

# CRC screening in the Era of informatics: can data-based knowledge enhance coverage?



Institute of Biostatistics and Analyses  
Masaryk University



National Reference Center  
Health Care Payers

# Data -> Information -> Impact -> Effect?

## Disease diagnostics



Screening performance

Screening efficacy & safety

Screening effectiveness

..... follow-up

QA & QC



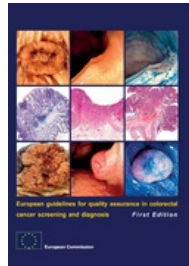
Compliance

Cancer burden

## Target population

Epidemiology  
Population risk  
assessment

European Council (2003/878/EC)  
+ European Guidelines (2010)



+ Communication



# Key problem: standardization of EHR



Clinical stage: 4, evaluated .....

Cl. st. 4, ....

Advanced disease *KS IV*

*Le Robinson. mps. S IV kls*

CS: -> diagnostic imaging: IV

Cl. staging: \_\_\_\_\_

I.  II.  III.  IV.

T: \_\_\_\_\_

T1  T2  T3  T4

Date: \_\_ / \_\_ / \_\_\_\_

Follow-up cotrol \_\_\_\_\_

Yes/date  No/why



EUnetHTA – collaboration via Europe  
EUnetHTA FINAL TECHNICAL REPORT - YEARS 2006-2008

# Electronic health care records - where are you?



**SCREENING  
PROGRAMME**

**SEPARATED KEY  
INFORMATION SOURCES**



**NON-STANDARDIZED  
INFORMATION SYSTEMS**



A collage of overlapping spreadsheets representing data from various information sources. Three blue boxes with white text are overlaid on the spreadsheets: "Diagnostics" at the top, "Clinical monitoring" in the middle, and "Health care payers" at the bottom. The spreadsheets contain various columns of data, including numbers and text labels.

# Solution? Multi-level information system

## Monitoring of Population Cancer Burden

- epidemiology of cancer in target population
- evaluation of screening programs impact

**Source of data:** CZECH NATIONAL CANCER REGISTRY  
13 regional data collection points / 57 district points  
annual no. of records: 8,093 colorectal cancer cases in 2009



## Performance & Quality Monitoring of Health Care Facilities

- performance indicators at screening centres
- detection of cancer and precancerous lesions

**Source of data:** RECOMMENDED HEALTH CARE FACILITIES  
160 centres (summer 2011)  
annual no. of records: 22,227 preventive colonoscopies in 2010



## Clinical Monitoring using Health-Care Administrative Data

- population-based performance indicators
- monitoring of programs accessibility by target population
- assessment of programs cost-effectiveness

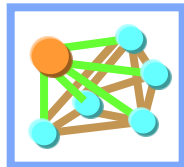
**Source of data:** HEALTH INSURANCE COMPANIES – NATIONAL REFERENCE CENTRE  
8 health insurance companies / 4,400 general practitioner offices, 1,200 gynaecologist offices  
annual no. of records: 521,000 FOBTs performed in 2010



Information Support Provider

MASARYK UNIVERSITY, INSTITUTE OF BIostatISTICS AND ANALYSES

# Five principal outcomes from the system



## Population reporting

1) Cancer burden (description & prediction)

2) Regional monitoring, equity of care

-> Population risk analyses



## Data-based networking of the diagnostic centers

3) Performance indicators

4) Quality indicators

-> Management decision support



## Clinical monitoring

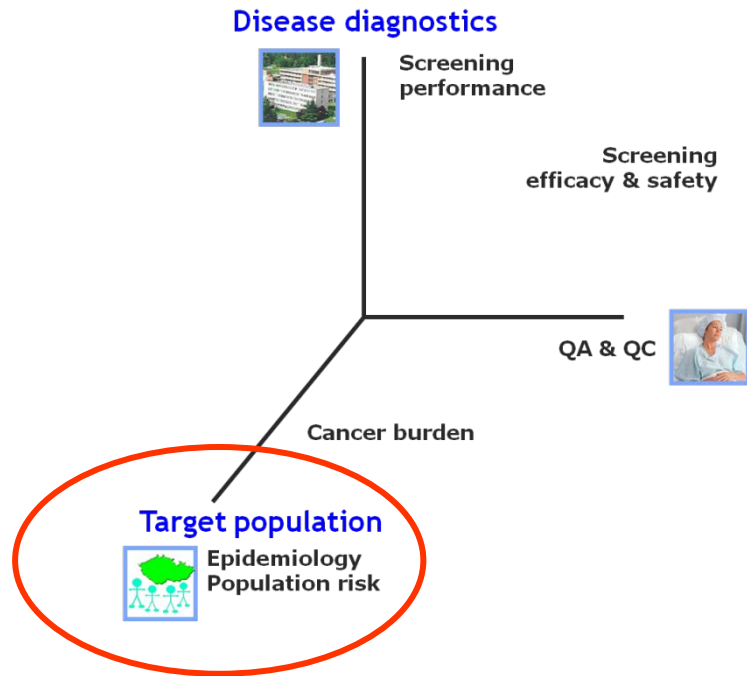
5) Patient flow, follow-up support

-> Real world evidence

Data -> information -> impact



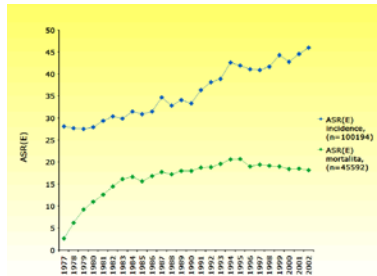
# Population-based monitoring



# Introducing the Czech National Cancer Registry

## CNCR

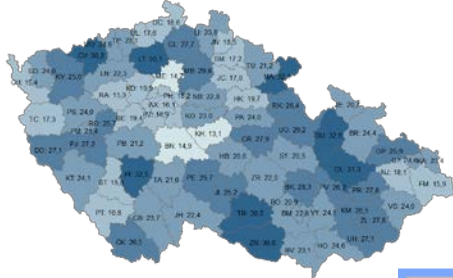
**Standardized and validated data,  
collected since 1977**



