FROM THE TRANSITION PROJECT TO A LEARNING HEALTHCARE SYSTEM FOR PRIMARY CARE

Jean K Soler

Malta

European General Practice Research Network

European Commission
Information Society and Media


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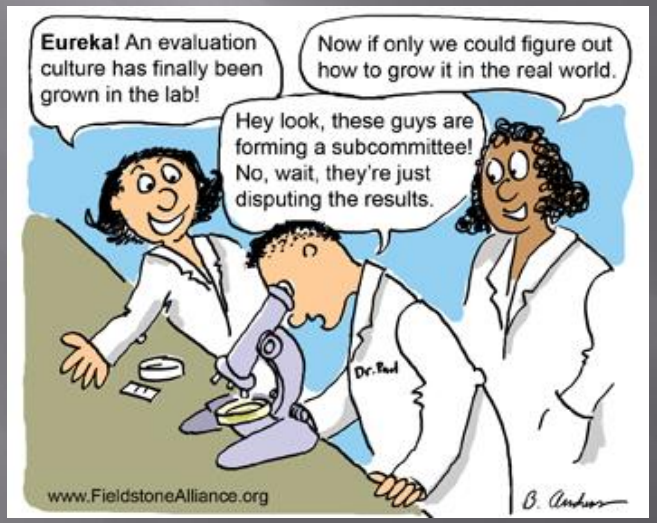
Introduction

- The Transition Project
  - Dutch based data collection project using ICPC-2
  - First to collect reasons for encounter and structure episodes of care
- Learning HealthCare System
  - Using data from clinical practice for research to deliver knowledge to support quality improvement in practice

