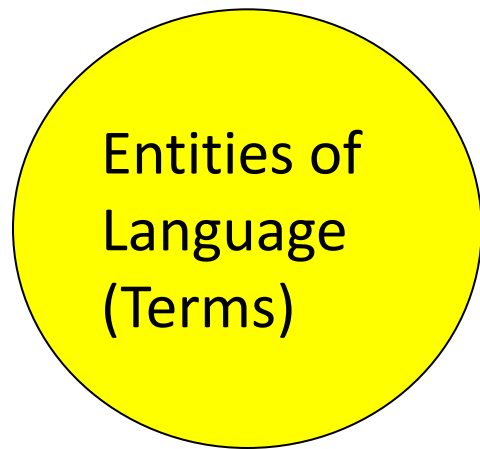
# Medical Coding <> AI



1. How is AI used in medical coding?
2. Is AI accurate in medical coding?
3. Will medical coding get replaced by AI?
4. Is medical coding being phased out?

# Medical Coding

## Language -> Code / Concept

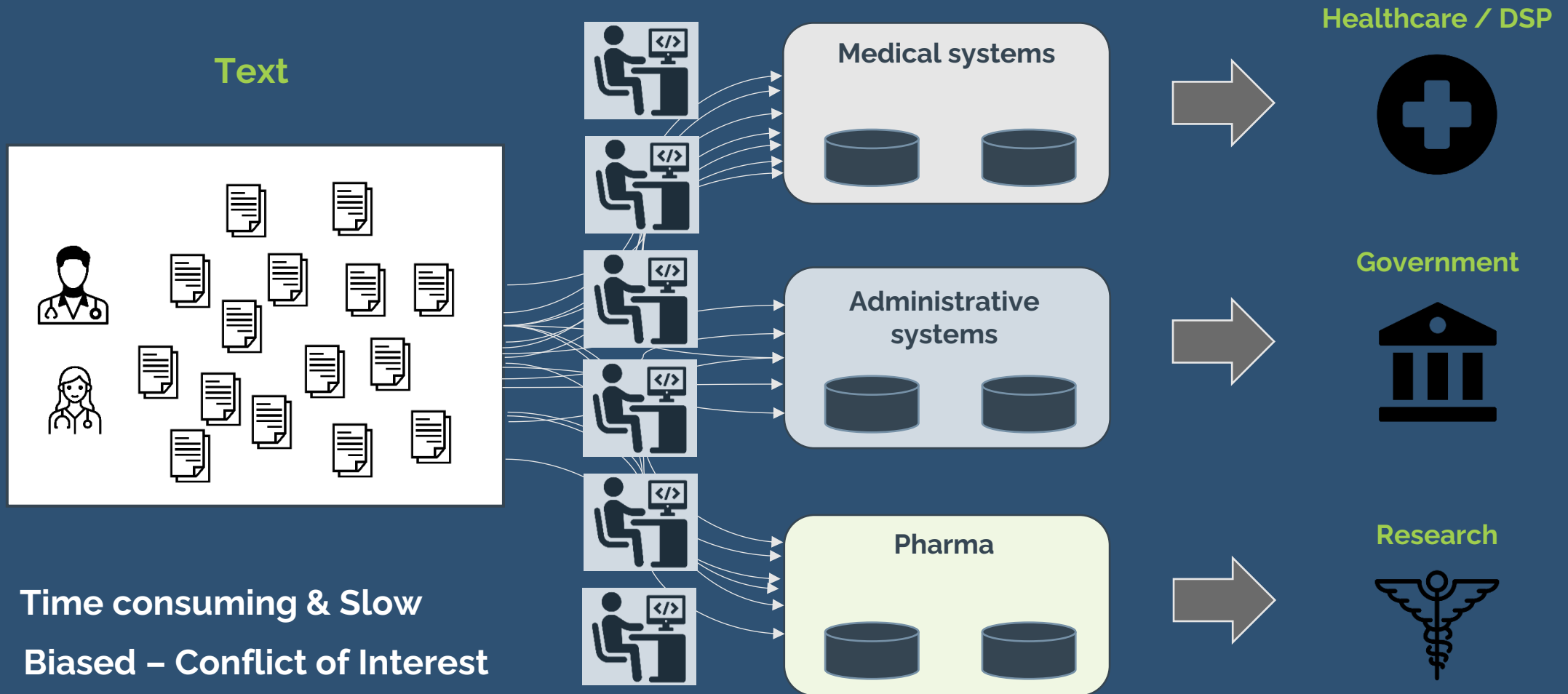


*„benign neoplasm of heart“*  
*„gutartige Neubildung des Herzmuskels“*  
*“Tumeur bénigne du cœur”*