> 1 700 000 cases

- > Morphology
- > TNM, staging
- > Therapeutic strategy
- > Overall survival
- > Death reasoning

**Regions**



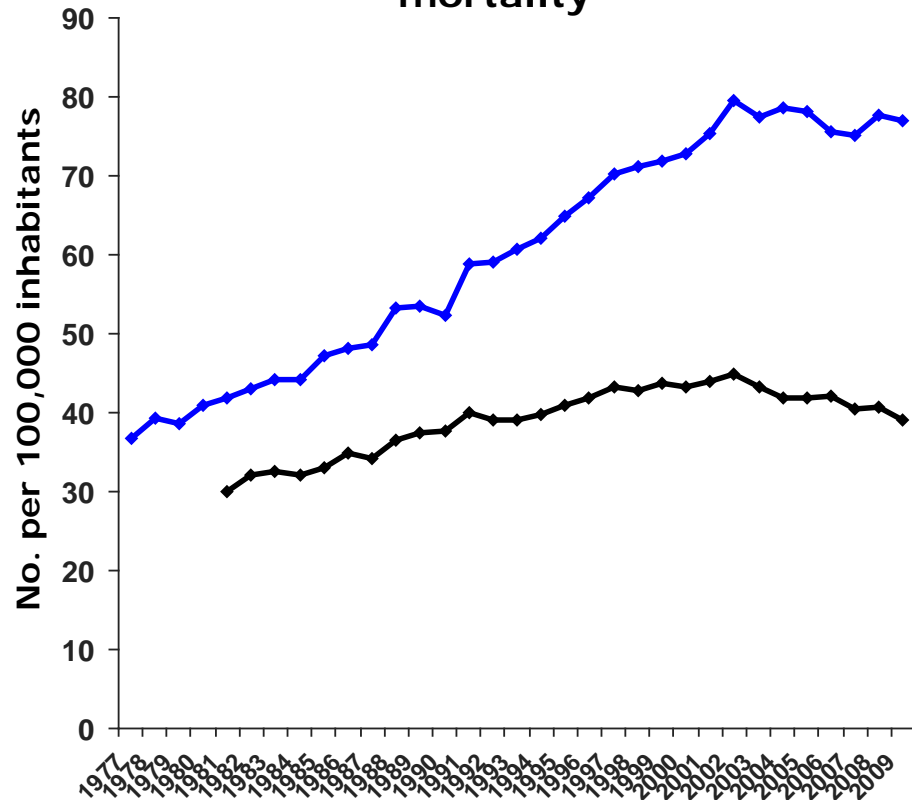
**Diagnostic  
centers**



# Population - based monitoring: examples

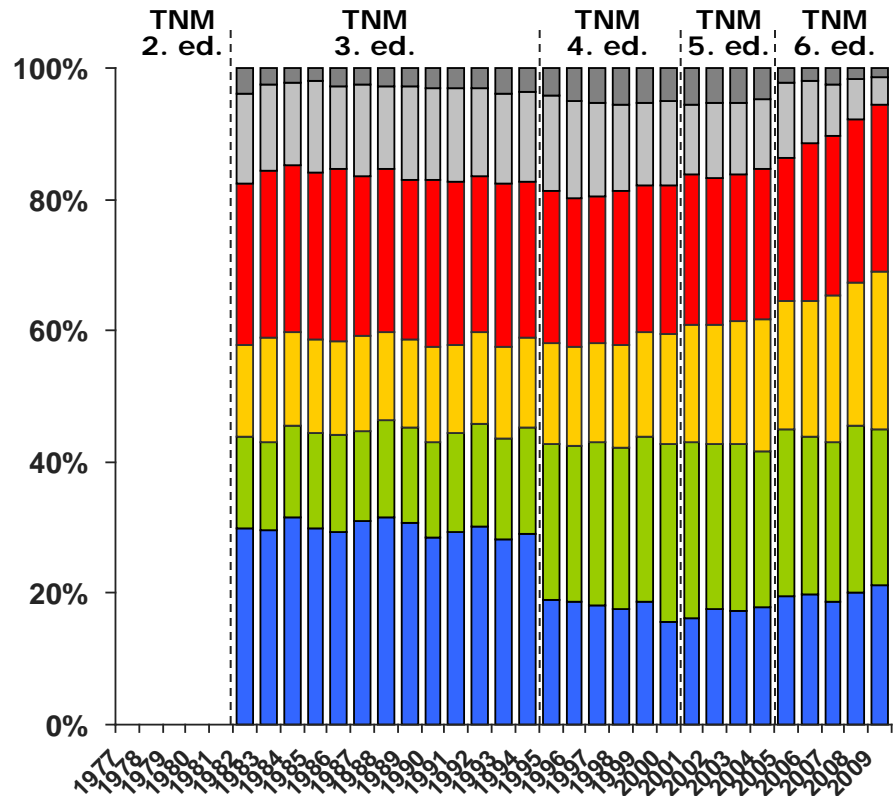


## Time-related trends: incidence and mortality



◆ incidence    ◆ mortality

## Incidence stratified according to clinical stage



Clinical stage:  
 ■ 1    ■ 2    ■ 3    ■ 4    ■ Unstaged for objective reasons    ■ Stage not recorded

