Rhinosinusitis: Health economics aspects

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Problem

- Types
- Risk factors
- Symptoms
- Pathophysiology
- Screening
- Treatment
- Prevention
- Management

TREY Research

SOLUTION

- Assist in decision-making for high cost technologies
- Allocate resources to programs
- Provide most cost-effective treatment vs. least/most costly
- Choose between alternative treatments

Outline

1

Health economics

Introduction

Burden of disease

Cost of illness

Quality of life

2

Rhinosinusitis

Epidemiology

Quality measurements

Cost of Rhinosinusitis

3

Examples

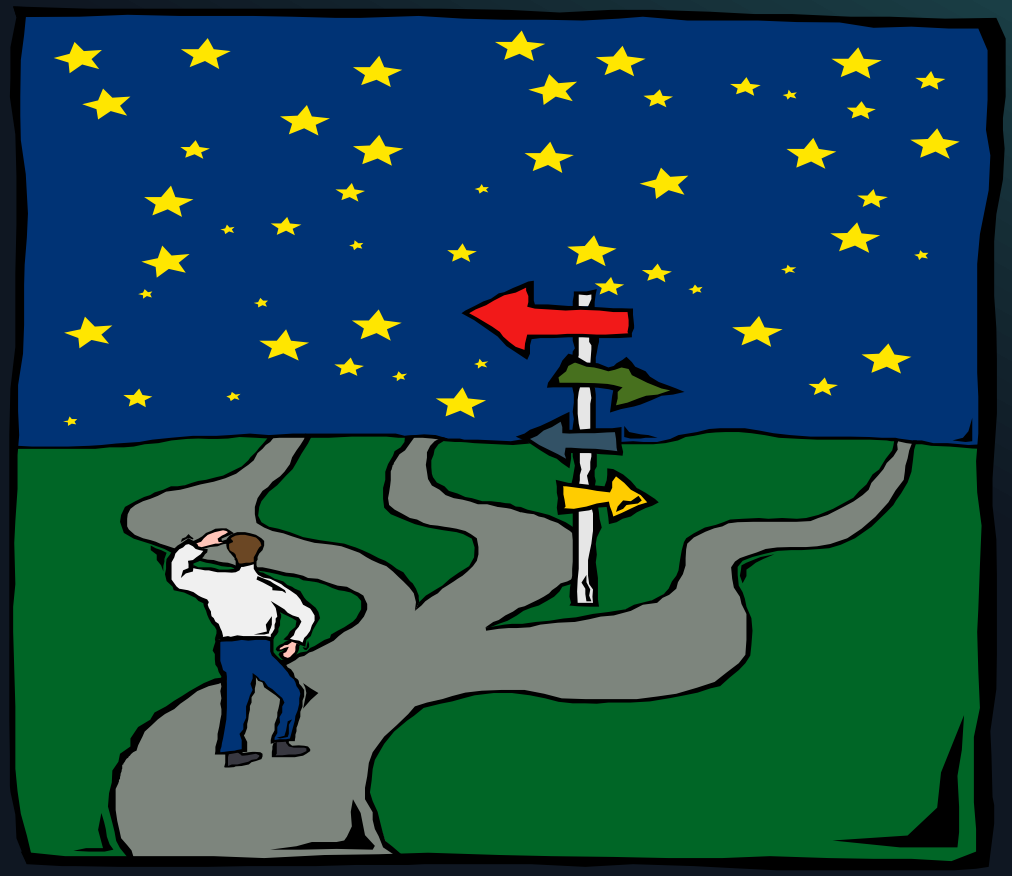
Cost utility analysis

TREY Research

Health economics

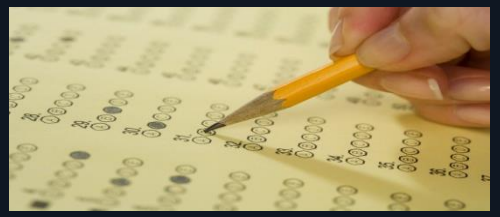
What is Health Economics?

- how to make decisions based on scarcity of resources



Conceptual Underpinnings of health economics

- Unlimited wants
- Finite resources
- Inevitability of choices
- Balance of benefits and costs
- Need for formal analysis

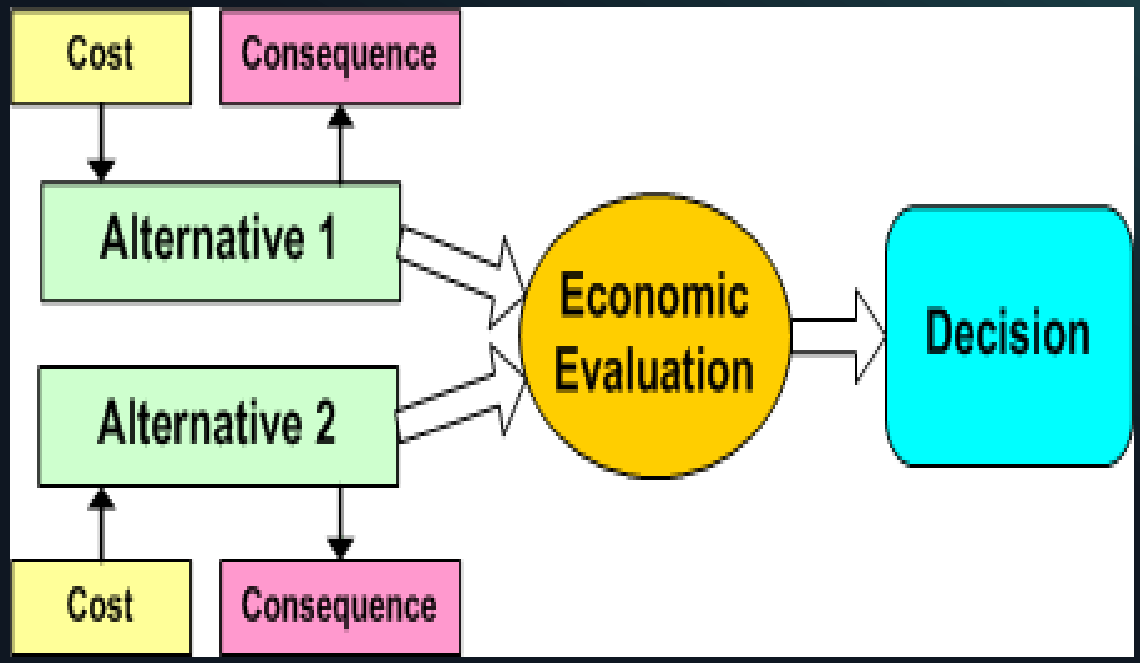


Economic evaluations

- Assess program *costs* and *benefits* in quantitative terms.
  - ❖limited financial resources
  - ❖To maximize the level of benefits (health effects) relative to the level of resources available
- prioritization
  - ✓e.g. Which program is most effective in terms of costs per child?

