

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

Jean K Soler
Malta



European General Practice Research Network

@Health



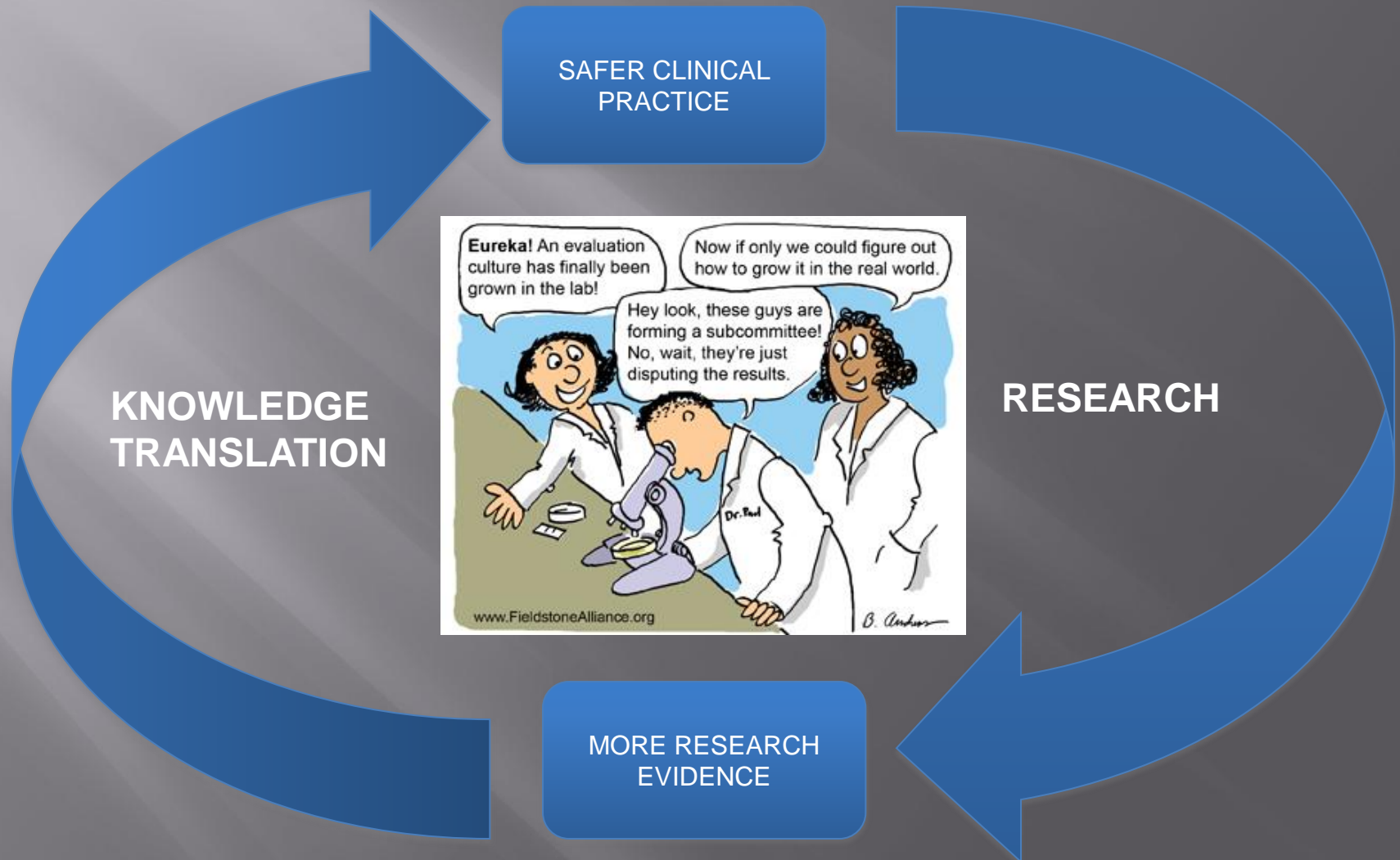




Introduction

- ▣ 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



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

Does this patient have influenza? [JAMA. 2005] - PubMed result - Internet Explorer provided by Dell

http://www.ncbi.nlm.nih.gov/pubmed/15728170

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Does this patient have influenza? [JAMA. 2005] - ...

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JAMA. 2005 Feb 23;293(8):987-97.

Does this patient have influenza?

Call SA, Vollenweider MA, Hornung CA, Simel DL, McKinney WP.
Department of Medicine, University of Louisville, Louisville, Ky 40202, USA.

Comment in:

Evid Based Nurs. 2005 Oct;8(4):121.
Ann Emerg Med. 2007 Jan;49(1):103-5.