The Learning Healthcare System

SAFER CLINICAL PRACTICE

KNOWLEDGE TRANSLATION



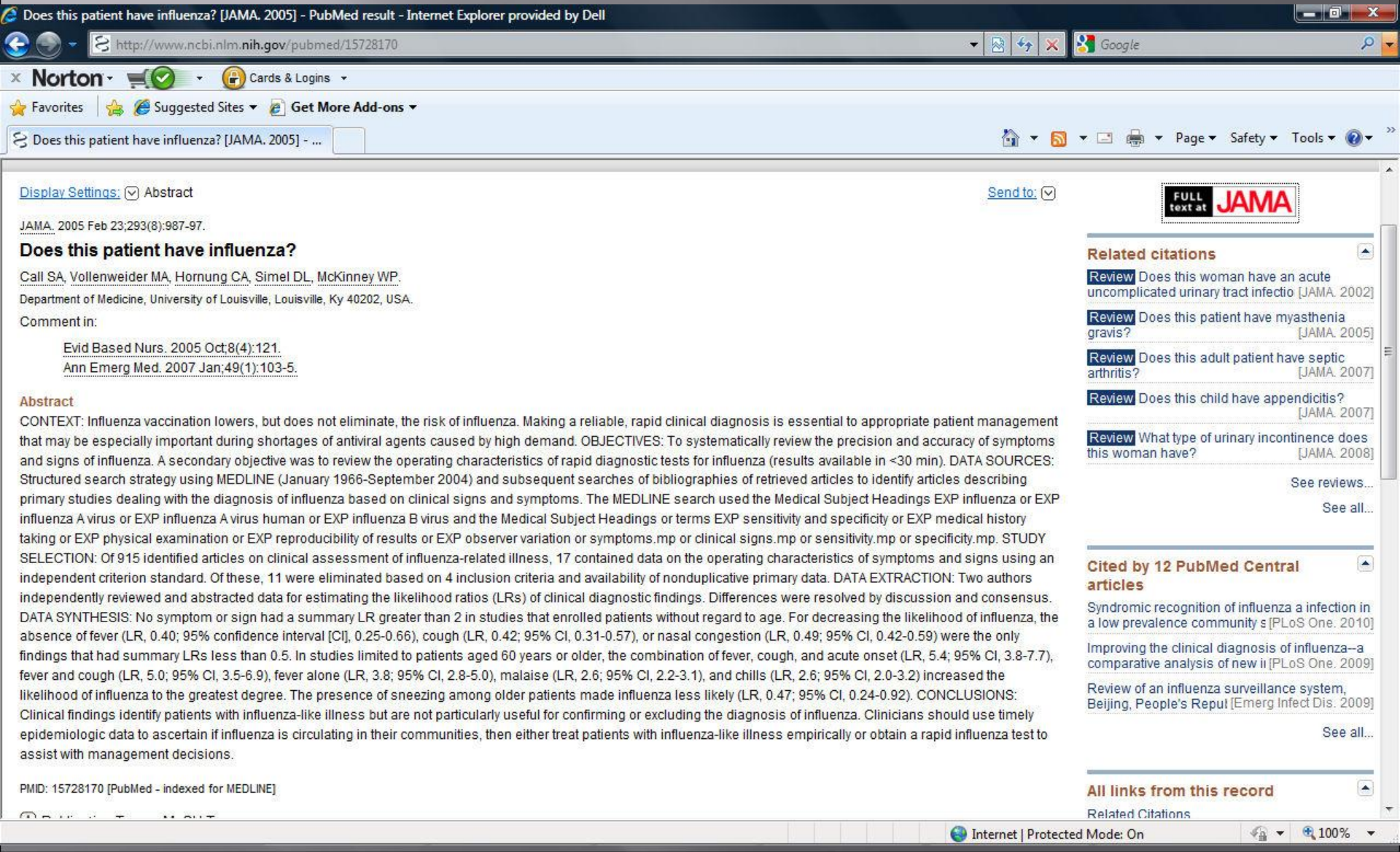
RESEARCH

MORE RESEARCH EVIDENCE

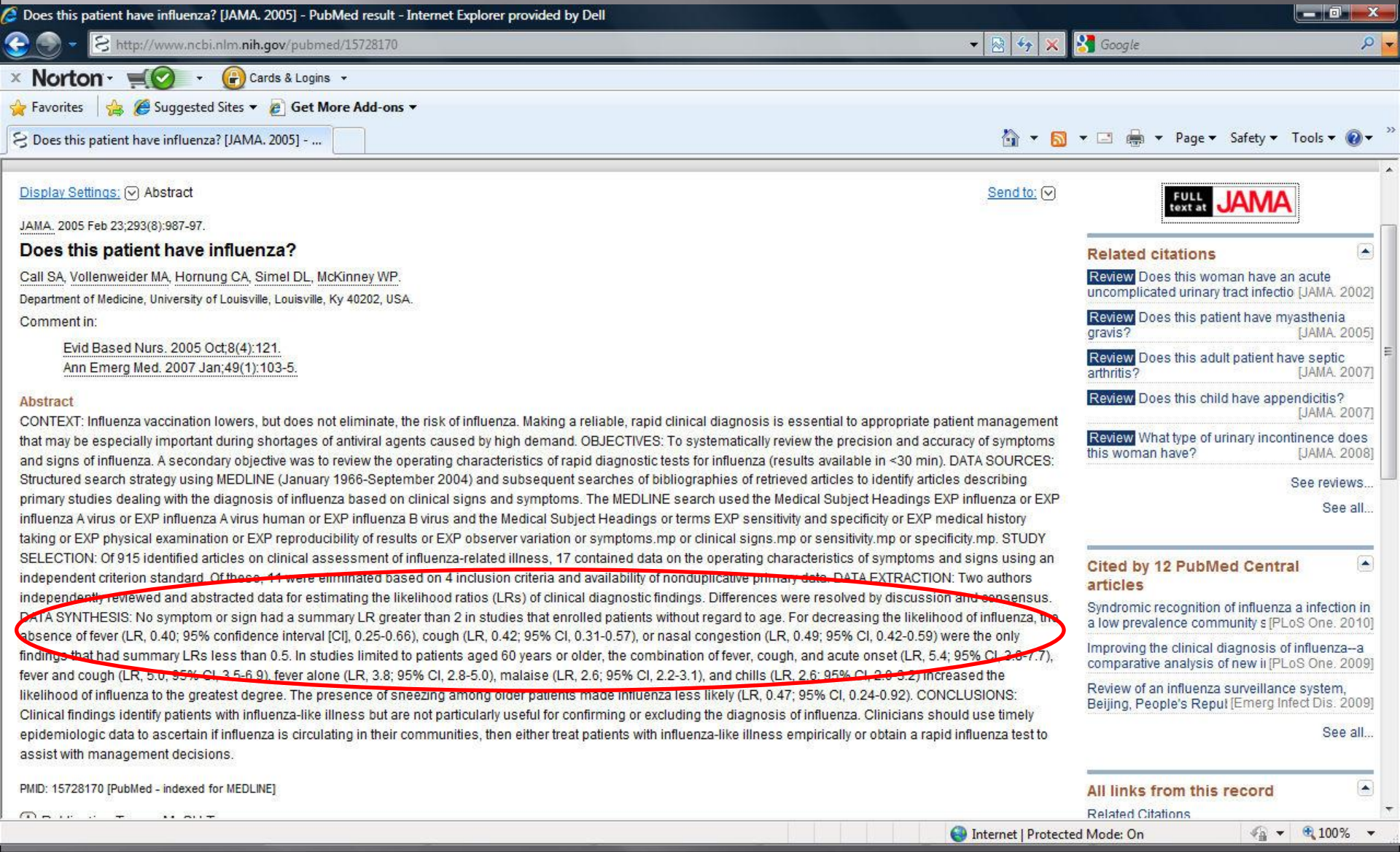
Diagnosis

- **Diagnosis (medical).** The process of attempting to determine and/or identify a possible disease or disorder, and the opinion reached by this process.
- (**Episode title.** The diagnosis of the episode of care gives it its title. The diagnostic label of the last encounter in an episode of care gives the entire episode its title. (ICPC).)

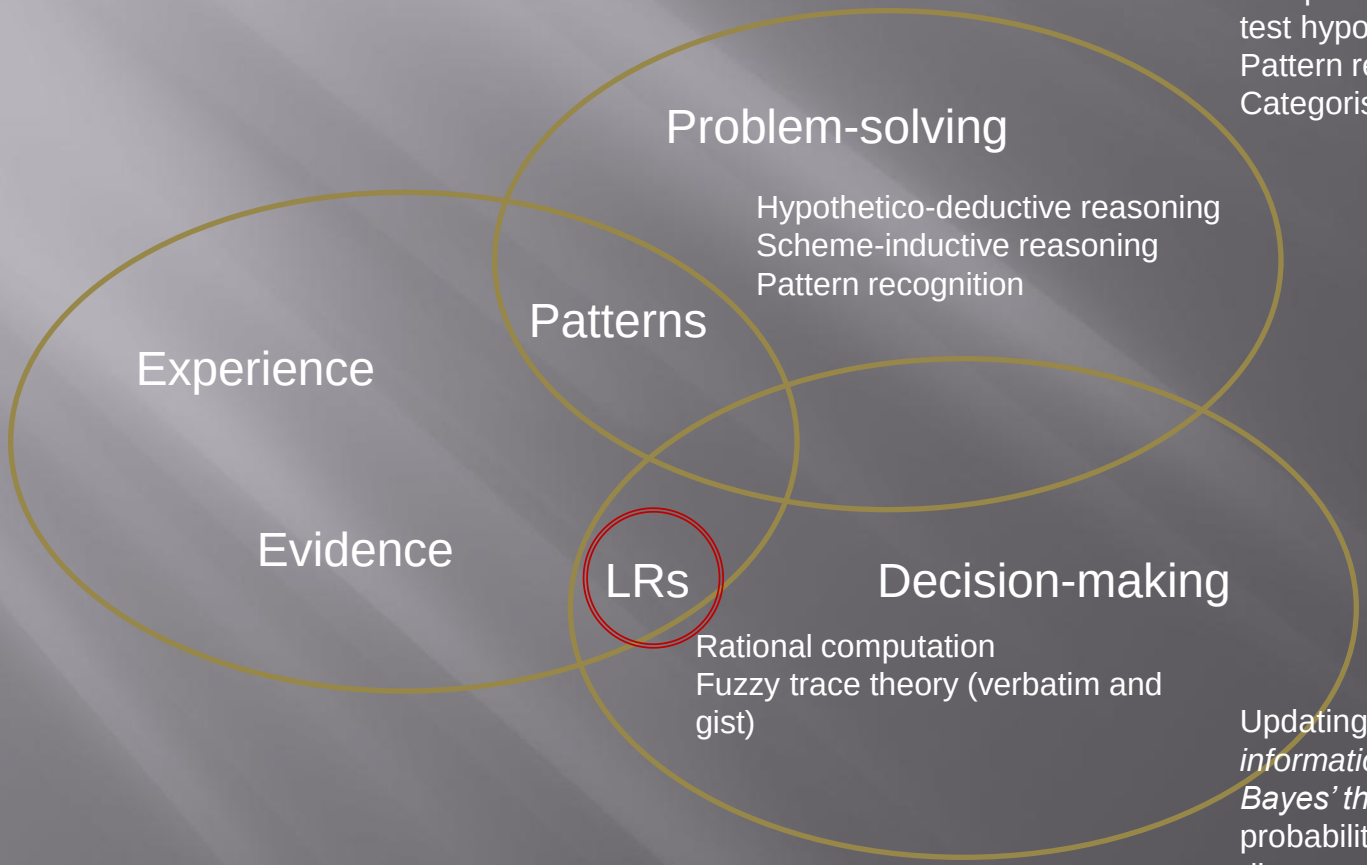
Diagnosis evidence



Diagnosis evidence



The literature on diagnosis



Hypothesis generation
Interpretation of clinical data to test hypotheses
Pattern recognition
Categorisation

Hypothetico-deductive reasoning
Scheme-inductive reasoning
Pattern recognition

Rational computation
Fuzzy trace theory (verbatim and gist)

Updating *opinion* with *imperfect information*
Bayes' theorem to update the probability of disease versus non-disease

Bayes theorem

- The *likelihood ratio (LR)* summarises the operating characteristics of a diagnostic test
- It is the amount by which the test updates the prior probability, and reflects the utility of a diagnostic test (Post Prob = Prior Prob X LR)
- A likelihood ratio of greater than 1 indicates that the test is associated with the presence of the disease, whilst a likelihood ratio of less than 1 indicates that the test result is associated with the absence of the disease

Knottnerus JA, Buntinx F (Ed.). (2009). The evidence base of clinical diagnosis. Theory and methods of diagnostic research. 2nd Edition. Oxford, UK: John Wiley & Sons Ltd.

Guyatt and Rennie. (2002). Users' Guides to the Medical Literature: A Manual for Evidence-Based Clinical Practice. USA: American Medical Association

Transition Project

Crosstab of diagnosis against RfE at the start of a new EoC			
	With bronchitis (R78)	With any other EoC	Total
With cough (R05)	4717 (24.4%)	14578 (75.6%)	19295
With any other RfE	1899 (0.6%)	316154 (99.4%)	318053
Total	6616 (2.0%)	330732 (98.0%)	337348
LR+: 16.2	LR-: 0.3	Odds: 53.9	
C. Int.: 15.8 - 16.5	C. Int: 0.3 - 0.3	C. Int.: 51.0 - 57.0	
Sens: 0.71	PV+: 0.24	Pretest 0.02	
Spec: 0.96	PV-: 0.99	Posttest: 0.32	

Okkes IM, Oskam SK, Lamberts H. The probability of specific diagnoses for patients presenting with common symptoms to Dutch family physicians. J Fam Pract. 2002 Jan; 51(1):31-6.