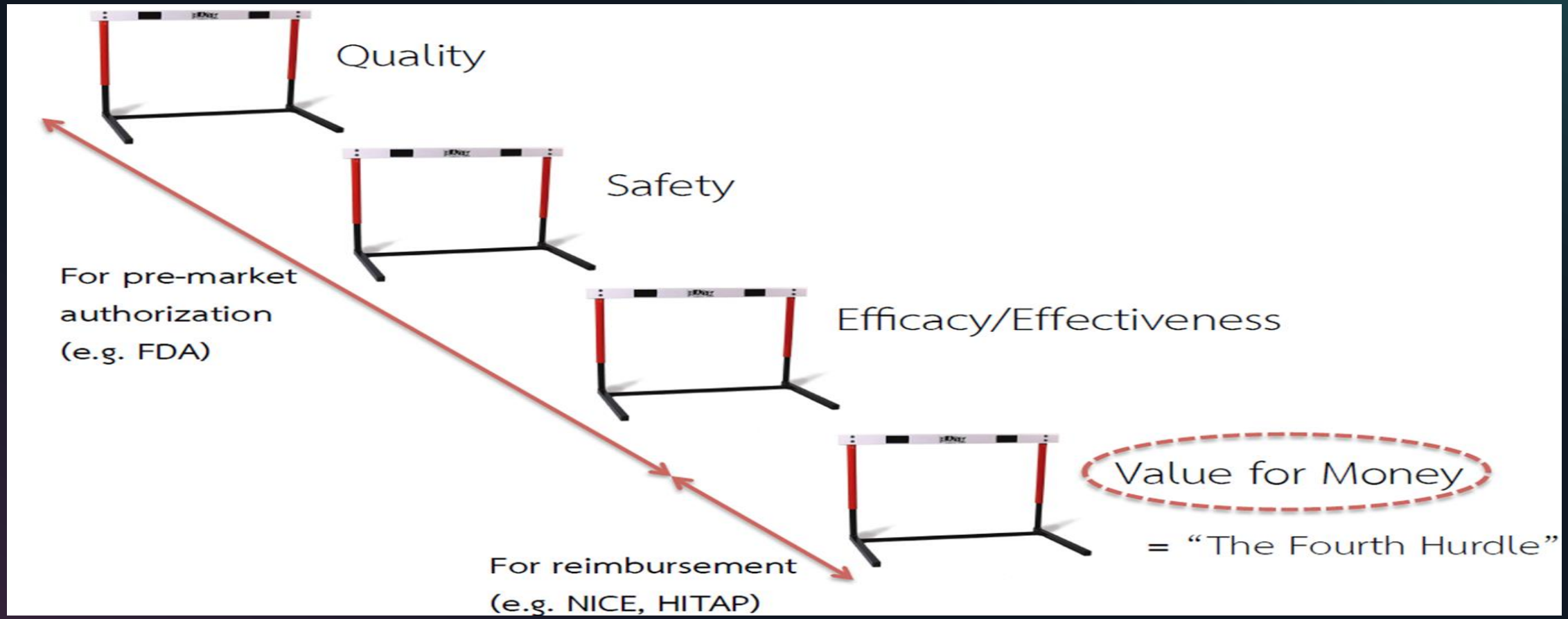
Economic evaluation is …

- " The comparative analysis of alternative courses of action in terms of both their costs and consequences in order to assist policy decisions" *(Drummond et al,1997)*



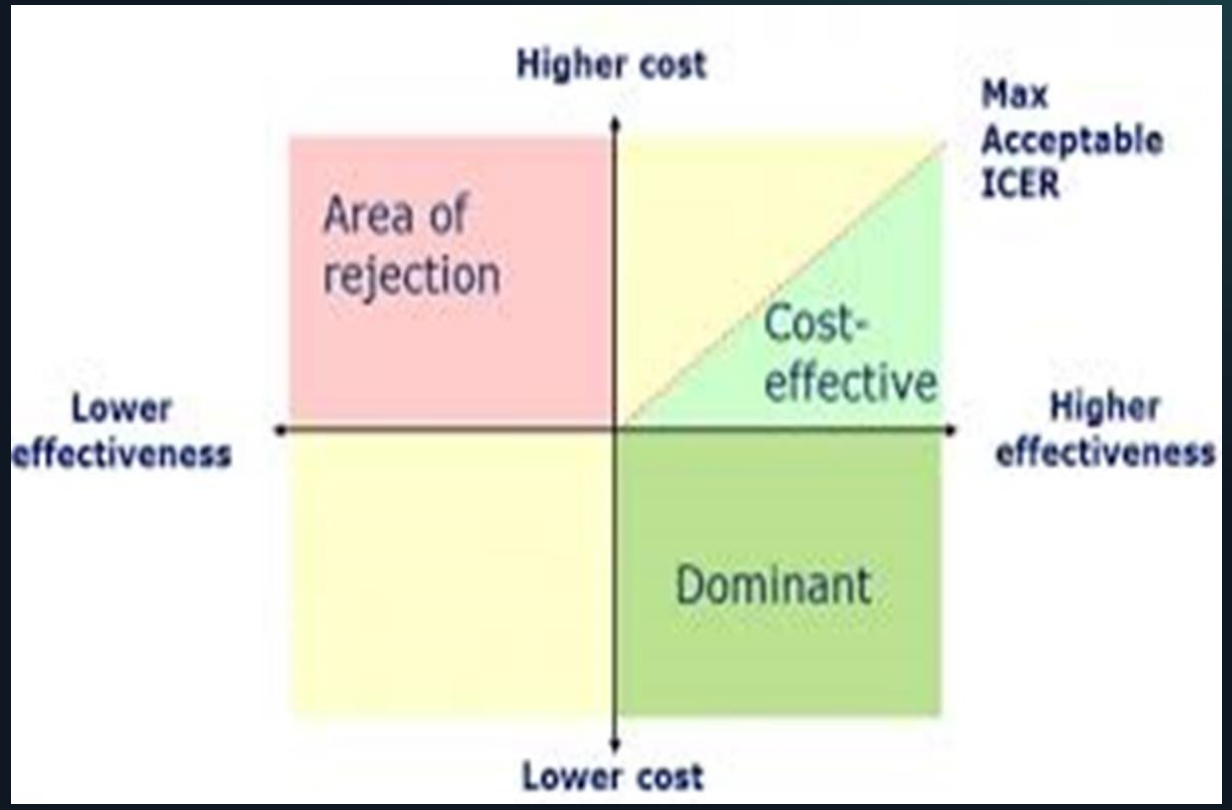
Economic evaluation is not "choosing the cheapest"