Abstract

CONTEXT: Influenza vaccination lowers, but does not eliminate, the risk of influenza. Making a reliable, rapid clinical diagnosis is essential to appropriate patient management that may be especially important during shortages of antiviral agents caused by high demand. OBJECTIVES: To systematically review the precision and accuracy of symptoms and signs of influenza. A secondary objective was to review the operating characteristics of rapid diagnostic tests for influenza (results available in <30 min). DATA SOURCES: Structured search strategy using MEDLINE (January 1966-September 2004) and subsequent searches of bibliographies of retrieved articles to identify articles describing primary studies dealing with the diagnosis of influenza based on clinical signs and symptoms. The MEDLINE search used the Medical Subject Headings EXP influenza or EXP influenza A virus or EXP influenza A virus human or EXP influenza B virus and the Medical Subject Headings or terms EXP sensitivity and specificity or EXP medical history taking or EXP physical examination or EXP reproducibility of results or EXP observer variation or symptoms.mp or clinical signs.mp or sensitivity.mp or specificity.mp. STUDY SELECTION: Of 915 identified articles on clinical assessment of influenza-related illness, 17 contained data on the operating characteristics of symptoms and signs using an independent criterion standard. Of these, 11 were eliminated based on 4 inclusion criteria and availability of nonduplicative primary data. DATA EXTRACTION: Two authors independently reviewed and abstracted data for estimating the likelihood ratios (LRs) of clinical diagnostic findings. Differences were resolved by discussion and consensus. DATA SYNTHESIS: No symptom or sign had a summary LR greater than 2 in studies that enrolled patients without regard to age. For decreasing the likelihood of influenza, the absence of fever (LR, 0.40; 95% confidence interval [CI], 0.25-0.66), cough (LR, 0.42; 95% CI, 0.31-0.57), or nasal congestion (LR, 0.49; 95% CI, 0.42-0.59) were the only findings that had summary LRs less than 0.5. In studies limited to patients aged 60 years or older, the combination of fever, cough, and acute onset (LR, 5.4; 95% CI, 3.8-7.7), fever and cough (LR, 5.0; 95% CI, 3.5-6.9), fever alone (LR, 3.8; 95% CI, 2.8-5.0), malaise (LR, 2.6; 95% CI, 2.2-3.1), and chills (LR, 2.6; 95% CI, 2.0-3.2) increased the likelihood of influenza to the greatest degree. The presence of sneezing among older patients made influenza less likely (LR, 0.47; 95% CI, 0.24-0.92). CONCLUSIONS: Clinical findings identify patients with influenza-like illness but are not particularly useful for confirming or excluding the diagnosis of influenza. Clinicians should use timely epidemiologic data to ascertain if influenza is circulating in their communities, then either treat patients with influenza-like illness empirically or obtain a rapid influenza test to assist with management decisions.

PMID: 15728170 [PubMed - indexed for MEDLINE]

Related citations

- Review** Does this woman have an acute uncomplicated urinary tract infection? [JAMA. 2002]
- Review** Does this patient have myasthenia gravis? [JAMA. 2005]
- Review** Does this adult patient have septic arthritis? [JAMA. 2007]
- Review** Does this child have appendicitis? [JAMA. 2007]
- Review** What type of urinary incontinence does this woman have? [JAMA. 2008]

See reviews...

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Cited by 12 PubMed Central articles

- Syndromic recognition of influenza infection in a low prevalence community [PLoS One. 2010]
- Improving the clinical diagnosis of influenza—a comparative analysis of new [PLoS One. 2009]
- Review of an influenza surveillance system, Beijing, People's Republic of China [Emerg Infect Dis. 2009]

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All links from this record

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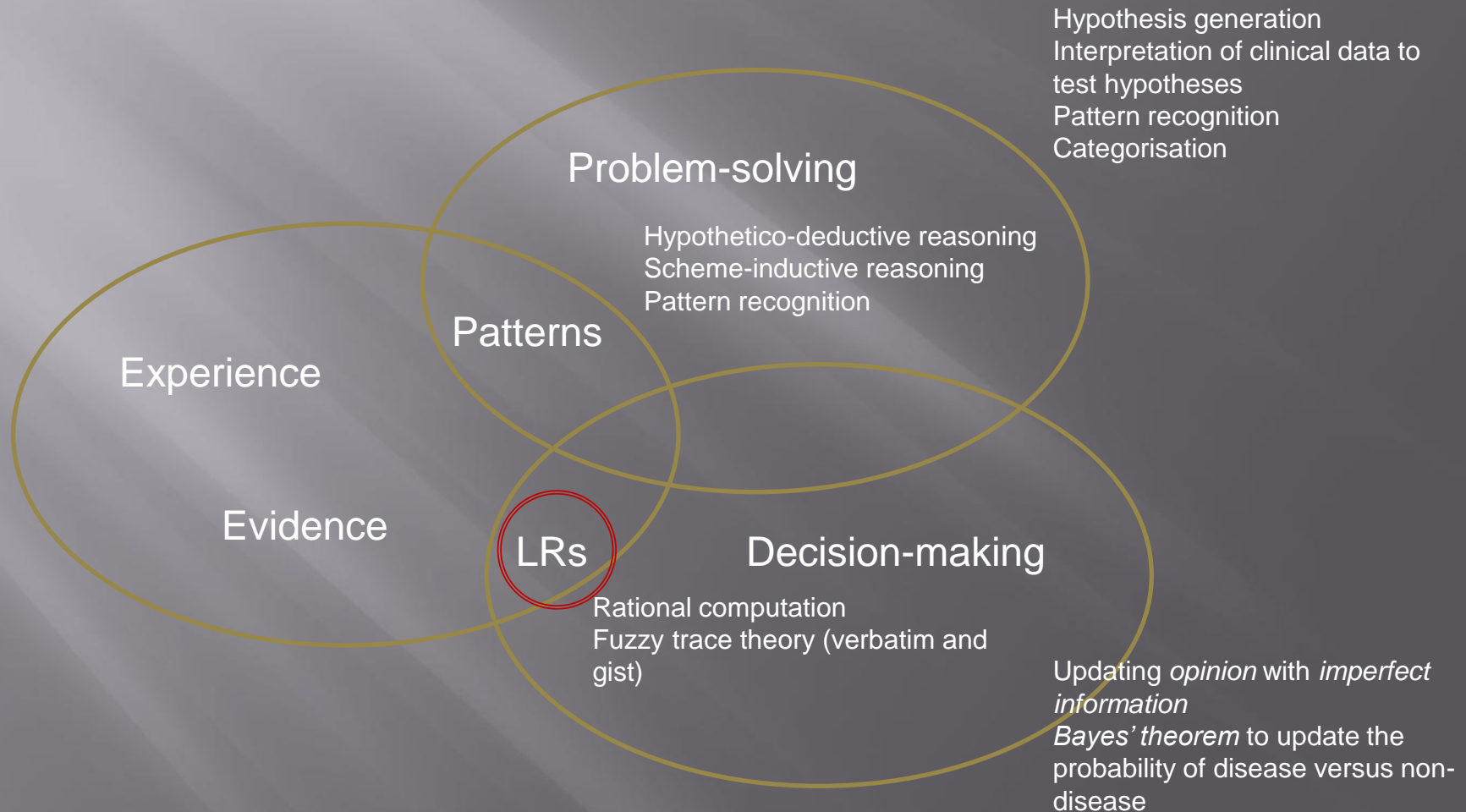
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Related Citations