# Medical Coding Classification (group) - Standardisation

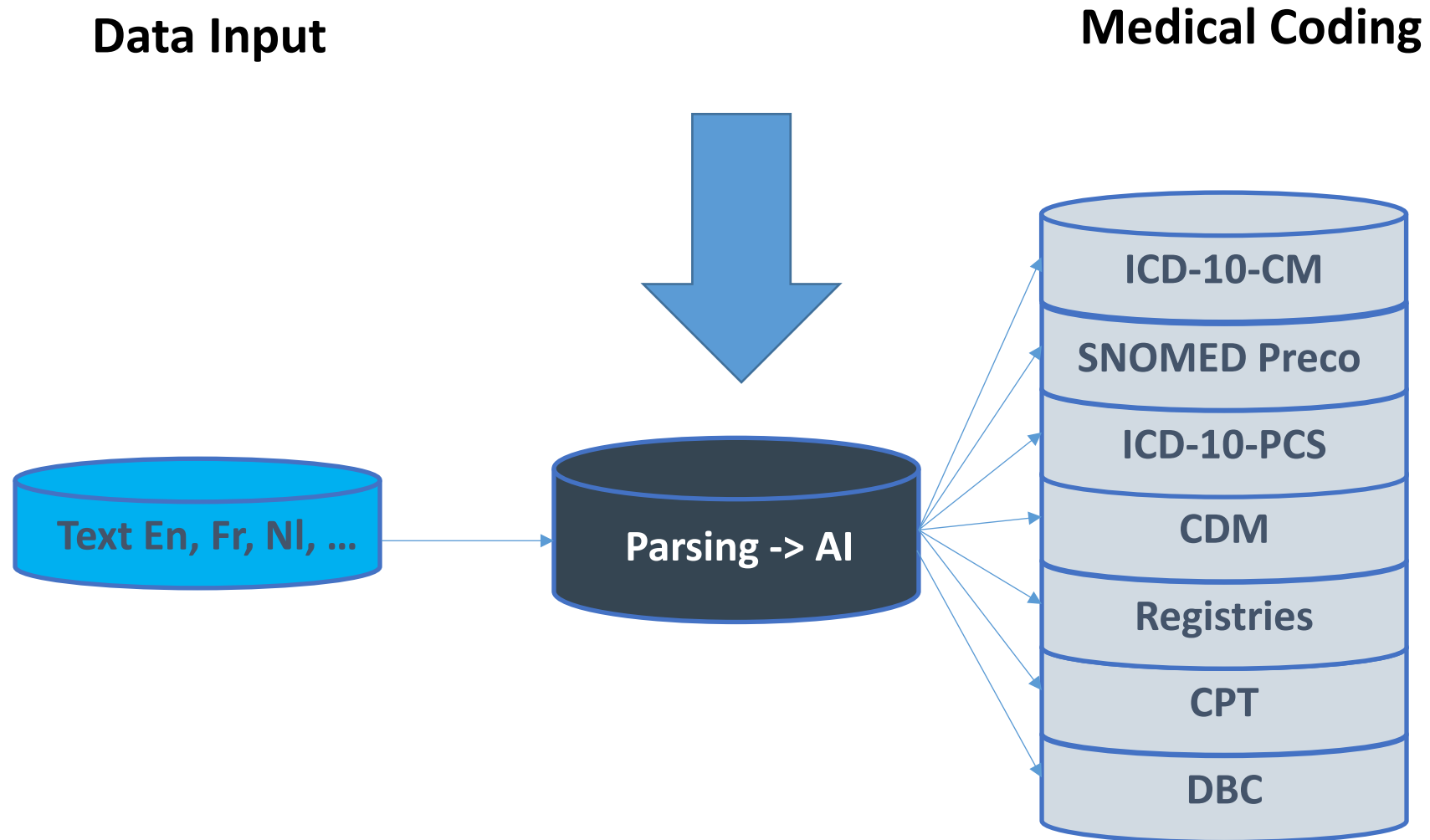
- Reimbursement - Billing
  - Diagnosis Related Groups, Procedure codes, Care plans .....
- Epidemiology
  - ICD-10-WHO, ICD-11
- Evidence Based Medicine (SNOMED CT) – Clinical Trials (eCRF)
  - Condition (ICD, OMIM, LOINC, .....
  - Nursing (ICNP, MVG, ...)
  - Medication (ATC, RxNorm, CNK...)
  - Procedures (CPT, PCS, operation room,...)
  - Outcome (quality of life, life years)