# Population - based monitoring: examples



## INCIDENCE

Colorectal carcinoma (C18-C20)	Predicted values for 2012	
	Incidence <sup>1</sup>	(90% CI)
Stage I	1696	(1520; 1870)
Stage II	2014	(1835; 2192)
Stage III	2090	(1940; 2239)
Stage IV	1971	(1826; 2114)
Stage unknown for objective reasons <sup>2</sup>	605	(474; 736)
Stage unknown without stated reason <sup>2</sup>	197	(153; 240)
<b>TOTAL</b>	<b>8573</b>	<b>(7748; 9391)</b>

## PREVALENCE

Colorectal carcinoma (C18-C20)	Predicted values for 2012	
	Prevalence	(90% CI)
Stage I	16 192	(15 900; 16 484)
Stage II	15 617	(15 338; 15 896)
Stage III	10 698	(10 464; 10 932)
Stage IV	6 824	(6 637; 7 011)
Stage unknown for objective reasons	3 297	(31 66; 3 428)
<b>TOTAL</b>	<b>52 628</b>	<b>(51 505; 53 751)</b>

Pavlik et al. BMC Public Health 2012, 12:117  
<http://www.biomedcentral.com/1471-2458/12/117>



RESEARCH ARTICLE Open Access

### Estimating the number of colorectal cancer patients treated with anti-tumour therapy in 2015: the analysis of the Czech National Cancer Registry

Tomáš Pavlík<sup>1</sup>, Ondřej Májek<sup>1</sup>, Jan Mužík<sup>1</sup>, Jana Koptíková<sup>1</sup>, Lubomír Slavíček<sup>2,3</sup>, Jindřich Finek<sup>1,3</sup>, David Feltr<sup>4</sup>, Rostislav Vyzula<sup>1,3</sup> and Ladislav Dušek<sup>2\*</sup>

**Abstract**  
**Background:** Colorectal cancer (CRC) represents a serious health care problem in the Czech Republic, introducing a need for a prospective modelling of the incidence and prevalence rates. The prevalence of patients requiring anti-tumour therapy is also of great importance, as it is directly associated with planning of health care resources.  
**Methods:** This work proposes a population-based model for the estimation of stage-specific prevalence of CRC patients who will require active anti-tumour therapy in a given year. Its applicability is documented on records of the Czech National Cancer Registry (CNCR), which is used to estimate the number of patients potentially treated with anti-tumour therapy in the Czech Republic in 2015.  
**Results:** Several scenarios are adopted to cover the plausible development of the incidence and survival rates, and the probability of an anti-tumour therapy initiation. Based on the scenarios, the model predicts an increase in CRC prevalence from 13% to 30% in comparison with the situation in 2008. Moreover, the model predicts that 10,074 to 11,440 CRC patients will be indicated for anti-tumour therapy in the Czech Republic in 2015. Considering all patients with terminal cancer recurrence and all patients primarily diagnosed in stage IV, it is predicted that 3,485 to 4,459 CRC patients will be treated for the metastatic disease in 2015, which accounts for more than one third (34-40%) of all CRC patients treated this year.  
**Conclusions:** A new model for the estimation of the number of CRC patients requiring active anti-tumour therapy is proposed in this paper. The model respects the clinical stage as the primary stratification factor and utilizes solely the population-based cancer registry data. Thus, no specific hospital data records are needed in the proposed approach. Regarding the short-term prediction of the CRC burden in the Czech Republic, the model confirms a continuous increase in the burden that must be accounted for in the future planning of health care in the Czech Republic.