The literature on diagnosis



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

<i>Crosstab of diagnosis against RfE at the start of a new EoC</i>			
	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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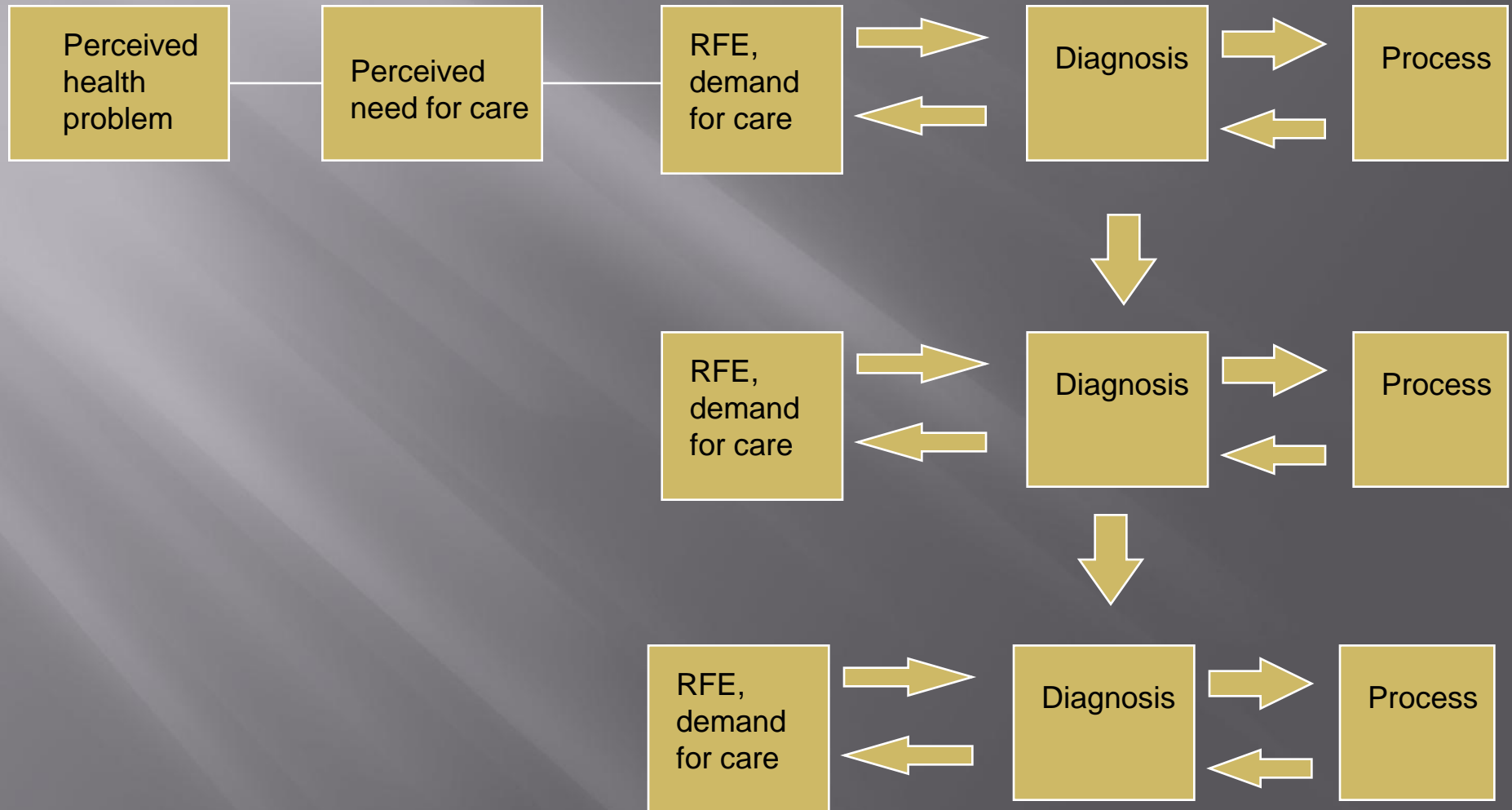
Diagnosis of bronchitis

- ▣ With cough present, in Dutch primary care patients...
 - $\text{Post-test probability} = \text{pre-test probability} \times 16.2$