Assessment of New intervention

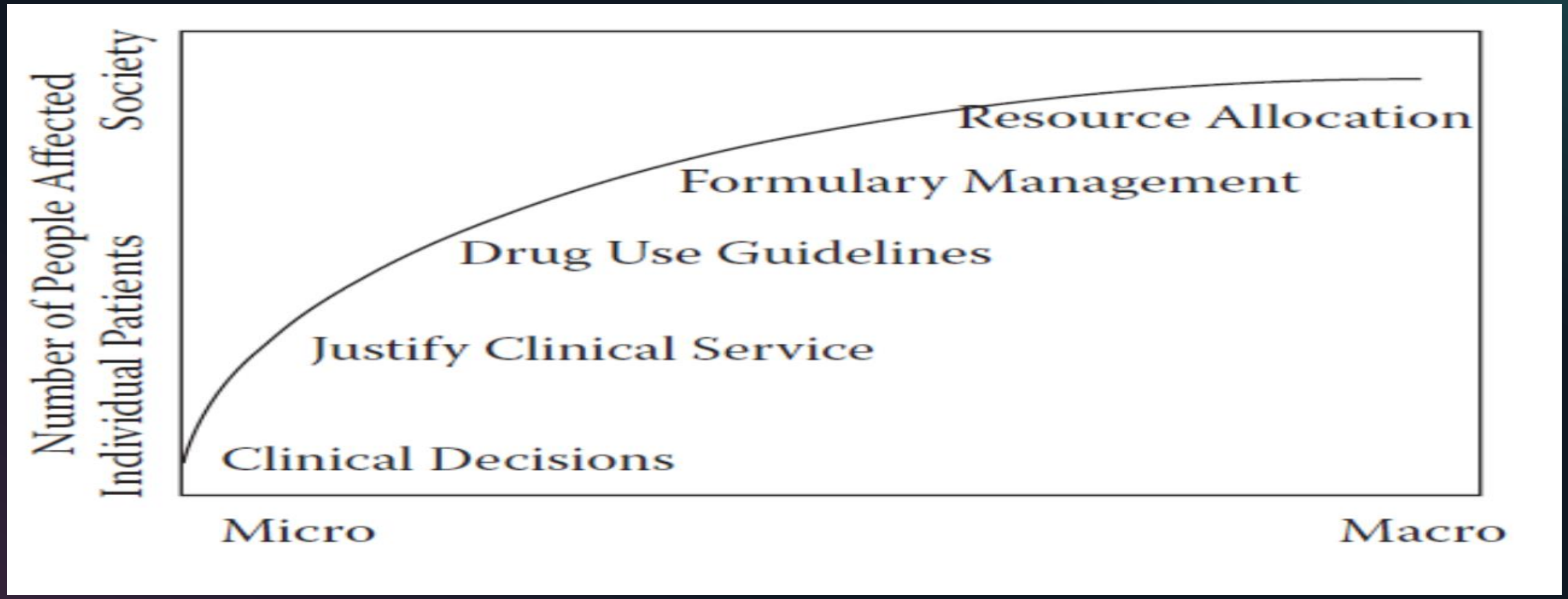


Which interventions can pass fourth hurdle?

- Incremental cost-effectiveness ratio (ICER) The ratio of the difference in cost between two alternatives to the difference in effectiveness between the same two alternatives



Micro to Macro application of health economics



Definition of Costs

- Opportunity cost (economic cost):
  In economic evaluation, costs result from *using resources* and *loosing resources*
  - ❖Direct cost from usage of resources
  - ❖Indirect costs from lost production due to morbidity/mortality

It is not Accounting cost

- Costs occur to the entity ultimately paying for the resource
  - ❖Society, insurance/health service, patients (perspective)

Types of costs

- Direct costs
  - Direct medical costs
    - Cost of treatment:
    - medicine
    - hospital care
    - ambulatory care
    - medical procedures
    - doctors' fee
  - Direct non-medical
    - social services
    - adaptations
    - transportation

- Indirect costs

(can not work/can not easily replaced)

  - loss of production due to morbidity
  - loss of production due to mortality

(Informal care)

- Intangible costs

reduced quality of life

grief, disability, anxiety, social isolation, loss of amenity, etc.

Types of economic studies

Descriptive

- Cost of illness (COI)
- Cost-consequence analysis (CCA)

Evaluative

- Cost-effectiveness analysis
  - Cost-minimisation analysis (CMA)
  - Cost-effectiveness analysis (CEA)
  - Cost-utility analysis (CUA)
- Cost benefit analysis (CBA)

Roles of a burden of illness study

- Describing the relative burden of different disease
- Helping to establish priorities for health system
- Showing where the healthcare expenditure is high
  - Research and Development
  - New product development
  - Detect where the market is potentially large
- It could be baseline for other studies

Burden

1. Disease burden
   - Incidence/Prevalence
   - Mortality
   - Morbidity
2. Patient burden
   - Quality of Life
3. Economic burden
   - Cost of illness

Epidemiology the main tool

- Measurement of disease outcome in relation to a population at risk
- Descriptive epidemiology
  describe a disease or variable within a population or condition
- Analytic epidemiology
  study the associations between disease and other factors

Morbidity

- Describe the occurrence of disease or disability in a population.