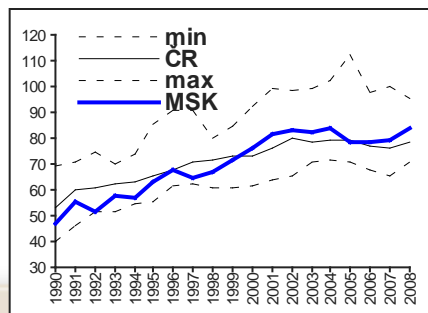
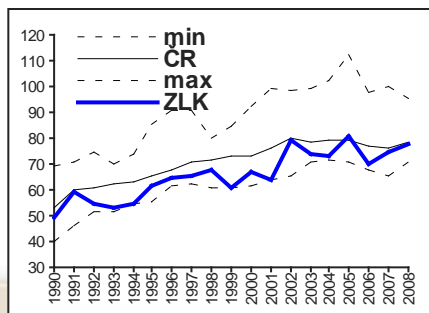
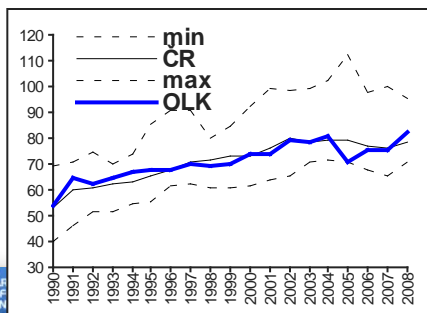
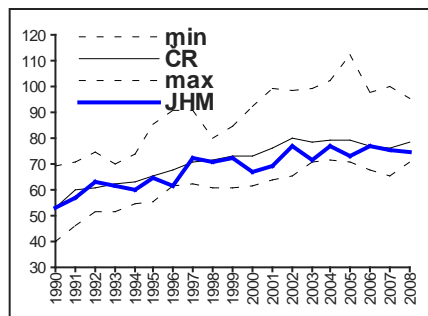
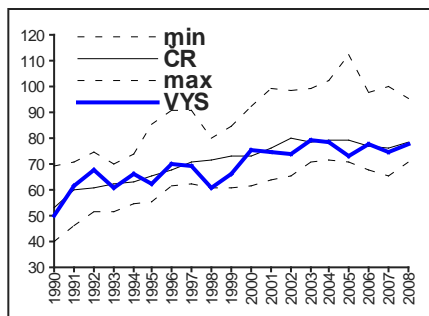
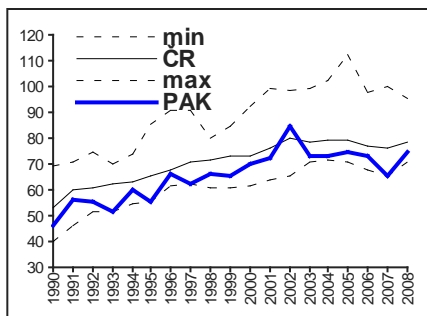
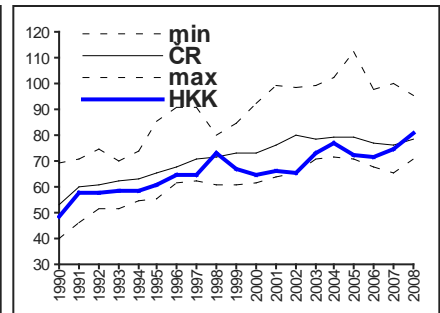
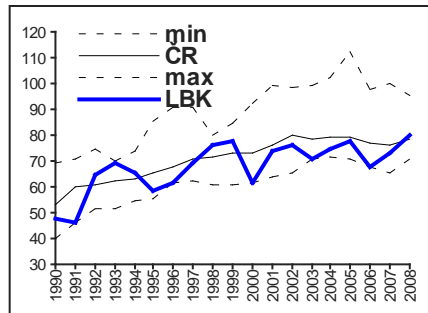
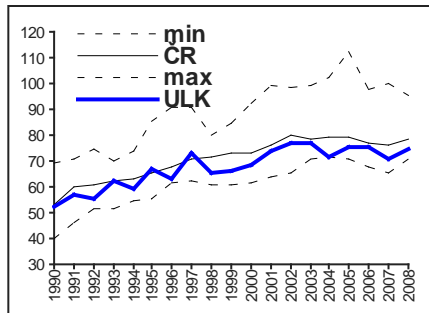
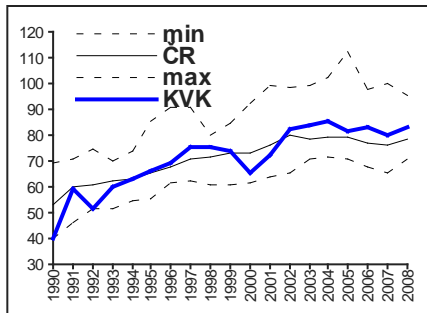
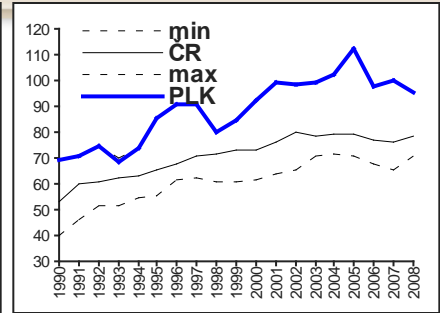
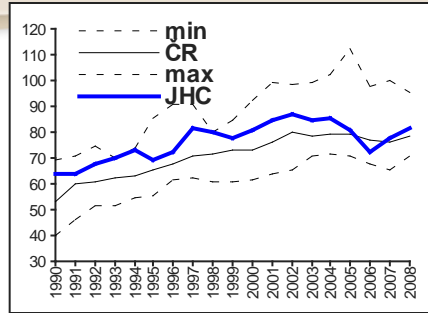
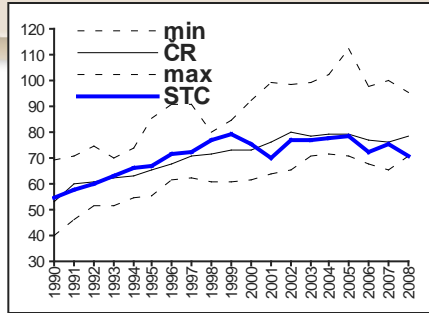
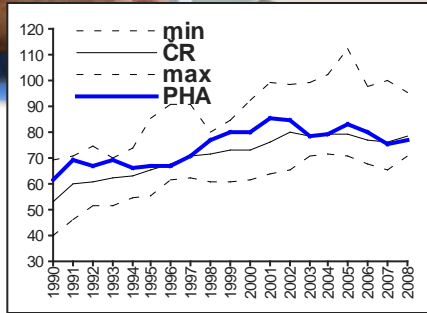
**Background**  
 The Czech population, with an annually diagnosed 78.7 colorectal cancer (CRC) patients per 100,000 inhabitants (2008), presently occupies an undesirable 3rd position in international statistics of age-standardised CRC incidence rates [1]. Moreover, the number of newly diagnosed cases is supposed to be high in the future as well, namely due to population ageing. This health care problem is further worsened by the fact that a large proportion of colorectal carcinomas are primarily diagnosed in a metastatic stage (25% in 2008) [2]. Thus, there is a strong need for a prospective modelling of CRC incidence and prevalence rates, as these measures are necessary for monitoring of the overall cancer load and its dynamics [3]. The prospective estimates should also enable us to quantify the resources necessary for the health care system [4], provided that we are able to adjust the rates for patients untreated by