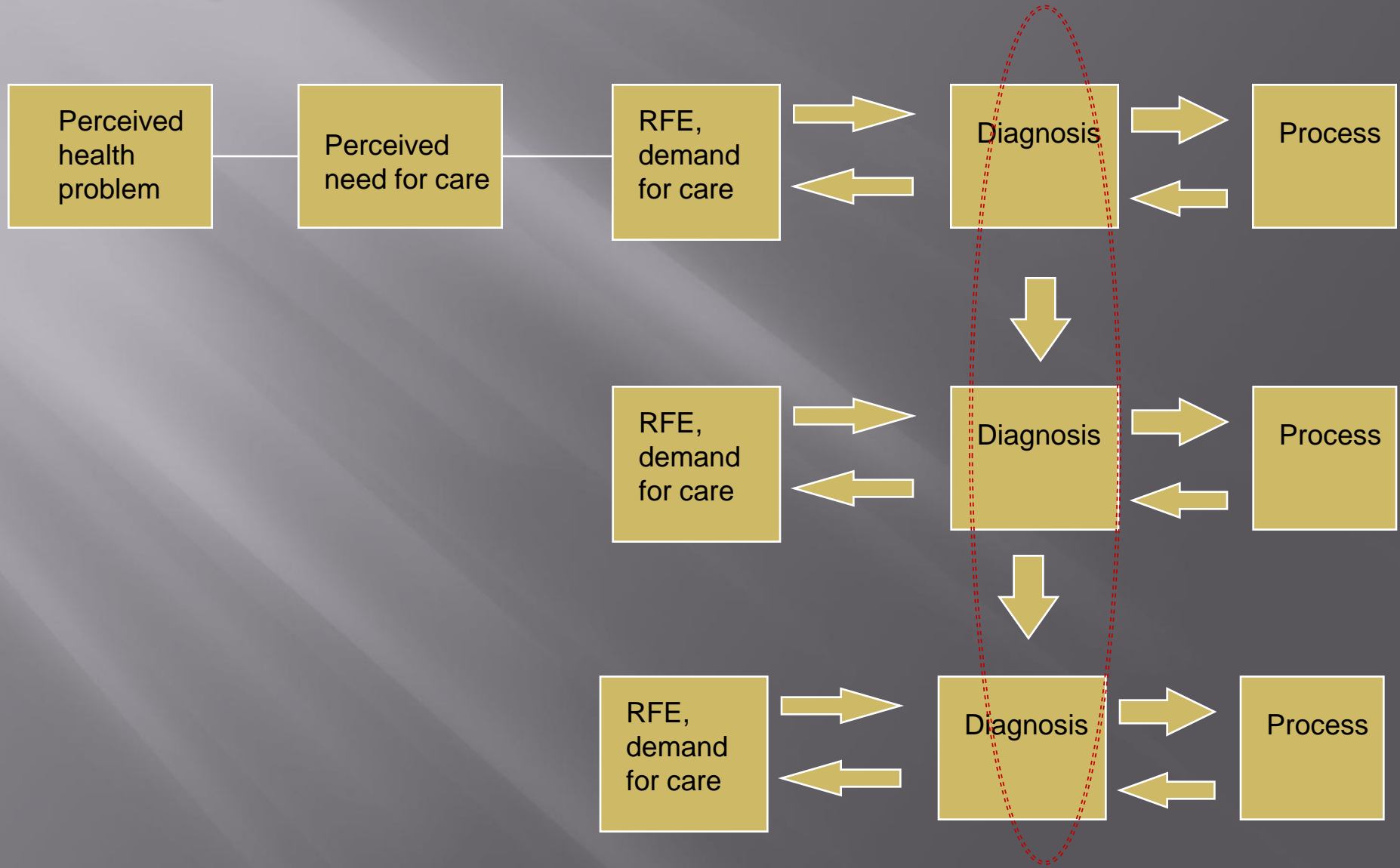
Diagnosis

- ▣ **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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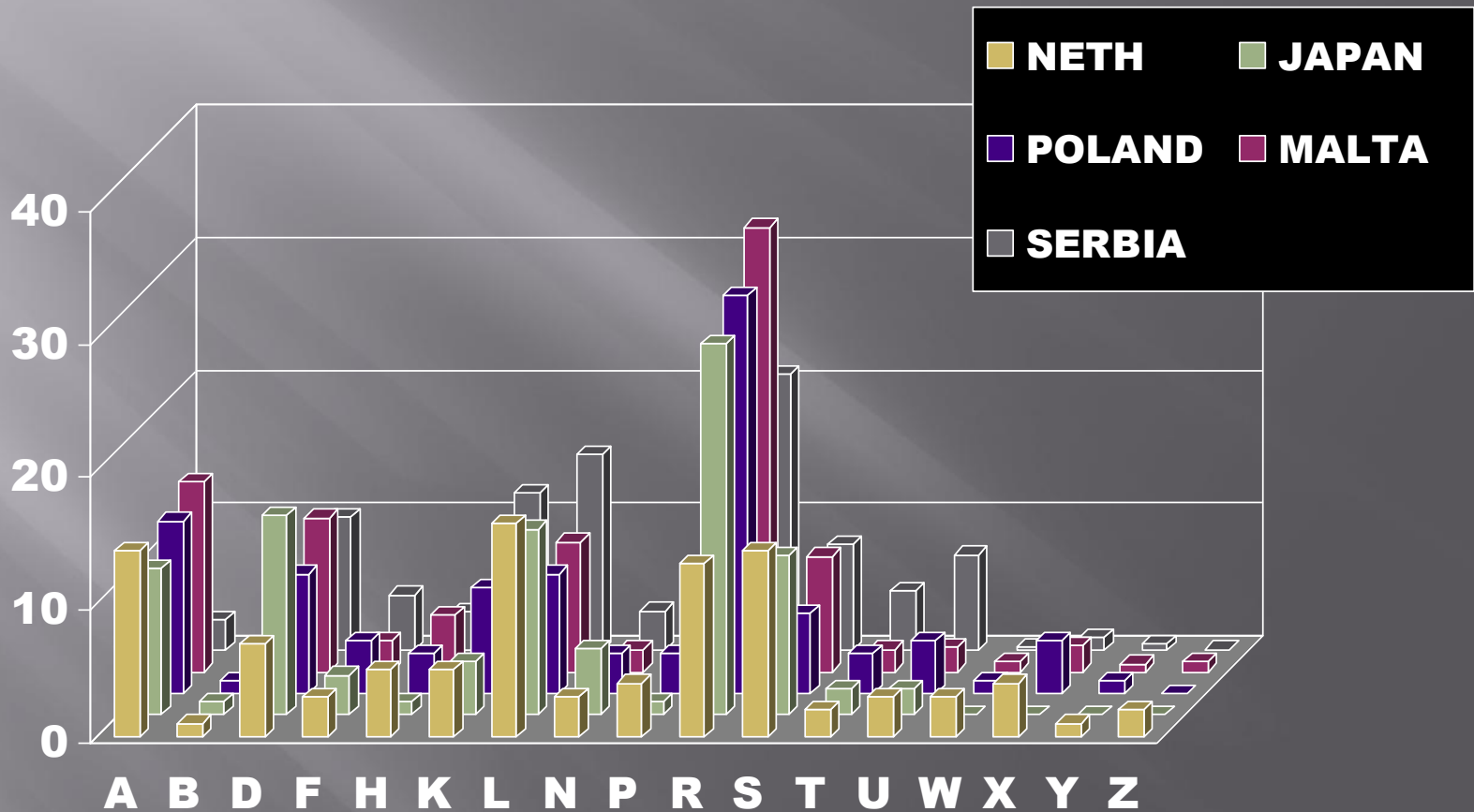
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The screenshot shows a software interface for entering a new encounter for a patient named Mrs. Agius. The main window is titled "Enter new encounter of Mrs. Agius" and contains a menu bar with options like Edit, ICPC, Investigation, Medication, Referral/consultation, Other, and Lists. Below the menu bar is a toolbar with various icons representing different medical actions. The main area of the window is divided into sections: "Add