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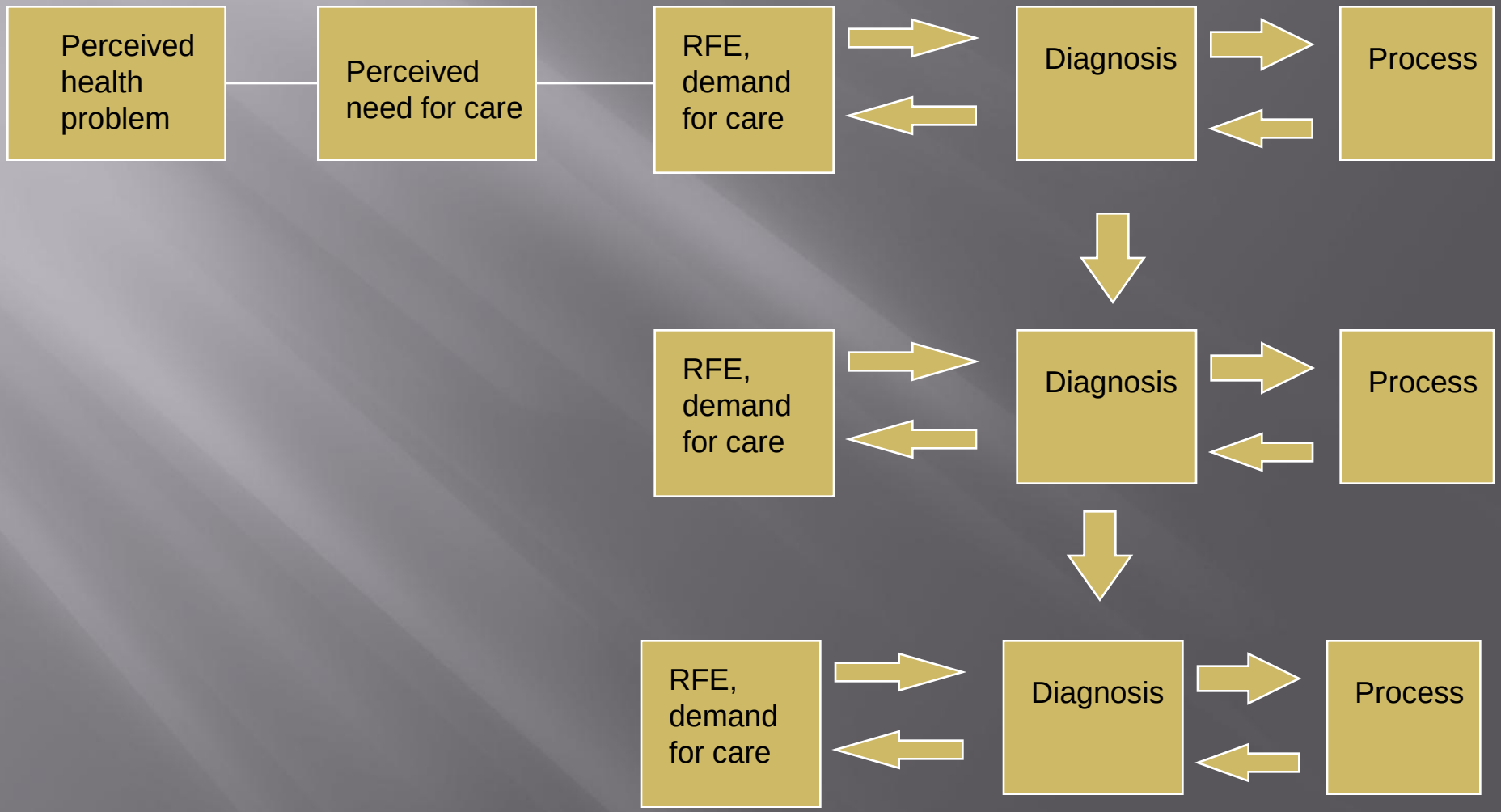
Diagnosis of bronchitis

- With cough present, in Dutch primary care patients…
  - Post-test probability = pre-test probability x 16.2

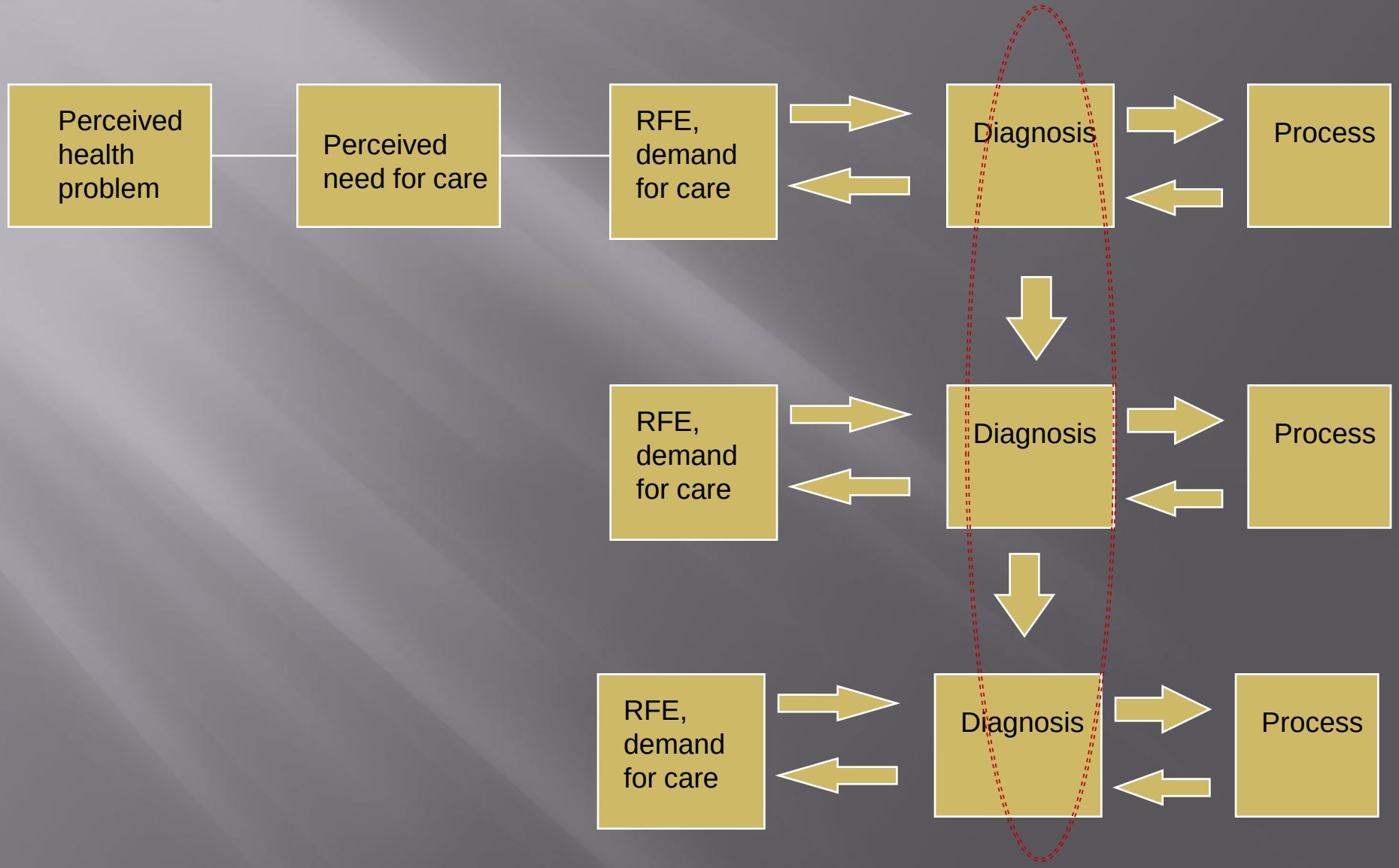
Diagnosis

- **Diagnosis (medical).** The process of attempting to determine and/or identify a possible disease or disorder, and the opinion reached by this process.
- **Episode title.** The diagnosis of the episode of care gives it its title. The diagnostic label of the last encounter in an episode of care gives the entire episode its title. (ICPC).