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# Population - based monitoring: examples

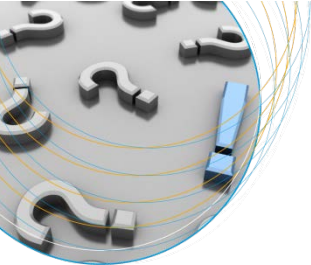
Number pf cases per 100 000 persons



CR: Czech Republic  
max: maximum in regions  
min: minimum in regions

PHA: Capital City of Prague  
STC: Středočeský region  
JHC: Jihočeský region  
PLK: Plzeňský region  
KVK: Karlovarský region  
ULK: Ústecký region  
LBK: Liberecký region  
HKK: Královéhradecký region  
PAK: Pardubický region  
VYS: Vysočina region  
JHM: Jihomoravský region  
OLK: Olomoucký region  
ZLK: Zlínský region  
MSK: Moravskoslezský region

# Communication based on open reporting in analytical portals



About project

News

Epidemiological analyses

Publications, reports

Software SVOD

Analytic tools tutorial

SVOD - Mozilla Firefox

http://www.svod.cz/?sec=analyzy&lang=en

EPIDEMIOLOGY OF MALIGNANT TUMORS IN THE CZECH REPUBLIC

ISSN 1802-8861

ABOUT PROJECT  
NEWS  
SOFTWARE SVOD  
EPIDEMIOLOGICAL ANALYSES  
ANALYSES WIZARD

Publications  
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WWW links

Related links  
Web portal of epidemiology of malignant tumours in the Slovak Republic  
www.nor-sk.org

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**INCIDENCE AND MORTALITY**  
Time trends in cancer incidence and mortality in Czech Republic.

**REGIONAL OVERVIEWS**  
Comparison of cancer incidence and mortality in individual regions of Czech Republic.

**TIME TRENDS**  
Changes in trends in cancer incidence and mortality over time (growth index and year-on-year changes).

**CLINICAL STAGES**  
Time trends in cancer stages.

**AGE OF PATIENTS**  
Age structure of living and deceased cancer patients.

**COMPARISON WITH COUNTRIES**  
Comparison of cancer incidence and mortality in the Czech Republic (source: IARC - GL 2002).

**COMPARATIVE ANALYSE**  
Time trends in epidemiological data.

**SUMMARY PRESENTATION**  
Comprehensive presentation of epidemiological data and diagnoses.

Epidemiological analyses

Incidence and mortality

Time trends

Regional overview

Age analyses

Clinical stages

International data

Comparative standards

Comprehensive overview

<http://www.svod.cz>

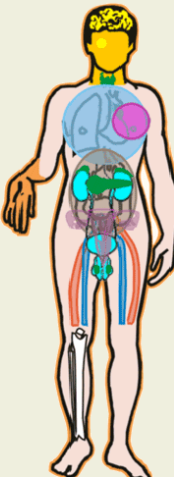
# Communication based on open reporting in analytical portals

www.svod.cz

http://www.cba.muni.cz - SVOD analýza - Microsoft Internet Explorer

INCIDENCE A MORTALITA - vývoj v čase

Zvolte požadovanou diagnózu



VIII. NÁDORY UROGENITÁLNÍHO SYSTÉMU

- C60 - ZN pyje
- C61 - ZN předstojně žlázy - prostaty
- C62 - ZN ledviny nino pánevníku
- C63 - ZN konečníku - recta
- C64 - ZN kůže
- C65 - ZN žlázy
- C66 - ZN svalů
- C67 - ZN urinu
- C68 - ZN orgánů