subcounter" with a date field set to "20/06/2011" and a day field set to "Monday", and "Subcounter 1" which contains a table with columns "Type" and "Label". The table has one row with "Icpc" in the "Type" column. A smaller dialog box titled "Select code and label of RFE cp.1,7" is open in the foreground, showing a "Code" field with "R05" and a "Label" field with "Cough". It also has buttons for "Thesaurus", "Ok", and "Cancel".

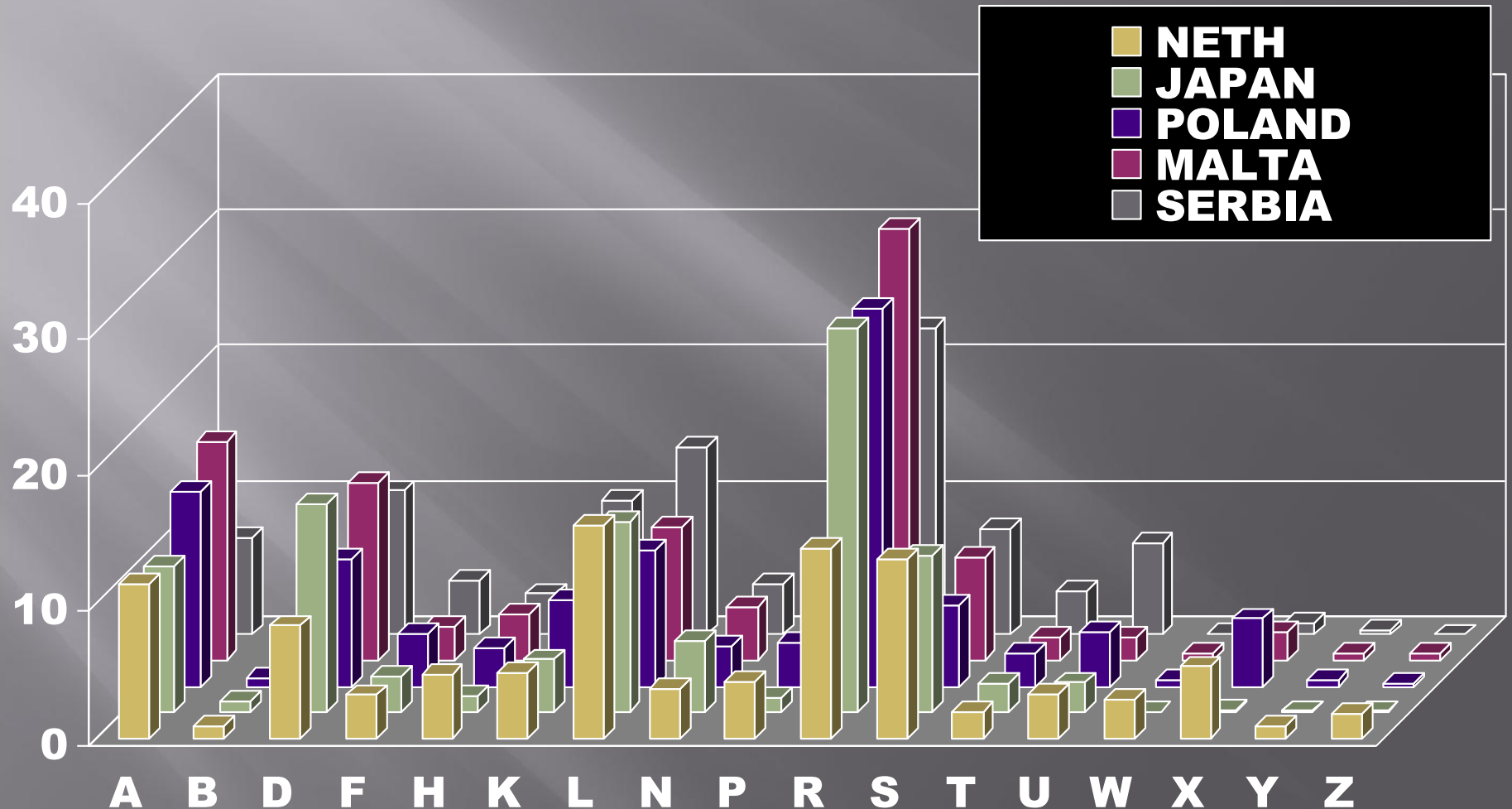
	Number	Average per year
Registration from 02/03/2000 until 20/06/2011	11.30	
encounters	200	17.70
new episodes	75	6.64
old episodes	0	0.00
subencounters	493	43.63
referrals, consultation	26	2.30
medication	454	40.18