# Manual Medical Coding



Time consuming & Slow  
Biased – Conflict of Interest  
Training Medical Coders

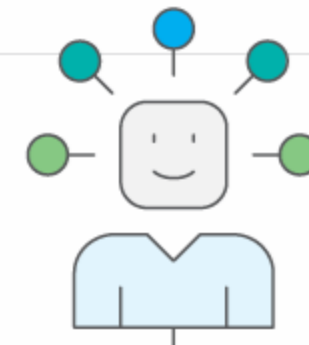
# How is AI used in medical coding?



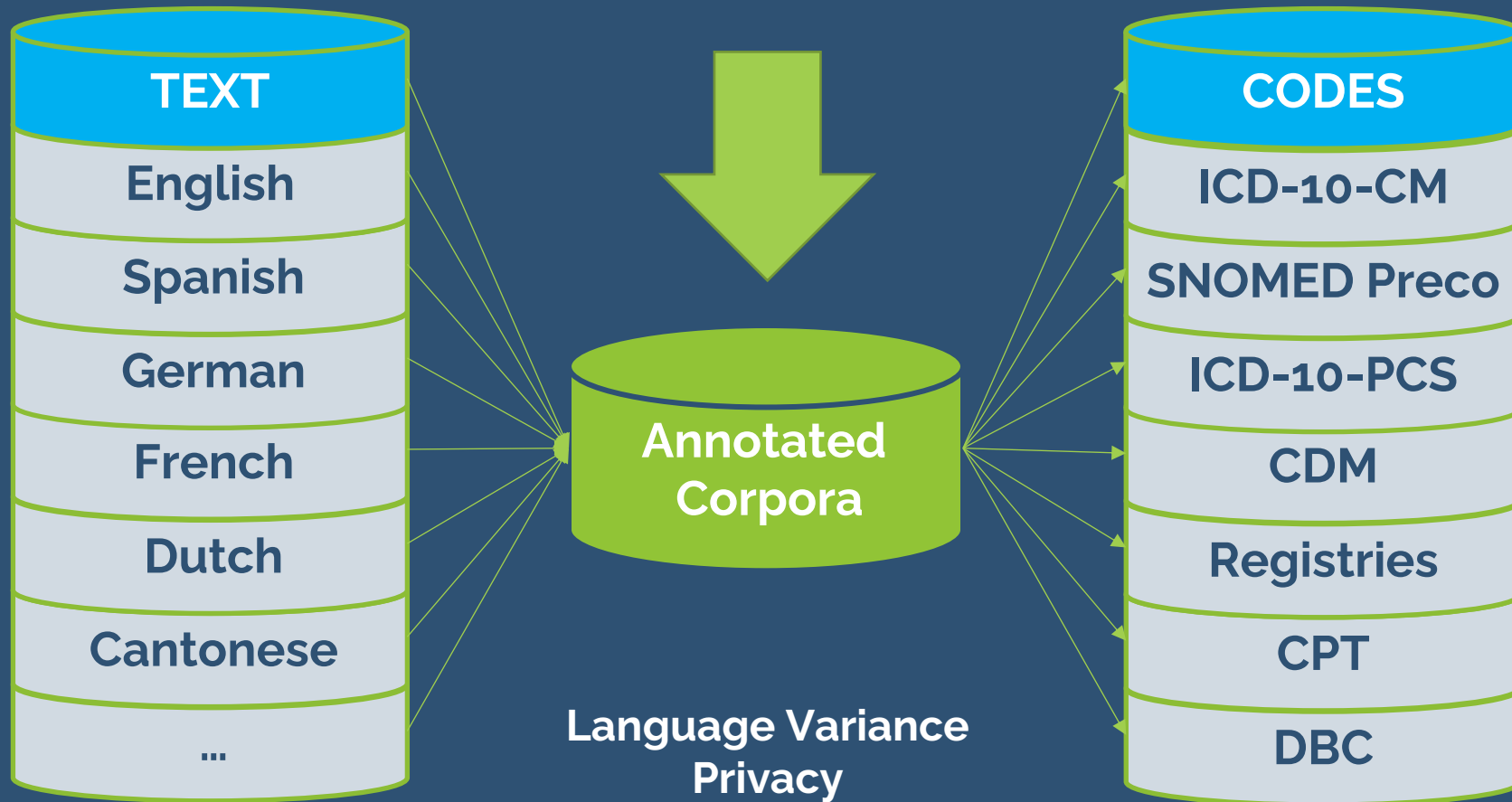
# Is AI accurate in medical coding?