Zobrazit kategorie diagnóz

Pop-up window blocked

http://www.cba.muni.cz - SVOD analýza - Microsoft Internet Explorer

INCIDENCE A MORTALITA - vývoj v čase

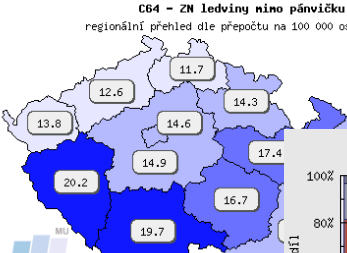
Výběr skupiny pacientů

Pohlaví, věk Region  
Stádium TNM klasifikace Da

Dašší analýzy pro vybranou diagnózu a sku

C64 - ZN ledviny nino pánevníku - Incidence

regionální přehled dle přečtu na 100 000 osob za období 1977-2002



18.0 - 20.2  
15.9 - 18.0  
13.8 - 15.9  
11.7 - 13.8

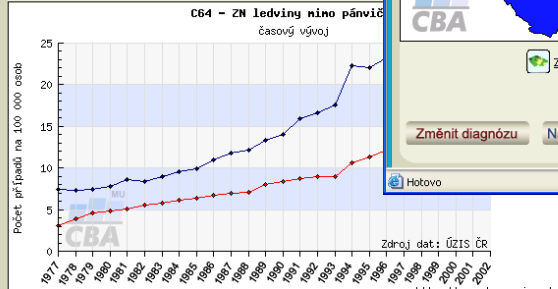
11.7 12.6 14.3 14.6 17.4 14.9 19.7 20.2

zobrazit mapu

Změnit diagnózu Nastavení analýzy

Hotovo

C64 - ZN ledviny nino pánevníku - časový vývoj



Počet případů na 100 000 osob

Zdroj dat: ÚZIS ČR

http://www.cba.muni.cz/svod

Změnit diagnózu Nastavení analýzy Tabulka

http://www.cba.muni.cz - SVOD analýza - Microsoft Internet Explorer

REGIONÁLNÍ PŘEHLEDY

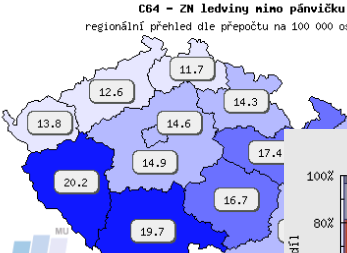
Výběr skupiny pacientů

Pohlaví, věk Region  
Stádium TNM klasifikace Dašší parametry

Dašší analýzy pro vybranou diagnózu a skupinu pacientů

C64 - ZN ledviny nino pánevníku - Incidence

regionální přehled dle přečtu na 100 000 osob za období 1977-2002



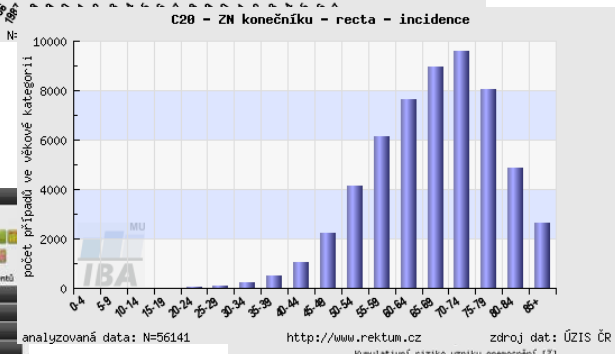
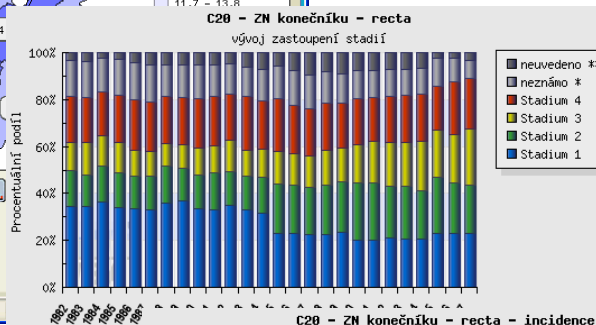
18.0 - 20.2  
15.9 - 18.0  
13.8 - 15.9  
11.7 - 13.8

11.7 12.6 14.3 14.6 17.4 14.9 19.7 20.2

zobrazit mapu

Změnit diagnózu Nastavení analýzy

Hotovo



História recta (diagnóza C20)

Vývoj incidence a mortality v čase



Počet případů na 100 000 osob

Zdroj dat: ÚZIS ČR

analýzovaná data: N:inc=30265, N:mor=22065

http://www.rektum.cz

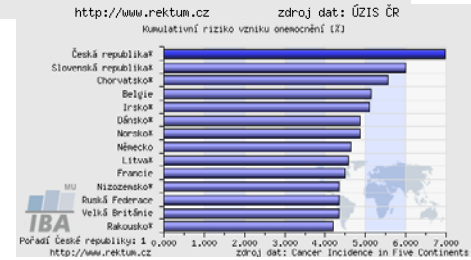
C20 - ZN konečníku - recta

časový vývoj, počet případů na 100 000 osob

rok	1990	1991	1992	1993	1994	1995	1996	1997	1998
incidence	15.76	16.45	16.8	17.11	18.36	18.72	19.44	20.08	21.45
mortality	12.68	12.82	12.85	13.66	13.9	12.91	12.43	12.44	12.93