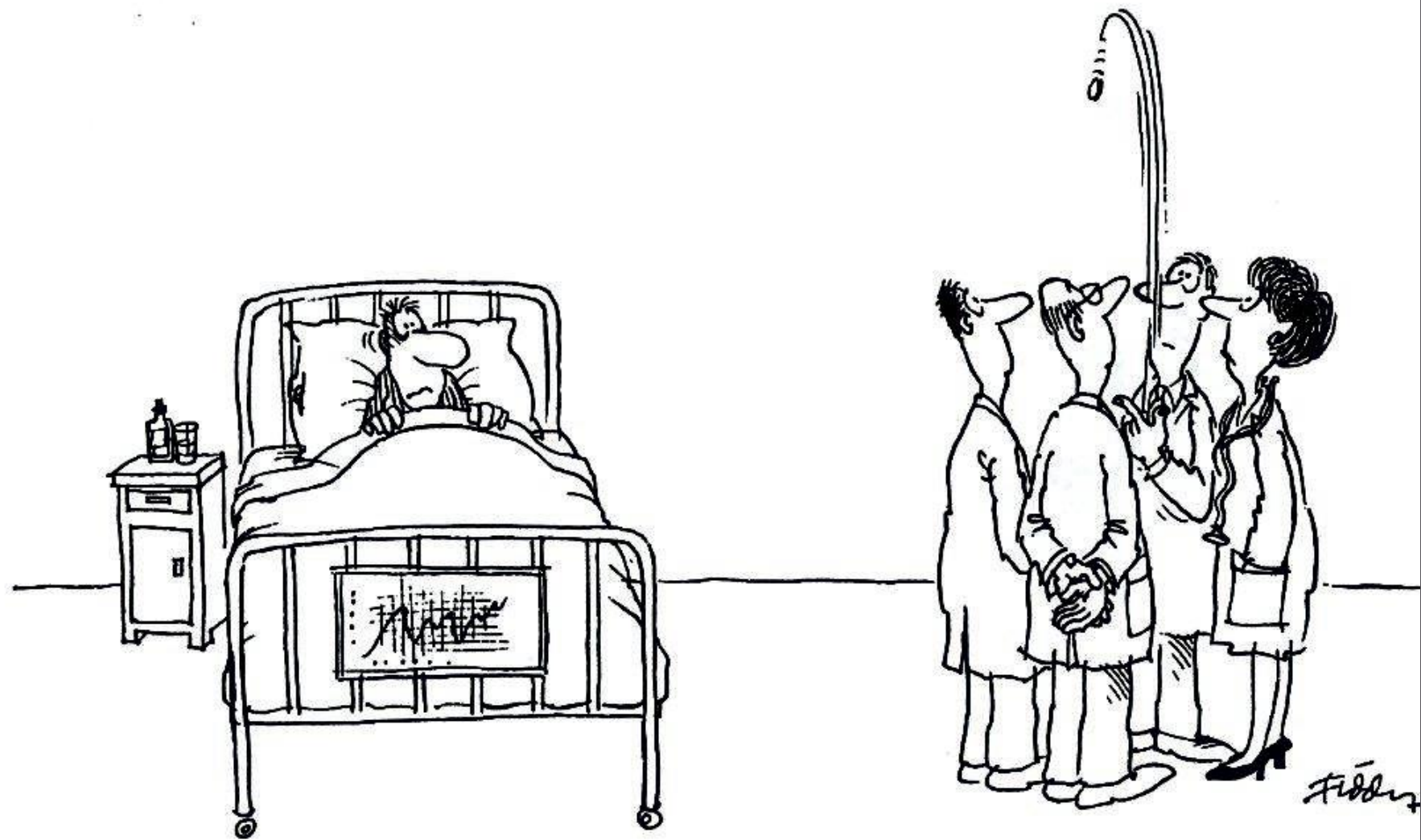


NEW EPISODES OF CARE BY ICPC-CHAPTER (%)



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





Bayes theorem

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- ▣ 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)
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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])
		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

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])
		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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A03 is fever

R74 is upper respiratory tract infection

R78 is acute bronchitis

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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		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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RfE and episode titles

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RfE and episode titles

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		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];-)