## Learning!

<b>Types</b>	<ul style="list-style-type: none"><li>● <b>Supervised learning algorithms:</b> Decision trees, support vector machines, neural networks</li><li>● <b>Unsupervised learning algorithms:</b> K-means clustering, principal component analysis, autoencoders</li><li>● <b>Reinforcement learning algorithms:</b> Q-learning, SRASA, policy gradients</li></ul>
<b>Techniques</b>	<ul style="list-style-type: none"><li>● <b>Machine learning:</b> Linear regression, decision trees, SVMs</li><li>● <b>Deep learning:</b> Convolutional neural networks, recurrent neural networks</li><li>● <b>Natural language processing:</b> Sentiment analysis, named-entity recognition, machine translation</li></ul>
<b>Applications</b>	<ul style="list-style-type: none"><li>● <b>Healthcare:</b> Drug discovery, diagnosis, personalized medicine, remote patient monitoring</li><li>● <b>Finance:</b> Credit scoring, fraud detection, financial forecasting, customer trends</li><li>● <b>Retail:</b> Personalized recommendations, inventory management, customer service</li></ul>
<b>Risks</b>	<ul style="list-style-type: none"><li>● Bias and other unintended consequences</li><li>● Privacy violations</li><li>● Lack of transparency making it difficult to detect errors</li><li>● Legal and ethical risks</li><li>● Job loss</li></ul>