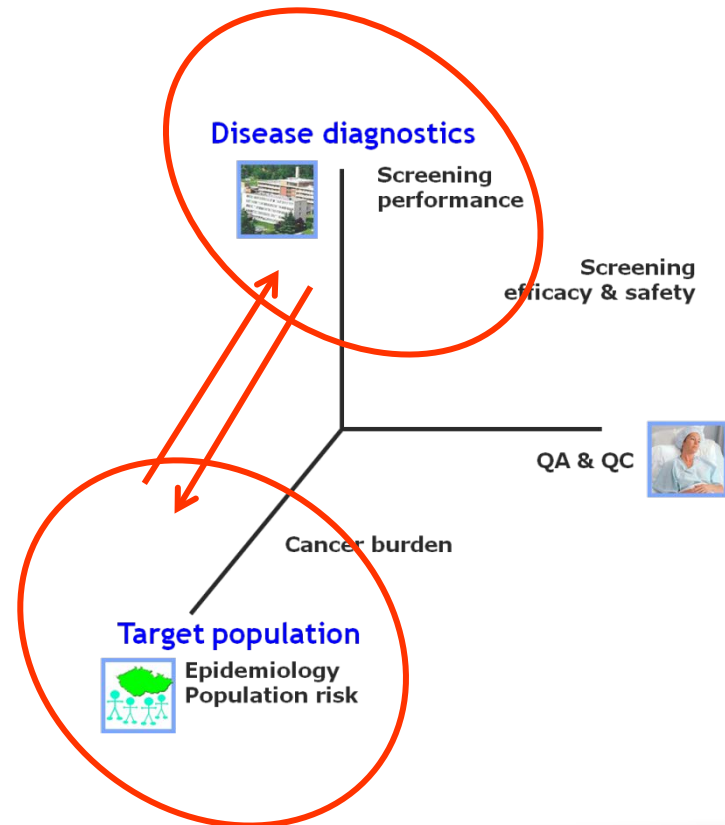
rok	1999	2000	2001	2002	2003	2004	2005	2006	2007
incidence	20.33	20.91	21.68	22.46	23.95	22.11	21.99	20.95	20.46
mortality	13.32	13.45	12.97	13.16	12.25	12.45	12.26	12.82	11.79