Episodes of care over time



Episodes of care over time



To study the diagnosis we need both the reason for the encounter and the diagnosis (episode of care title)

TRANSITION PROJECT

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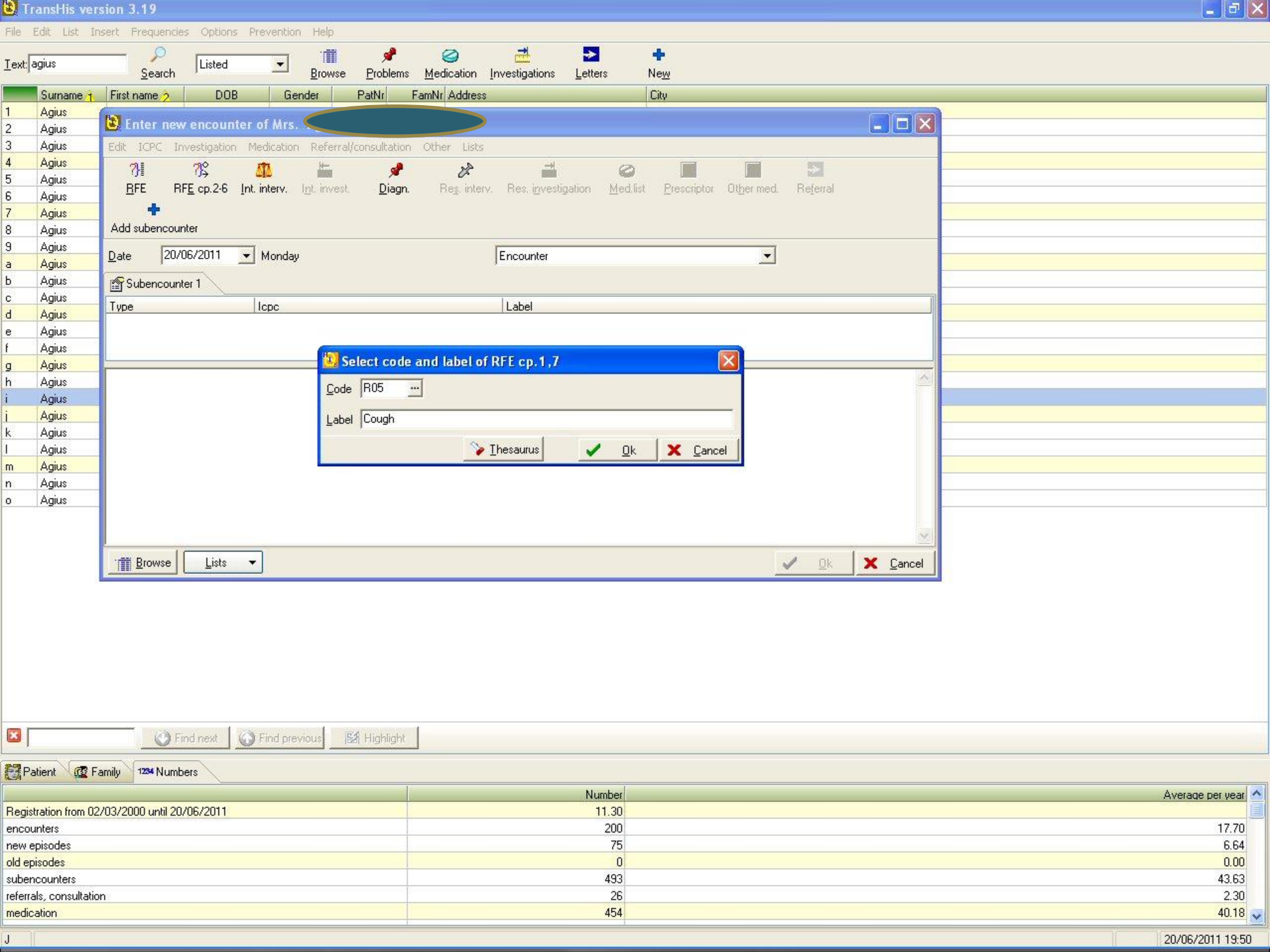
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Referral
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Type
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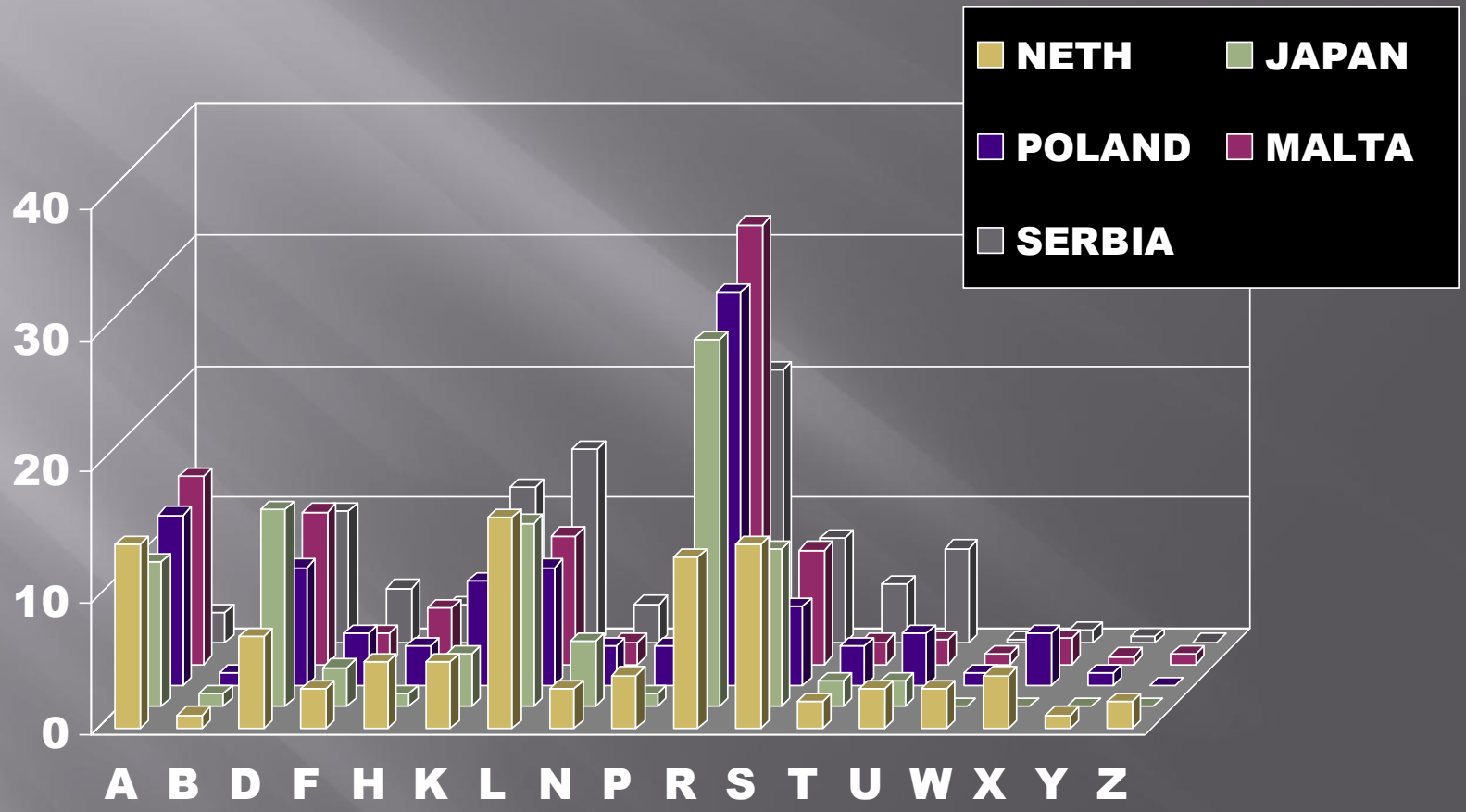
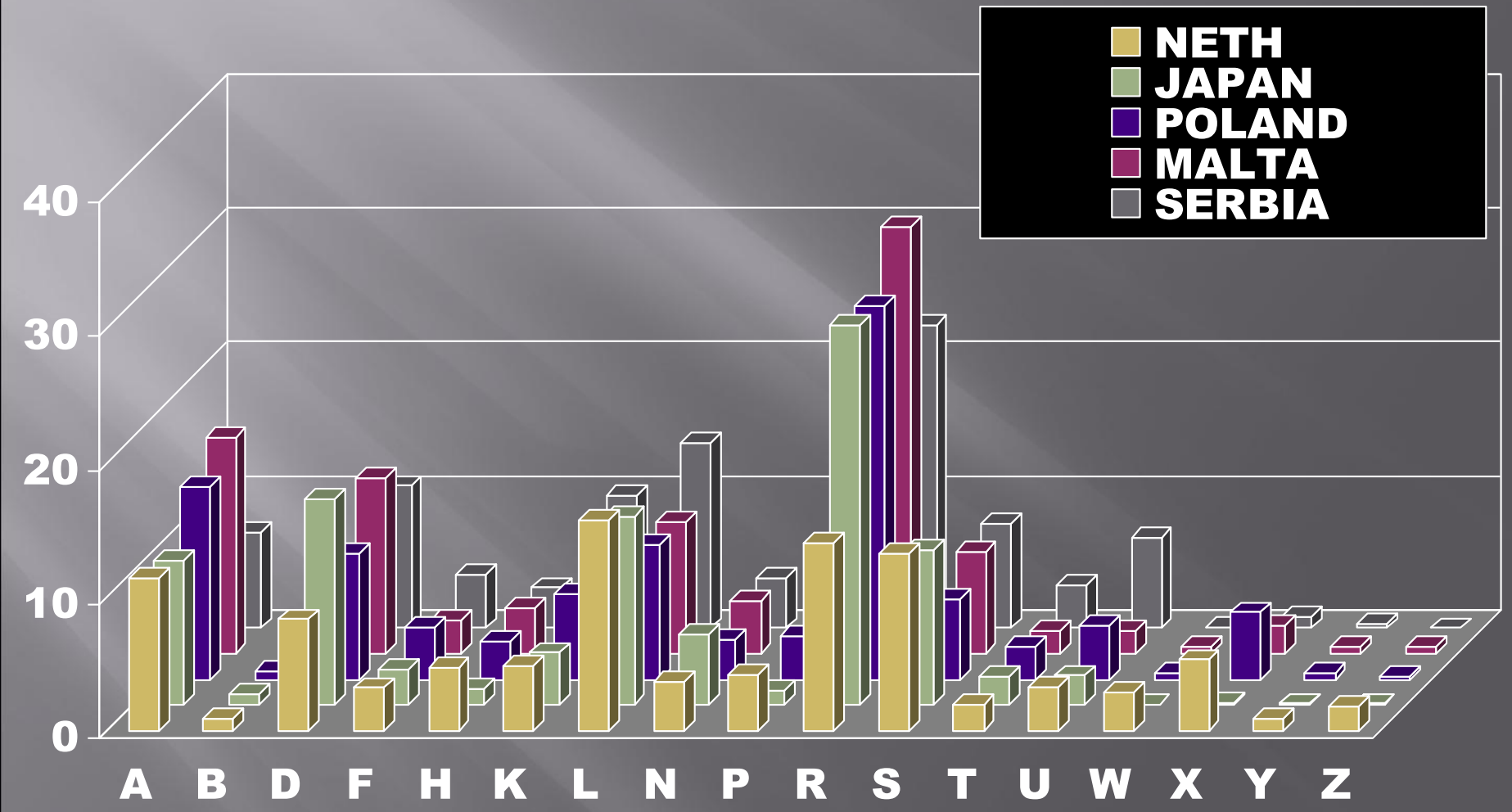
Average per year
Registration from 02/03/2000 until 20/06/2011 11.30
encounters 200 17.70
new episodes 75 6.64
old episodes 0 0.00
subencounters 493 43.63
referrals, consultation 26 2.30
medication 454 40.18
20/06/2011 19:50