❖Limited data (data on particular conditions)
❖No data for low level of disease (minor disease or chronic conditions)
❖No data for disease having no treatment

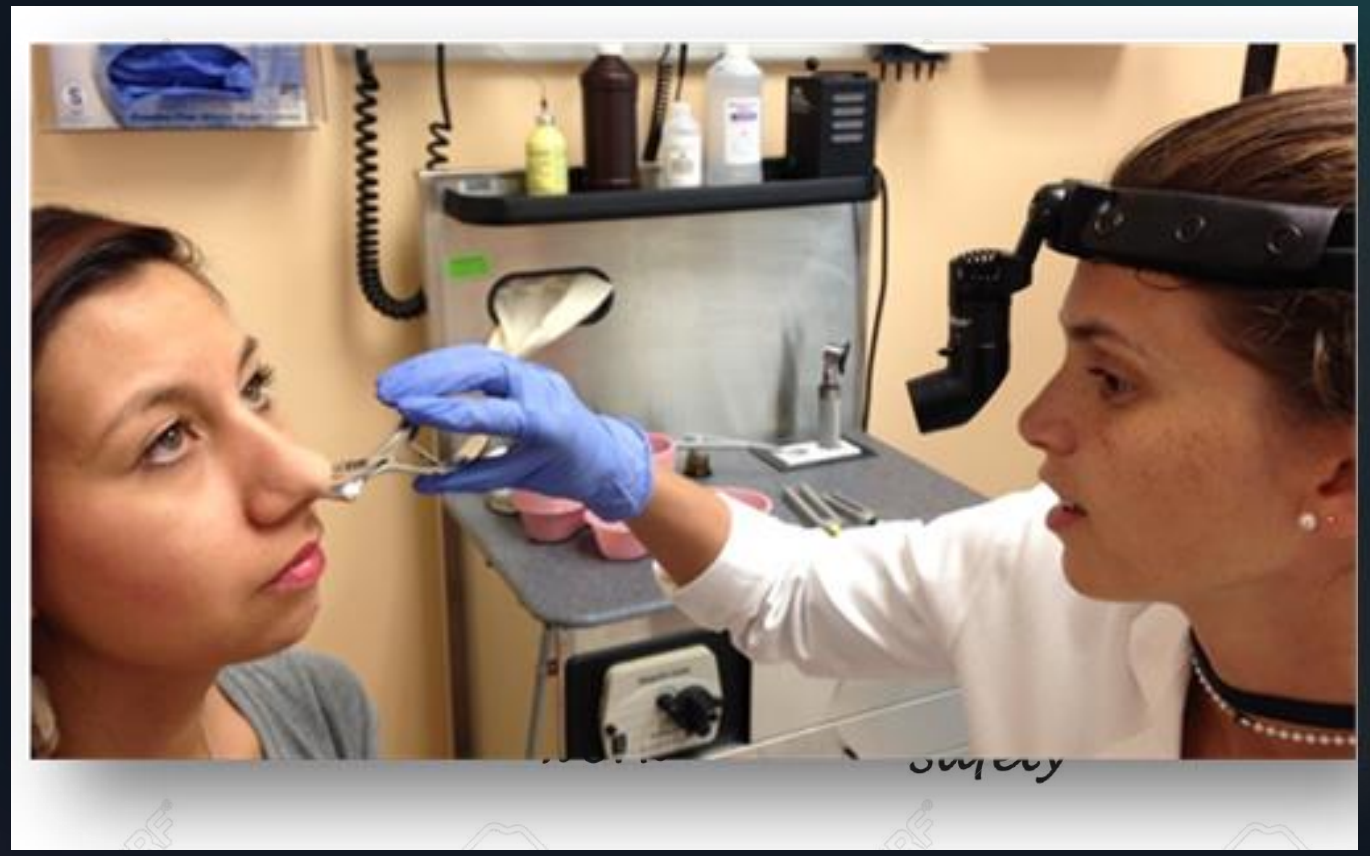
Main types of health outcomes

1. Clinical outcomes

2. Quality of life

   - ❖Health-related quality of life

3. Monetary outcomes



Health-related quality of life

- Disease specific measures

  Can be used for comparing different interventions for the same disease.

  Ex: SNOT-22, SNOT-20

- Generic QOL instruments

  As profiles, can only be used for comparing interventions within the same indication.

  If presented as a global score, can be used for comparing different interventions for different diseases.

  Ex: SF-6D, EQ-5D

The Quality Adjusted Life Year (QALY)

- QALYs combine both quantity and health-related quality of life (QoL) into a single measure of health gain

- QoL scores (utilities) should reflect people's preferences over health
  - Utilities usually scored with 'perfect health'=1 and death=0

- QALYs allow trade-off between length of life with quality of life:
  - 1 QALY = 1 year in perfect health
  - 1 QALY = 2 years with utility of 0.5

Burden of Illness Vs. Cost of Illness

- A burden of illness study

  Reports in term of numbers of patients affected, bed days used, and some other epidemiological end-points

- A cost of illness study

  Translates all of the burden of resource use (measured as hospital days, physician visits, etc.) into monetary terms (by putting a unit cost to each elements of burden)