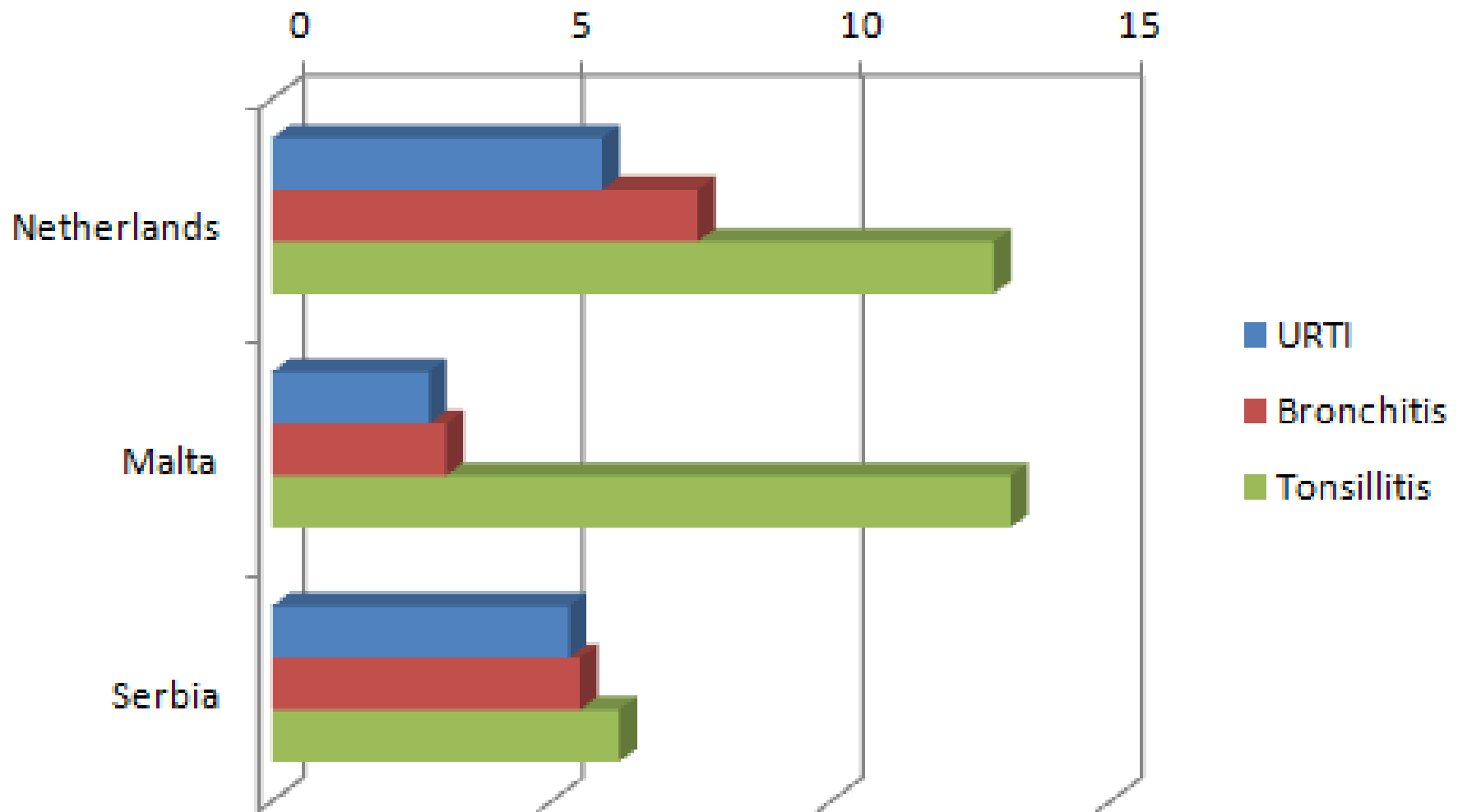
A03 is fever

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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];-;-) 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];-)
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]) 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];-)

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

▼

Specificity

▼

Sensitivity

▼

LR+

▼

LR-

▼

Odds

▼

Score

▼

Provenance

Netherlands

Scenario

a_130613

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Filter

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Expand table

Number of rules: 43

ANTECEDENTS	=>	CONSECUTIVE	AVG SCORE	SUPPOF▼	CONFIDENCE (%)	LIFT	SPECIFICITY	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	Netherlands	a_130613	add remark
D06, U01, F	=>	U71	0.0	65	62,50	27,23	1,00	0,01	70,95	0,99	70,95	Netherlands	a_130613	add remark
D06, U02	=>	U71	0.0	41	37,60	16,39	1,00	0,01	25,67	0,99	25,67	Netherlands	a_130613	add remark