# Learning

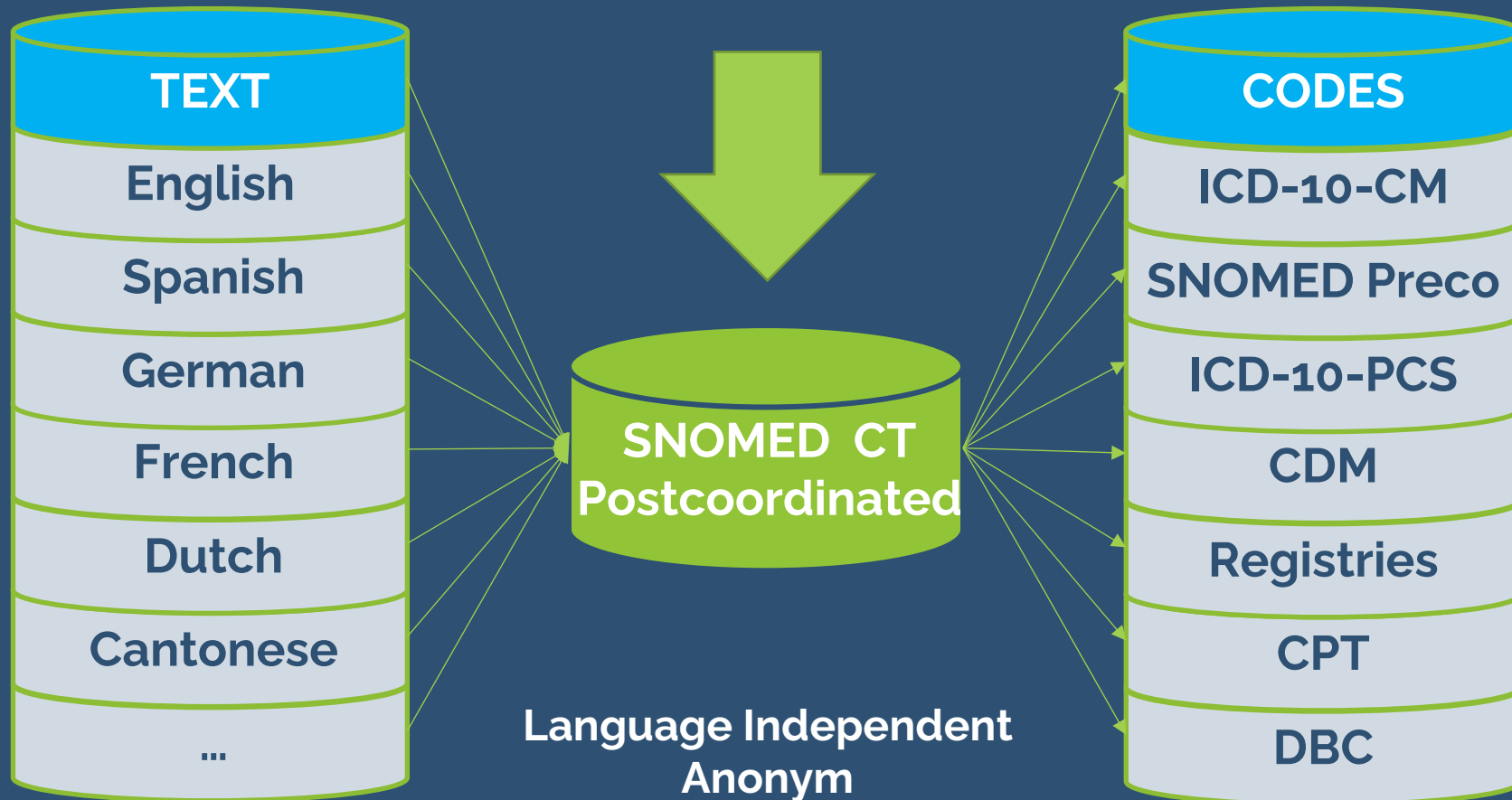




# Annotated Corpora Learning



# Terminology Parsing Tokenization AI



# Tokenization

## Token -> Atomic Code / Concept

Language	Term	ConceptId
en	acute	424124008
en	sudden onset AND/OR short duration	424124008
fr	aigu	424124008
fr	aiguë	424124008
fr	aigus	424124008
fr	apparition soudaine	424124008
fr	apparition soudaine et/ou de courte durée	424124008
nl	acute	424124008
nl	acuut	424124008
nl	acuut begin	424124008
nl	acuut optredend	424124008
nl	acuut optredend en/of kortstondig	424124008
nl	kortstondig	424124008
nl	onverwacht optredend en/of van korte duur	424124008
nl	plotseling optredend en/of kortdurend	424124008