COI advantages and disadvantages

Advantages

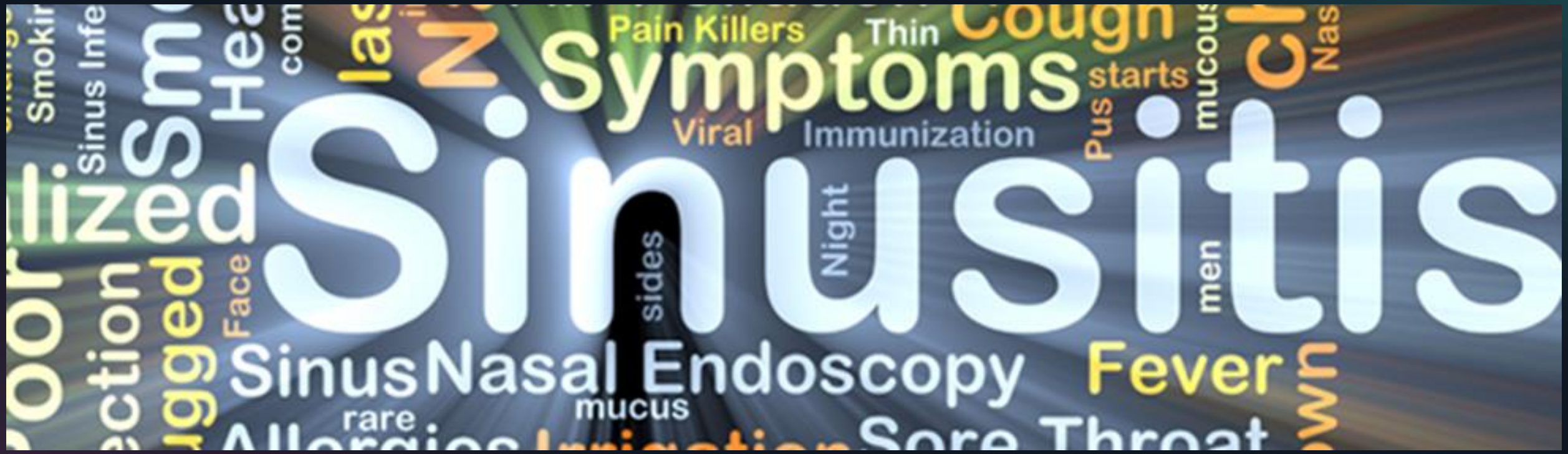
- Prepare league table of health problems according to the burden
- Provide data for economic evaluation
- Raise policymakers' consciousness to particular disease (future costs)
- Provide single index of BOI

Disadvantages

- Assume value of life is based on productivity
- Distort priorities toward high earners
- Methodological problems about human capital approach
- May lead to incorrect decisions (look only at costs)
- Risk of bias (poor method. Poor data, incomplete reporting)