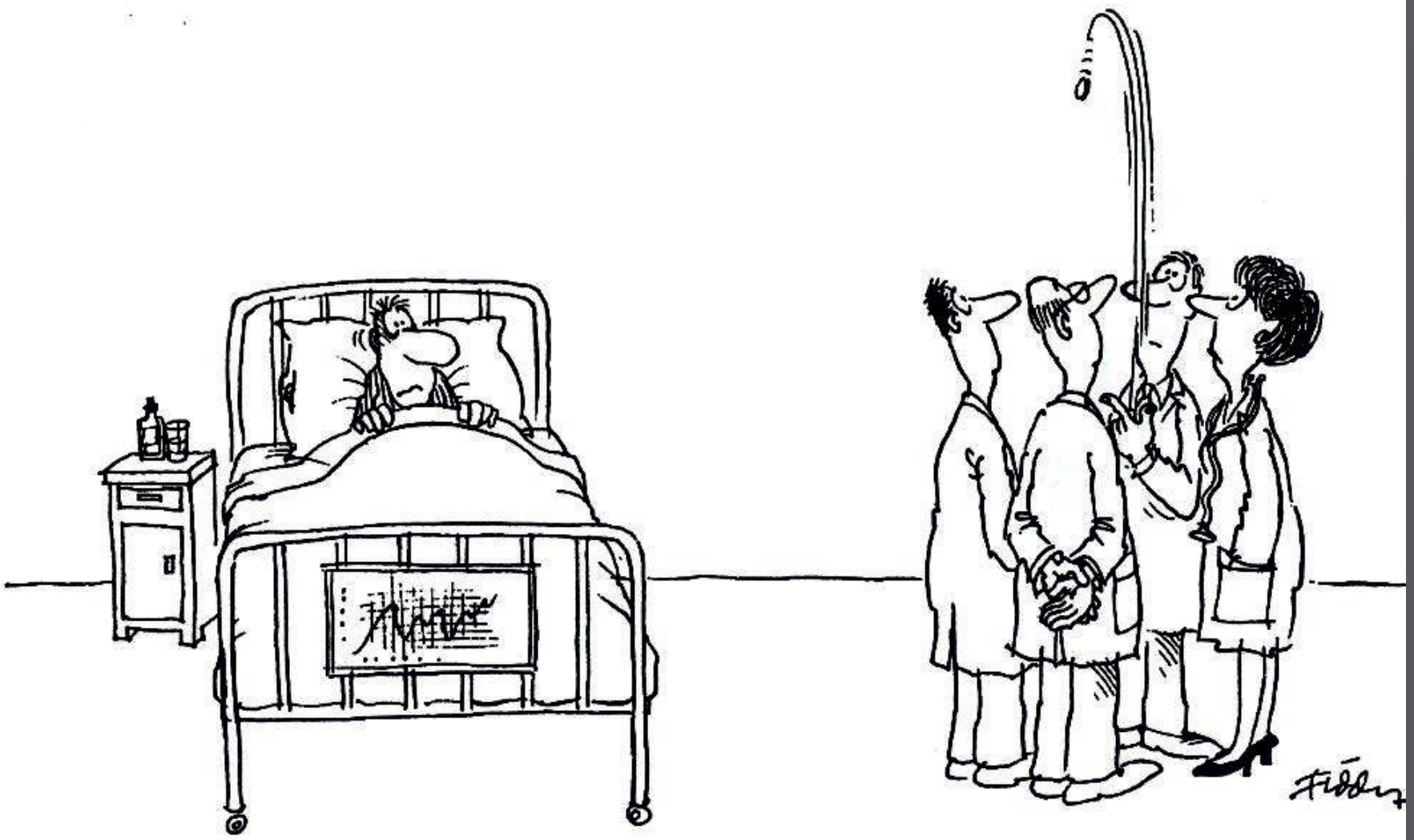

COMPLAINTS!! COMPLAINTS!!
NOTHING BUT COMPLAINTS!!
DOCTOR
Fiddy

NEW EPISODES OF CARE BY ICPC-CHAPTER (%)