# Token -> Composed Concept : Precoordination = n Atomic Codes : Post-coordination

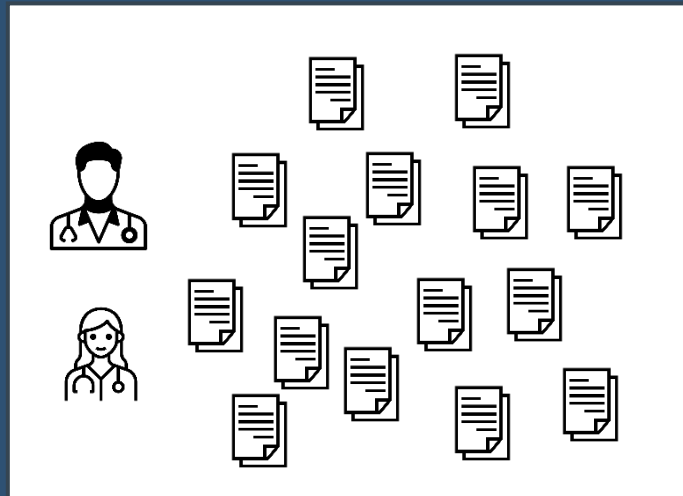
Term	Precoordinated	AI Postcoordinated	AI Outcome
Tenormin-100	x	732936001  Tablet   , ( 387506000  Atenolol   , #100, 258684004  milligram (qualifier value) )	bradycardia
Tenoretic	y	732936001  Tablet   , ( 387506000  Atenolol   , #100, 258684004  milligram (qualifier value) ) , (387324004  chlortalidone   , #25, 258684004  milligram (qualifier value) )	bradycardia, hypokalemia
Tenoretic Mitis	z	732936001  Tablet   , ( 387506000  Atenolol   , #100, 258684004  milligram (qualifier value) ) , (387324004  chlortalidone   , #12.5, 258684004  milligram (qualifier value) )	bradycardia, hypokalemia
Tenormin Minor	a	732936001  Tablet   , ( 387506000  Atenolol   , #25, 258684004  milligram (qualifier value) )	bradycardia
Hygroton	b	732936001  Tablet   , (387324004  chlortalidone   , #25, 258684004  milligram (qualifier value) )	hypokalemia

# Post-coordination Normalisation - Interoperability

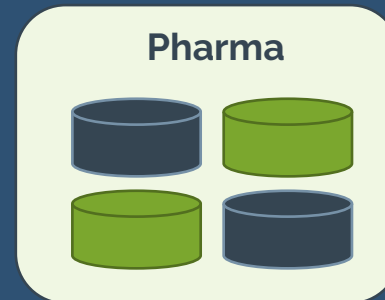
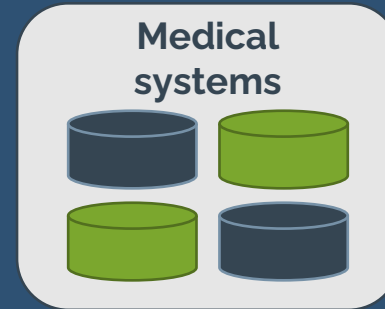
Code System	Description
English	Acute appendicitis
French	Appendicite aiguë
.....	
ICD-10	K35   Acute appendicitis
ICPC-2	D83   Appendicitis
.....	
SNOMED CT Precoordinated	85189001   Acute appendicitis
SNOMED CT Precoordinated	4532008   Acute inflammation   , 66754008   Appendix
SNOMED CT Precoordinated	74400008   Appendicitis   , 424124008   Sudden onset
SNOMED CT Postcoordinated	424124008   Sudden onset   , 409774005   Inflammatory morphology   , 66754008   Appendix