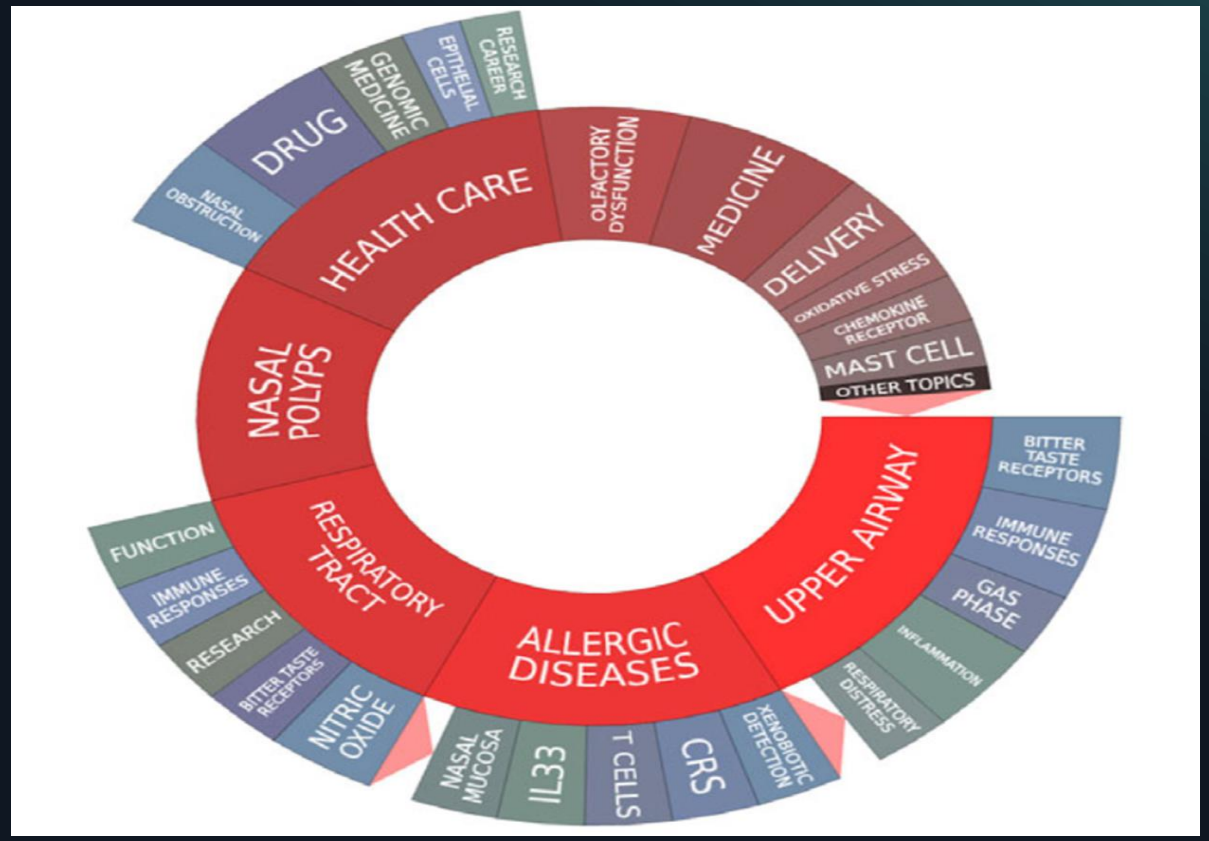
TREY Research

Rhinosinusitis

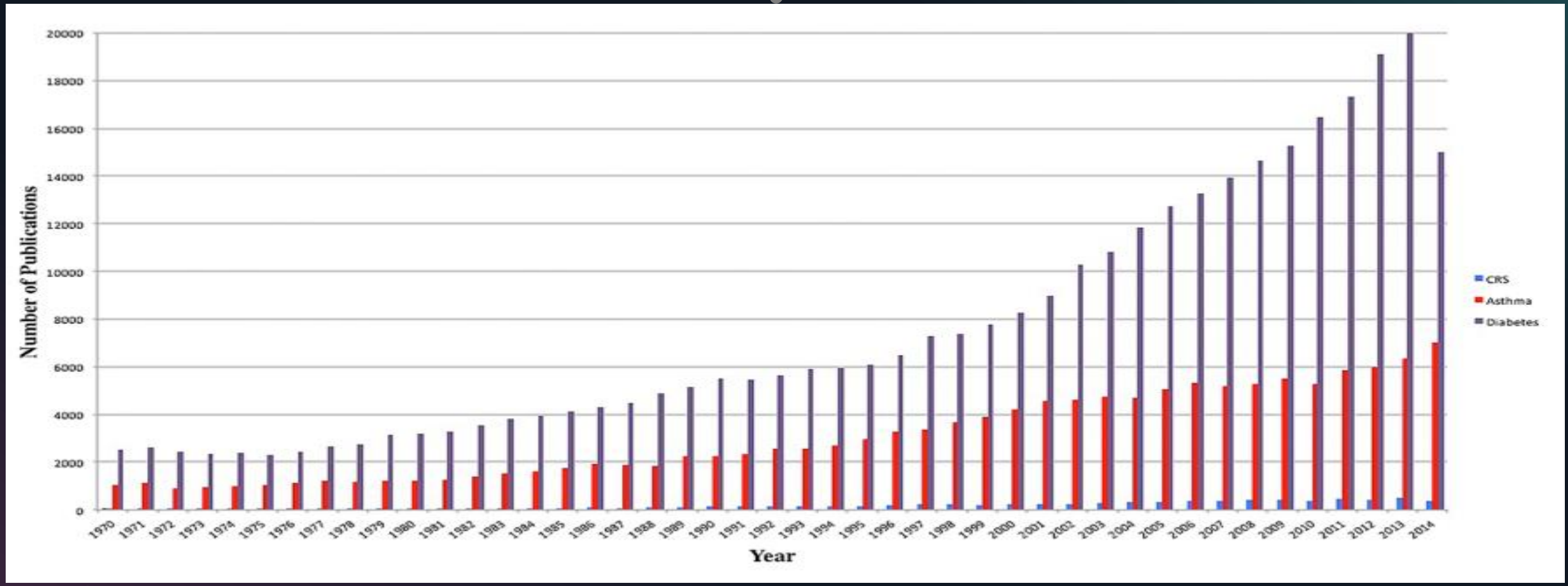


Quality and quantity of rhinology research

- Recent work has demonstrated significant advancement in the quality and quantity of rhinology research over the past 3 decades, with a 637% increase in number of rhinology publications, as well as an increased prevalence of prospective study designs and better overall study quality.
- Multiple-level pie-chart visualization of sinusitis-related projects currently (2017) supported by the NIH.
- Clustered representation of project terms by overall frequency and relationship.



Publications per year



Rhinosinusitis Epidemiology

- Rhinosinusitis occurs in 90% of individuals with the "common cold"
- Bacterial infection complicates ~2% of these cases

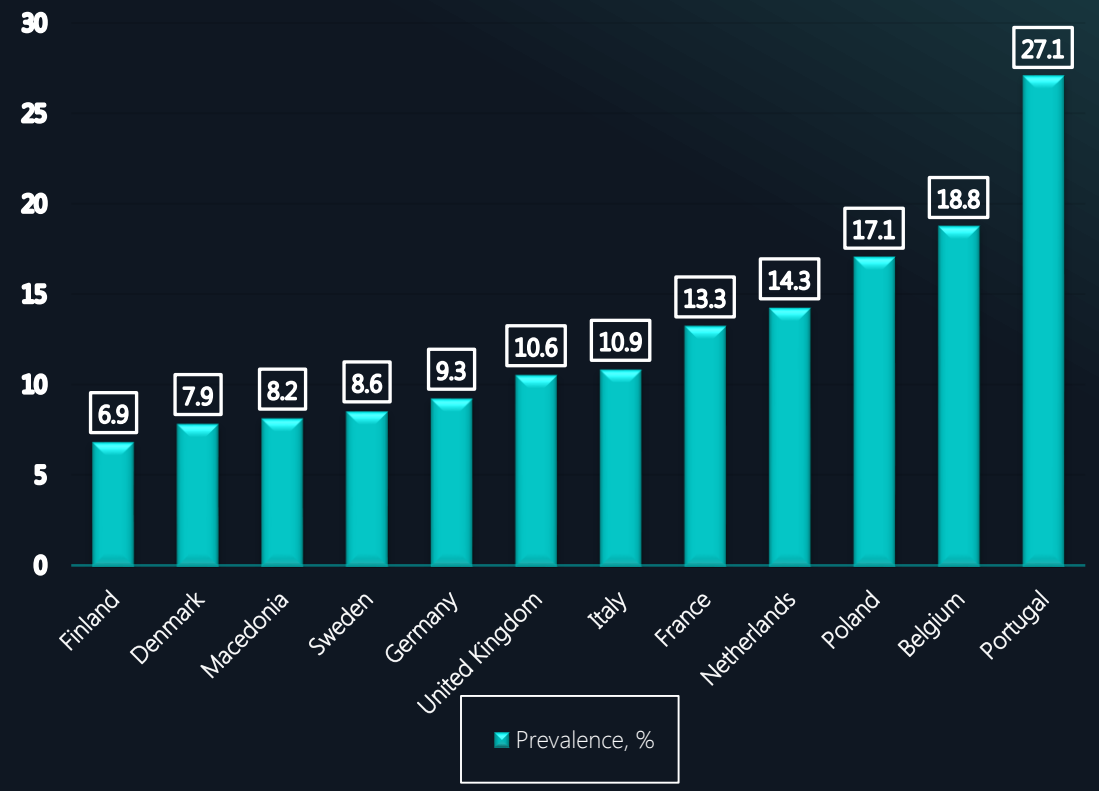
- In 2014, Brackwell et al. published the summary of health statistics for US adults using a population-based survey delivered in 2012. Rhinosinusitis was the ninth most condition in the USA with a prevalence rate of 12.1%.
- Rhinosinusitis affects more than 30 million individuals diagnosed each year. Sinusitis is more common from early fall to early spring.
- Rhinosinusitis affects an estimated 35 million people per year in the United States and accounts for close to 16 million office visits per year.