REASONS FOR ENCOUNTER AT START OF EPISODE BY ICPC-CHAPTER (%)





Bayes theorem

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RfE and episode titles

A03	Fever	**R74(5.9[5.6-6.4];2.8[2.6-3.0];5.3[4.2-6.6]), R78(7.6[7.1-8.2];3.1[2.8-3.5];5.5[4.3-7.1])**
		A97(0.1[0.1-0.1];-;-), A85(0.1[0.1-0.2];-;-), D73(4.3[3.8-4.9];-;-)
		R76(12.9[11.7-14.2];13.2[11.8-14.7];6.2[4.6-8.5]), R77(2.7[2.3-3.2];-;-)
		R80(33.3[30.0-36.9];6.9[6.1-7.8];-), R29(-;6.8[6.0-7.7];-)

A03 is fever
R74 is upper respiratory tract infection
R78 is acute bronchitis
R76 is tonsillitis

RfE and episode titles

Netherlands = 5.9

A03	Fever	**R74(5.9[5.6-6.4];2.8[2.6-3.0];5.3[4.2-6.6]), R78(7.6[7.1-8.2];3.1[2.8-3.5];5.5[4.3-7.1])**
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A03 is fever
R74 is upper respiratory tract infection
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RfE and episode titles

Malta = 2.8

A03	Fever	**R74(5.9[5.6-6.4];2.8[2.6-3.0];5.3[4.2-6.6]), R78(7.6[7.1-8.2];3.1[2.8-3.5];5.5[4.3-7.1])**
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A03 is fever
R74 is upper respiratory tract infection
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R76 is tonsillitis

RfE and episode titles

Serbia = 5.3

A03	Fever	**R74(5.9[5.6-6.4];2.8[2.6-3.0];5.3[4.2-6.6]), R78(7.6[7.1-8.2];3.1[2.8-3.5];5.5[4.3-7.1])**
		A97(0.1[0.1-0.1];-;-), A85(0.1[0.1-0.2];-;-), D73(4.3[3.8-4.9];-;-)
		R76(12.9[11.7-14.2];13.2[11.8-14.7];6.2[4.6-8.5]), R77(2.7[2.3-3.2];-;-)
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RfE and episode titles

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RfE and episode titles

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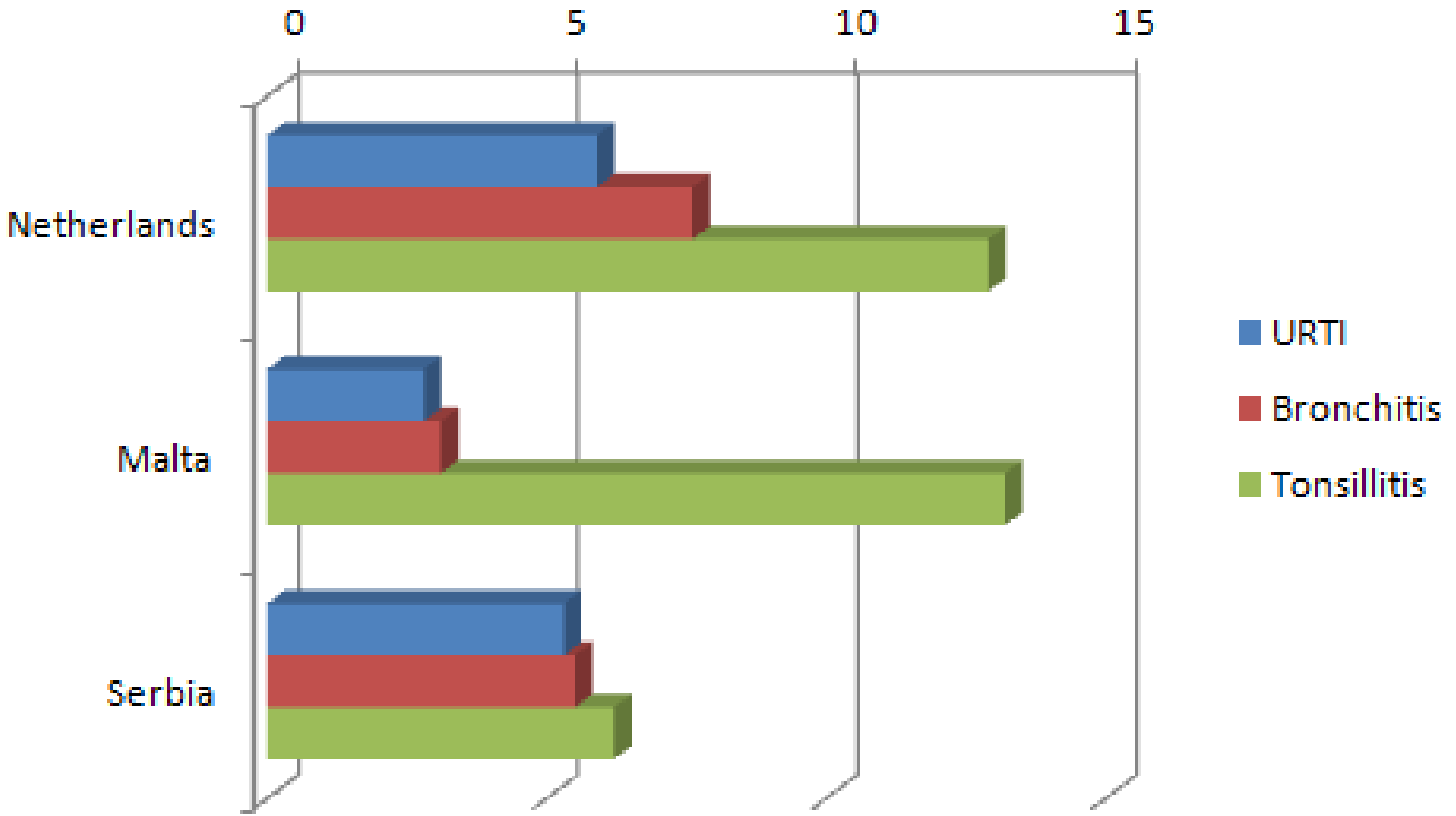
Diagnostic odds ratios for RfE "fever" and common infections