# Is AI accurate in medical coding?

Terms / Composed Codes



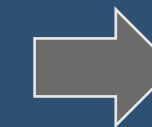
SNOMED  
Postco



Healthcare



Government



Research



Automatic - Fast

No bias

Less coding variance

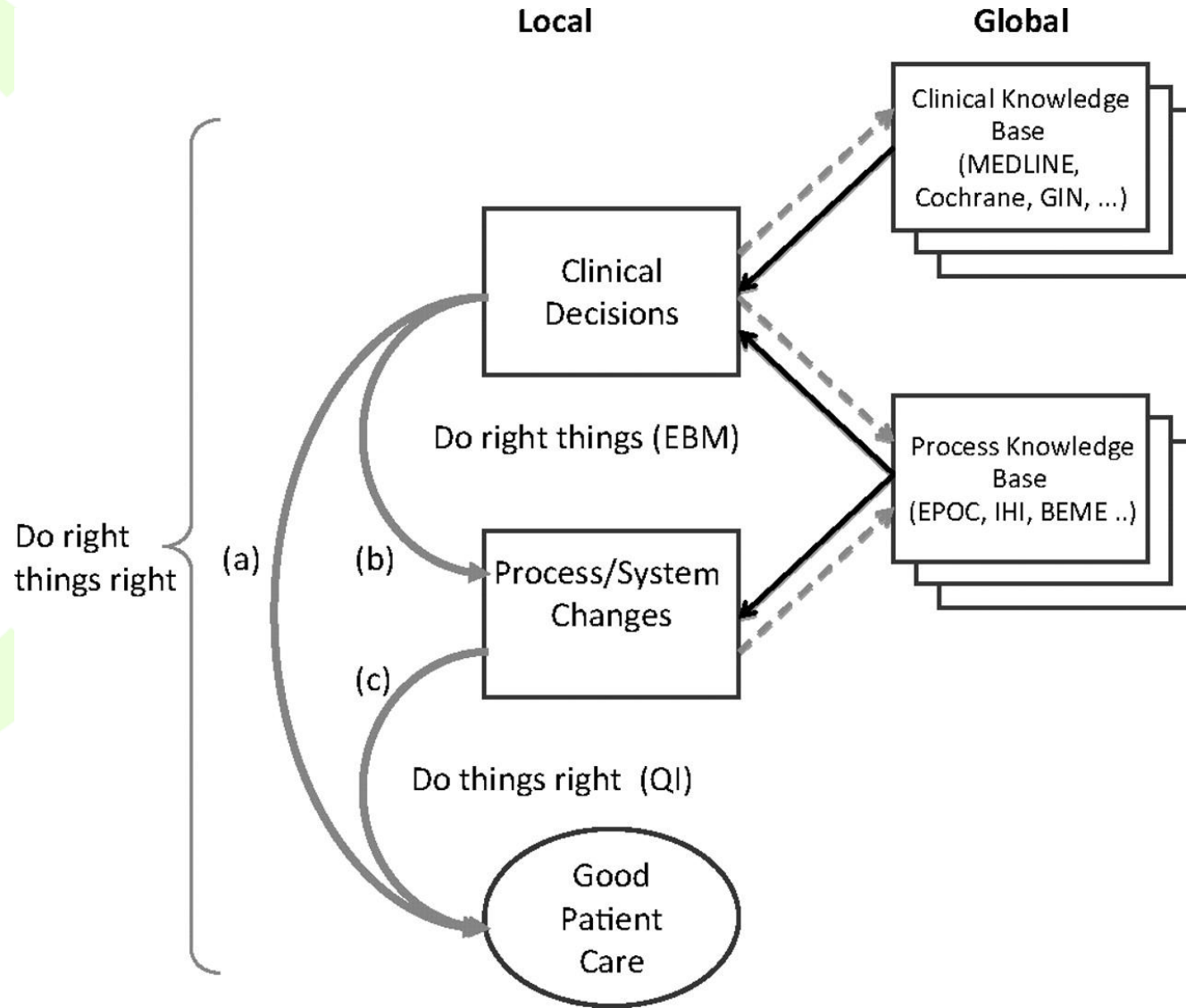
# Will medical coding get replaced by AI?

- AI existing coding systems
  - Learning AI-coding
    - Combine target codes and atomic SCT codes
  - AI-coding support
    - Semi-automatic coding
  - Full automatic target coding
- AI-created 'codes' (clustering)
  - Reimbursement
  - Evidence Based Medicine



# Is medical coding being phased out?

## AI-Based Medicine = Instant & Recursive





# Thanks for your attention

Have you got any questions ?