RfE

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

EPISODE DIAGNOSE

ICPC2

U71

DESCRIPTION

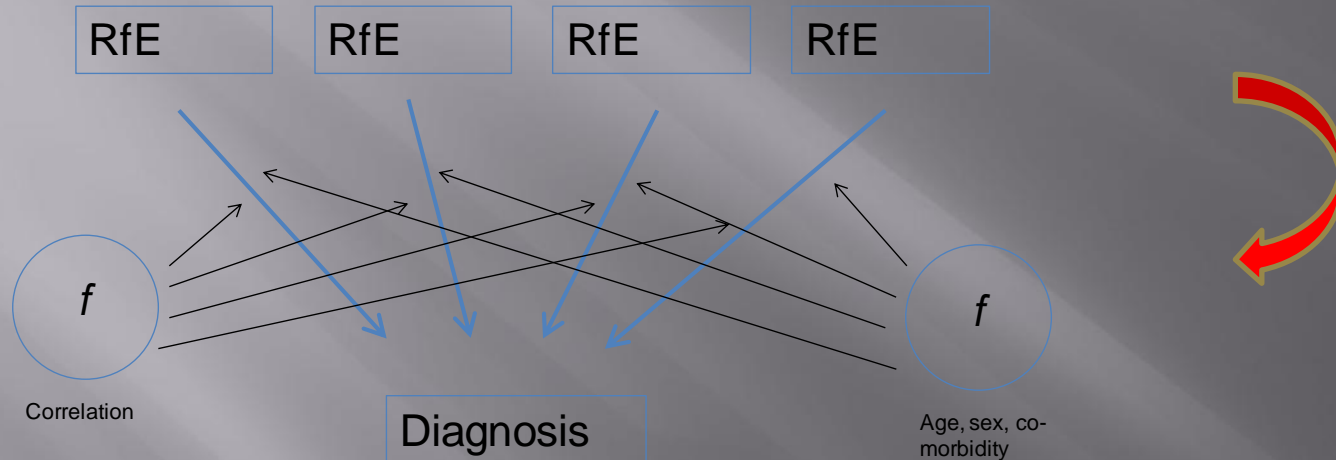
Cystitis/urinary infection, other

URTI in NI: 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];-)

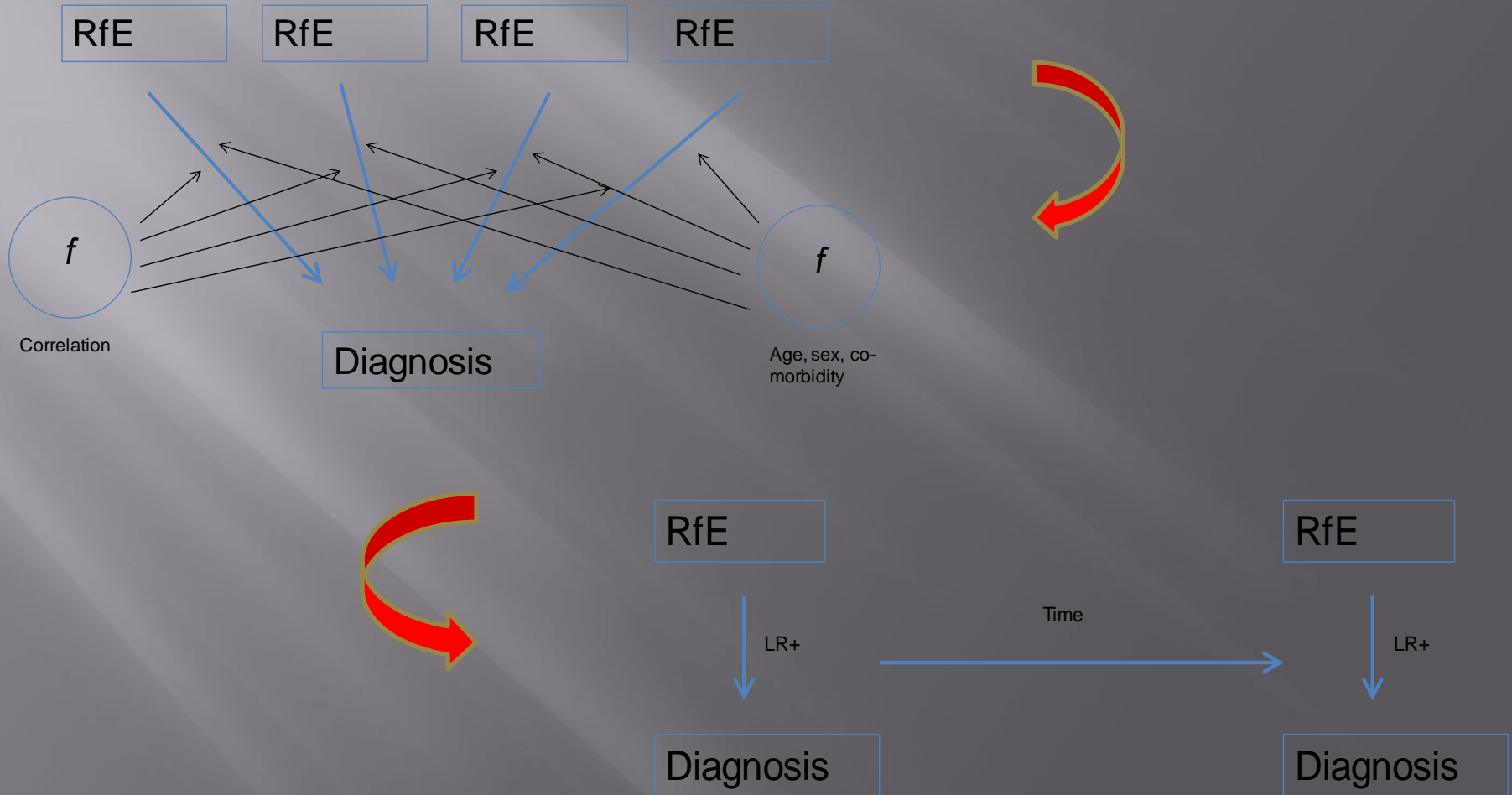
URTI in NI: OR 5.9; 95%CI 5.6 to 6.4

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 NI: 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];-)

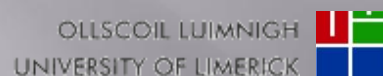


Future Research

- ▣ 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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