Prevalence of Acute Rhinosinusitis

European geographic variation of prevalence of CRS

Key Metrics

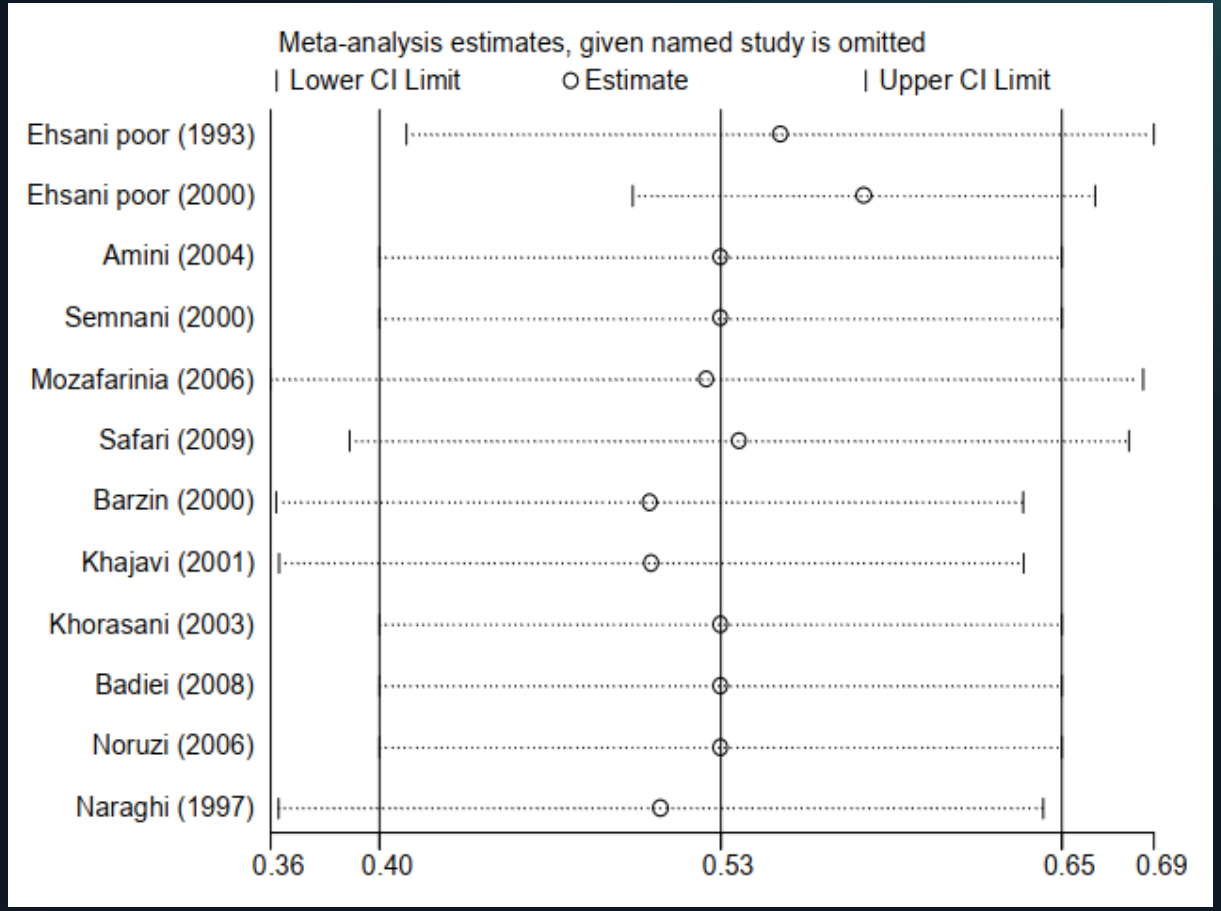
Country	Respondents	Prevalence, %
Finland	1809	6.9
Denmark	3340	7.9
Macedonia	3613	8.2
Sweden	26,675	8.6
Germany	3410	9.3
United Kingdom	3016	10.6
Italy	965	10.9
France	1385	13.3
Netherlands	3191	14.3
Poland	5711	17.1
Belgium	1851	18.8
Portugal	2162	27.1



The prevalence of sinusitis in Iran

Key Metrics

- The prevalence of sinusitis varied in different regions of Iran. In fact, the prevalence of sinusitis is 53% in northern Iran, 56%, in central Iran, and 48% in west of Iran.
- The minimum and maximum prevalence's of sinusitis were found in West and Central Iran, respectively.
- However, there cannot be an accurate estimate due to unequal distribution of studies in Iran.
- In the analysis conducted by age group of subject, it was concluded that the prevalence of sinusitis was 30% in patients under 20 years of age, 61% in patients aged 20 to 30 and 61% in adults over 30 years.
- The results indicated that with increasing age, the prevalence of sinusitis increased among the subjects who were more likely to develop sinusitis.