RfE and episode titles

Rank	Code	Label	EoCs with OR <0.3 or >3.0
1	R05	Cough	U71(0[0-0];-;-), **R74(13.7[13.1-14.3];4.3[4.1-4.5];11.6[10.6-12.7]), R05(122.2[114.2-130.8];153.3[112.0-209.7];46.4[29.6-72.7])**
			R78(53.9[51.0-57.0];17.1[15.4-19.0];19.3[17.4-21.5]), A97(0.1[0-0.1];-;-), R96(13.6[12.0-15.3];20.6[16.8-25.3];-). A04(0.1[0.1-0.2];-;-)
			R75(3.1[2.9-3.3];-;3.0[2.2-4.0]), A85(0.2[0.2-0.3];0.2[0.2-0.4];-), D73(-;0[0-0.1];-), **R77(35.4[32.4-38.7];13.4[11.4-15.7];16.6[13.3-20.8)**
			R80(9.1[8.2-10.1];4.8[4.2-5.4];6.1[3.8-9.6]), R79(-;-;3.2[2.4-4.3]), R29(-;12.0[10.5-13.7];-)
2	A03	Fever	**R74(5.9[5.6-6.4];2.8[2.6-3.0];5.3[4.2-6.6]), R78(7.6[7.1-8.2];3.1[2.8-3.5];5.5[4.3-7.1])**, A97(0.1[0.1-0.1];-;-), A85(0.1[0.1-0.2];-;-), D73(4.3[3.8-4.9];-;-)
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3	S06	Local redness/erythema,	**S88(32.3[30.4-34.3];51.1[40.5-64.5];29.0[18.4-45.8])**, A97(0.1[0.1-0.1];-;-), S74(13.2[12.4-14.2];40.4[32.5-50.4];-)
4	R21	Sympt/complt throat	A98(-;0[0-0];-), **R74(12.6[11.8-13.3];11.9[11.3-12.6];15.9[14.2-17.8])**, A97(0.2[0.1-0.2];0.1[0.1-0.1];-), A85(0.2[0.2-0.3];-;-), D73(-;0.1[0.1-0.2];-)
			R76(181.7[164.3-200.9];18.6[16.6-21.0];14.9[12.9-17.3]), R77(9.7[8.7-10.8];-;5.8[4.3-7.9]), R80(3.4[2.8-4.2];-;-), R29(-;6.6[5.8-7.4];-)

A03	Fever	**R74(5.9[5.6-6.4];2.8[2.6-3.0];5.3[4.2-6.6]) R78(7.6[7.1-8.2];3.1[2.8-3.5];5.5[4.3-7.1)**
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		R80(33.3[30.0-36.9];6.9[6.1-7.8];-), R29(-;6.8[6.0-7.7];-)

The Symptom "Cough"

- A strong, reliable predictor for the diagnoses:
  - Cough, acute bronchitis, URTI, acute laryngitis/tracheitis
- Less strong, but reliable predictor of the diagnoses:
  - Sinusitis, pneumonia, influenza, other viral diseases (NOS), whooping cough
- The absence of cough (as a symptom) is a moderately strong and reliable predictor to exclude the diagnoses:
  - cough, acute bronchitis and tracheitis
- Its presence allows strong, reliable exclusion of the diagnoses:
  - gastroenteritis, no disease and health promotion/prevention,
  - **and less strong exclusion of the diagnosis** "adverse effects of medication."
- There is less reliable evidence that cough supports making the diagnosis of "COPD", and supports the exclusion of "fever" and "muscle pain" as a diagnosis

Likelihood of a new episode of type II DM starting with selected RfE or history elements. Comparison of data from Malta and Dutch Transition Projects. Dutch data on RfE alone, excluding history, and use ICPC–1 where diabetes type I and II are included in T90.

Reason for encounter (* significant)	LR+ (95% CI) Malta	LR- (95% CI) Malta	LR+ (95% CI) Dutch	LR- (95% CI) Dutch
U02 (Urinary frequency)	**6.55 (2.99-14.33)***	**0.95 (0.90-1.00)**	**2.99 (1.96-4.57)***	**0.98 (0.97-0.99)***
T90 (Diabetes type II)	**797 (156.56-4057.38)***	**0.95 (0.90-0.99)***	**543.58 (392.09-753.61)***	**0.86 (0.83-0.88)***
T01 (Excessive thirst)	**136.63 (35.87-520.5)***	**0.97 (0.93-1.00)**	**107.26 (86.37-133.19)***	**0.85 (0.83-0.88)***
T08 (Weight loss)	**19.62 (7.29-52.77)***	**0.96 (0.92-1.00)**	**11.00 (7.43-16.28)***	**0.97 (0.95-0.98)***
A91 (Abnormal result inv.)	**49.05 (11.22-214.39)***	**0.98 (0.95-1.01)**	**7.83 (2.49-24.57)***	**1.00 (0.99-1.00)**
A04 (Weakness/ tiredness)	**0.32 (0.04-2.22)**	**1.02 (1.00-1.05)**	**1.00 (0.74-1.37)**	**1.00 (0.98-1.02)**

Diagnosis of DM in FM

- Patient suspects he/she has diabetes
- Excessive thirst
- Abnormal results of investigations
- Weight loss
- Urinary frequency
- *Not* tiredness!

- Soler JK, Okkes IM. 2005. Diagnosis of diabetes mellitus in Malta. The contribution of patients' reasons for encounter and doctors' interventions to the final diagnosis of diabetes. Poster presentation. EGPRN meeting, Tartu, Estonia. www.egprn.org

Antecedents - RfEs

D04
D05
D07
D08
D09
D10

>>
<<

D06

Antecedents - Anams

A01
A02
A03
A04
A05
A06

>>
<<

Sex

Age group

0-4
5-9
10-14
15-19
20-24

Consecutive

U26
U27
U28
U29
U70
U71

Support	Confidence	Lift	Specifity	Sensitivity	LR+	LR-	Odds	Score	Provenance	Scenario
									Netherlans	a_130613

Hide filters | Filter | Clear

Expand table

Number of rules: 43

ANTECENDENTS	=>	CONSECUTIVE	AVG SCORE	SUPPOF	CONFIDENCE (%)	LIFT	SPECIFITY	SENSITIVITY	LR+	LR-	ODDS	PROVENANCE	SCENARIO	ADD REMARK
D06, U01	=>	U71	0.0	72	58,50	25,50	1,00	0,01	60,10	0,99	60,10	Netherlans	a_130613	add rema
D06, U01, F	=>	U71	0.0	65	62,50	27,23	1,00	0,01	70,95	0,99	70,95	Netherlans	a_130613	add rema
D06, U02	=>	U71	0.0	41	37,60	16,39	1,00	0,01	25,67	0,99	25,67	Netherlans	a_130613	add rema