zdroj dat: ÚZIS ČR





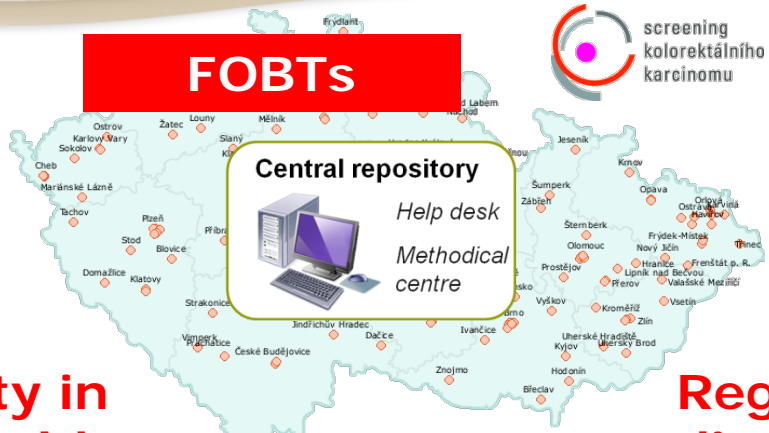
# Diagnostic monitoring



# Finally resulting three key data sources.....

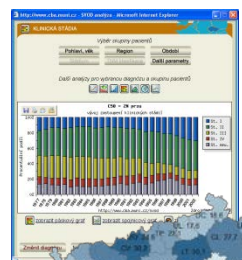


**FOBTs**

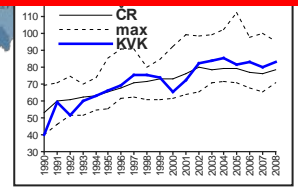


**Equity in health**

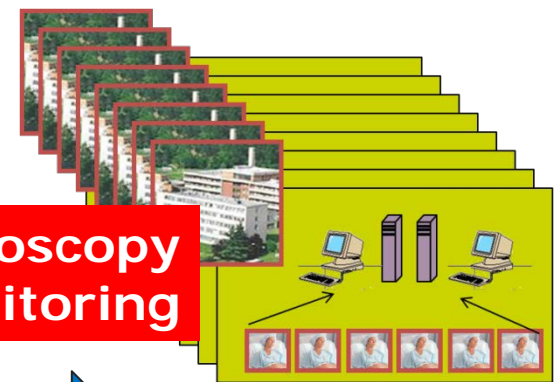
**Regional disparities**



**Cancer burden**



**160 colonoscopy centers**  
- local data collection -

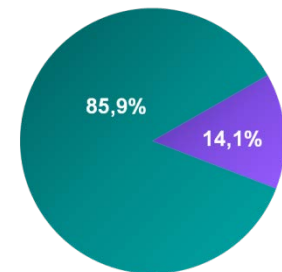
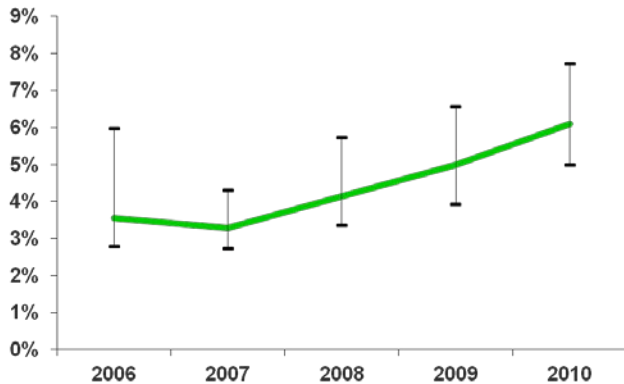
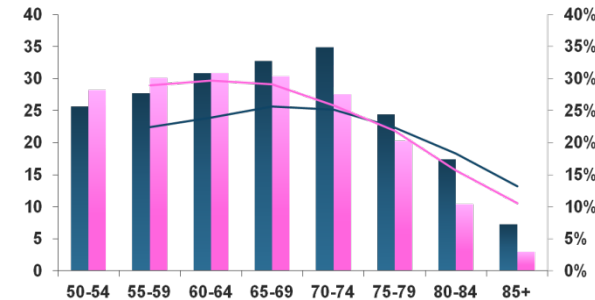
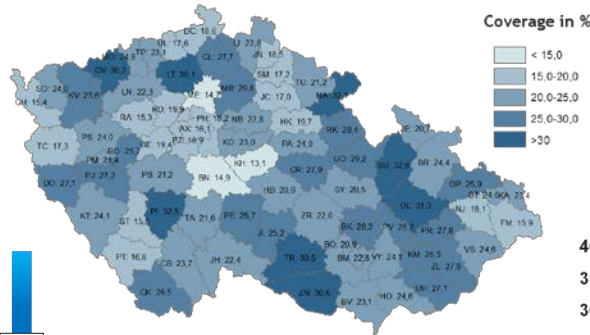
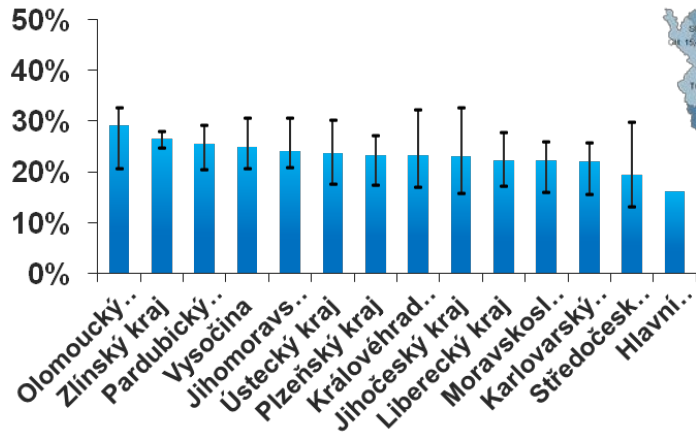


**Colonoscopy monitoring**



# .... and finally reachable results

13.1%    22.7%    32.6%



[www.kolorektum.cz](http://www.kolorektum.cz)





Data -> information -> impact

# Clinical monitoring and follow-up support

**Monitoring of Population Cancer Burden**

- epidemiology of cancer in target population
- evaluation of screening programs impact

Source of data: CZECH NATIONAL CANCER REGISTRY  
13 regional data collection points / 157 district points  
annual no. of records: 8,095 / 157 total cancer cases in 2009

**Performance & Quality Monitoring of Health Care Facilities**

- performance indicators at screening centres
- detection of cancer and precancerous lesions

Source of data: RECOMMENDED HEALTH CARE FACILITIES  
160 centres (summer 2011)  
annual no. of records: 22,2 / 160 preventive gynaecological examinations in 2010

**Clinical Monitoring using Health-Care Administrative Data**

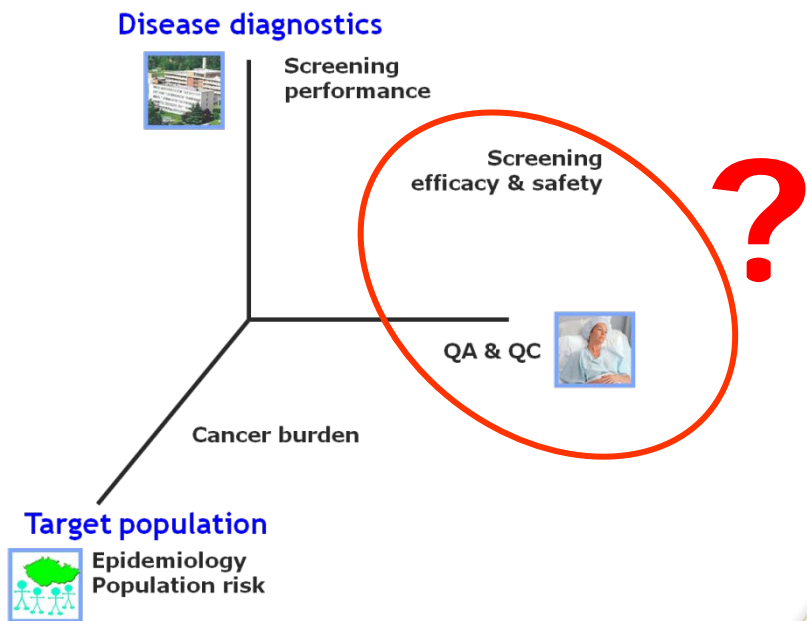
- population-based performance indicators
- monitoring of programs accessibility by target population
- assessment of programs cost-effectiveness

Source of data: HEALTH INSURANCE COMPANIES – NATIONAL REFERENCE CENTRE  
8 health insurance companies / 4,400 general practitioner offices, 1,200 gynaecologist offices  
annual no. of records: 521,000 FOBTs performed in 2010



Information Support Provider

MASARYK UNIVERSITY, INSTITUTE OF BIostatISTICS AND ANALYSES



# Can data-based knowledge enhance coverage?



## Czech colorectal cancer screening - coverage