RFE

ICPC2	DESC
U01	Dysuria/painful urination
D06	Abdominal pain localized, other

EPISODE DIAGNOSE

ICPC2

U71

DESCRIPTION

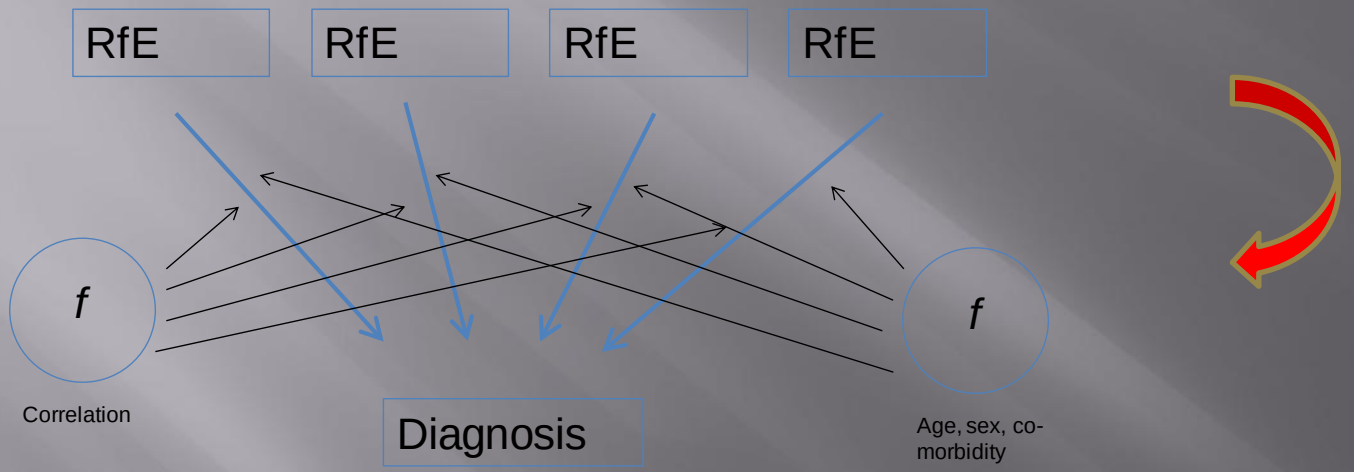
Cystitis/urinary infection, other

URTI in Nl: OR 5.9; 95%CI 5.6 to 6.4

A03	Fever	**R74(5.9[5.6-6.4];2.8[2.6-3.0];5.3[4.2-6.6]), R78(7.6[7.1-8.2];3.1[2.8-3.5];5.5[4.3-7.1])**
		A97(0.1[0.1-0.1];-;-), A85(0.1[0.1-0.2];-;-), D73(4.3[3.8-4.9];-;-)
		R76(12.9[11.7-14.2];13.2[11.8-14.7];6.2[4.6-8.5]), R77(2.7[2.3-3.2];-;-)
		R80(33.3[30.0-36.9];6.9[6.1-7.8];-), R29(-;6.8[6.0-7.7];-)

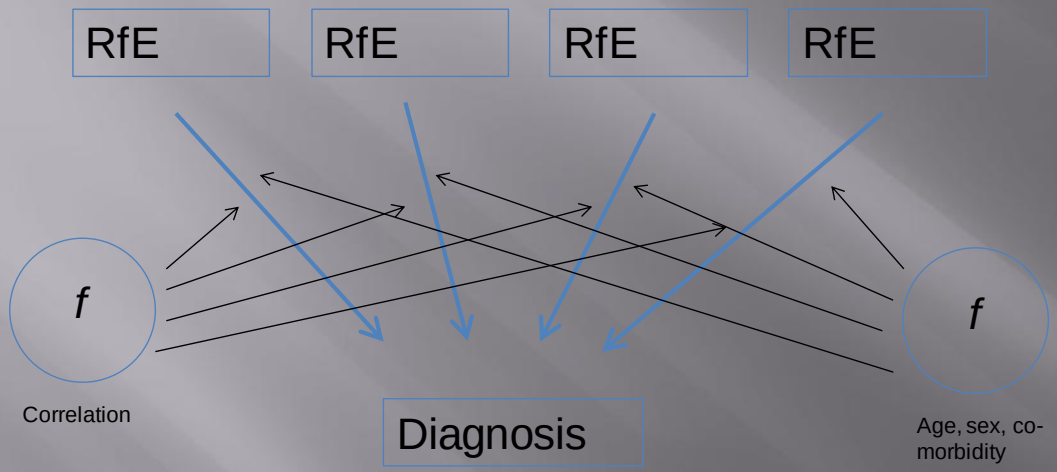
URTI in Nl: OR 5.9; 95%CI 5.6 to 6.4

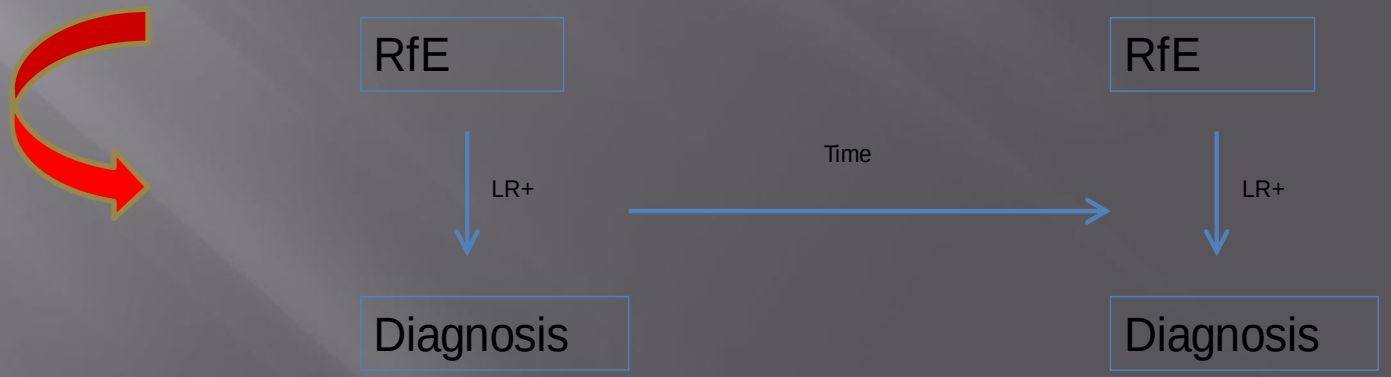
A03	Fever	**R74(5.9[5.6-6.4];2.8[2.6-3.0];5.3[4.2-6.6]), R78(7.6[7.1-8.2];3.1[2.8-3.5];5.5[4.3-7.1])**
		A97(0.1[0.1-0.1];-;-), A85(0.1[0.1-0.2];-;-), D73(4.3[3.8-4.9];-;-)
		R76(12.9[11.7-14.2];13.2[11.8-14.7];6.2[4.6-8.5]), R77(2.7[2.3-3.2];-;-)
		R80(33.3[30.0-36.9];6.9[6.1-7.8];-), R29(-;6.8[6.0-7.7];-)



URTI in Nl: OR 5.9; 95%CI 5.6 to 6.4

A03	Fever	**R74(5.9[5.6-6.4];2.8[2.6-3.0];5.3[4.2-6.6]), R78(7.6[7.1-8.2];3.1[2.8-3.5];5.5[4.3-7.1])**
		A97(0.1[0.1-0.1];-;-), A85(0.1[0.1-0.2];-;-), D73(4.3[3.8-4.9];-;-)
		R76(12.9[11.7-14.2];13.2[11.8-14.7];6.2[4.6-8.5]), R77(2.7[2.3-3.2];-;-)
		R80(33.3[30.0-36.9];6.9[6.1-7.8];-), R29(-;6.8[6.0-7.7];-)



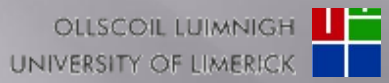


Future Research

- Multiple predictors for a diagnosis
- Computerised decision support system for primary care doctors
- Educational materials for interpretation of the meaning of symptoms
- Understanding transitions – from an early presentation of a health problem to a more defined diagnosis
- Large-scale datasets to understand the breadth, depth and impact of primary care

Thank you

- This study would not have been possible without the participation of the Transition Project doctors.
- From the Netherlands: C. van Boven MD, PhD, Franeker; P.H. Dijksterhuis MD, PhD, Wirdum and Olst; A. Groen, MD, Amstelveen; J. de Haan, MD, Franeker; A.M.Honselaar-De Groot MD, Amstelveen; D. Janssen MD, Franeker; T.A.L. Polman MD, Franeker; G.O. Polderman MD, Amstelveen; K.E.I. Stolp MD, Amstelveen; N. Valken MD, Wirdum; M.T.M. Veltman MD, PhD (deceased), Amstelveen; M. Woerdeman MD, Amstelveen.
- From Malta: Francis Paul Calleja MD, Birkirkara; Carmen Sammut MD, Siggiewi; Mario R Sammut MD MSc, Siggiewi; Daniel Sammut MD, Zabbar; David Sammut MD, Zabbar; Jason Bonnici MD, Zabbar; John Buhagiar MD, Zabbar; Andrew Baldacchino MD, Zabbar.
- From Serbia: the FDs in the region of Kraljevo, part of the ICRC project.



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