Mostafa Rezaei Tavirany et al
Der Pharmacia Lettre, 2016, 8 (5):31-39

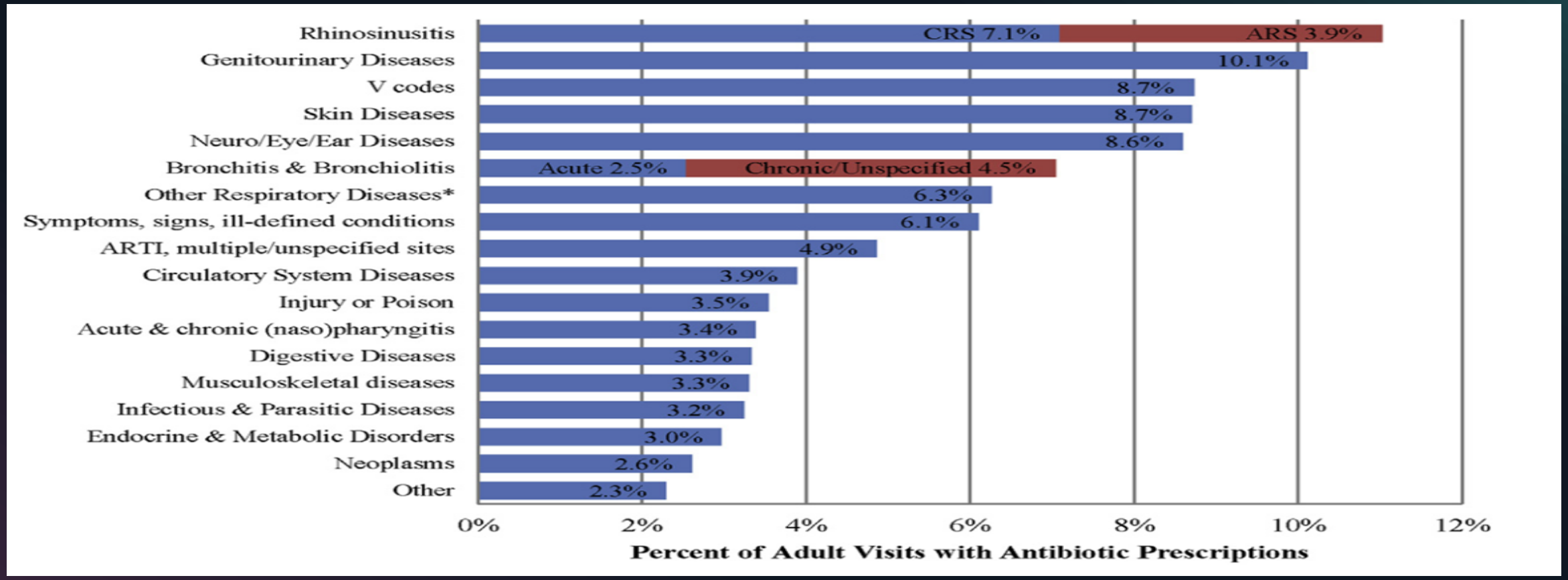
Rhinosinusitis

- Rhinosinusitis is the sixth leading cause of outpatient physician visits and is the diagnosis responsible for the most antibiotic prescriptions in the United States.
- Despite the lack of clear evidence supporting antibiotic use in sinusitis, approximately 85.5% of acute sinusitis and 69.3% of chronic sinusitis office visits resulted in an antibiotic prescription.

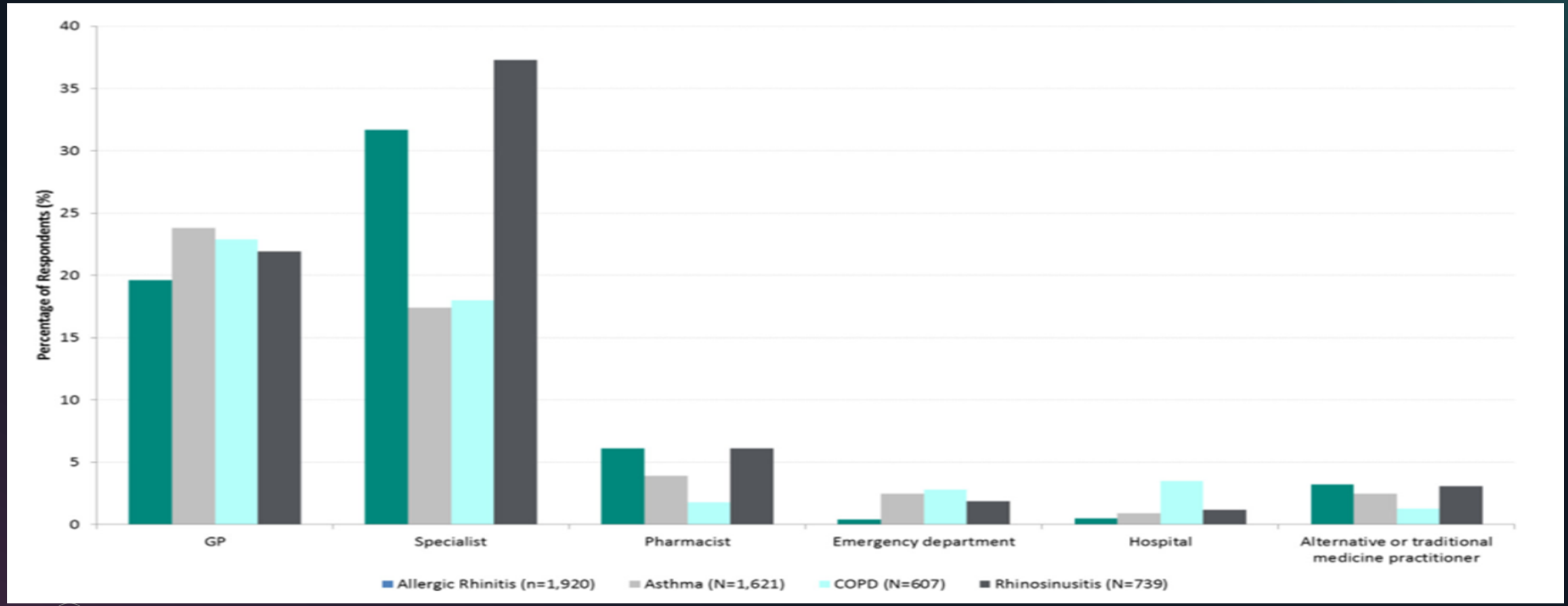
Overprescribing of antibiotics

- In the UK, 37%–63% of patients presenting with symptoms of sinusitis do not have reliably confirmed the diagnosis. Henceforth, a minor group of patients had dependably completed diagnosis by a physician.
- Regardless of the clinical ambiguity of bacterial cause of ARS and CRS in commonplace practice, antimicrobials prescribing rates in the UK, the Netherland and Norway were 92%, 80% and 67%, respectively.
- The reason for such overprescribing of antibiotics as there were no acceptable research studies were conducted for primary care patients for the microbiological aetiology of ARS and CRS even in developed countries.

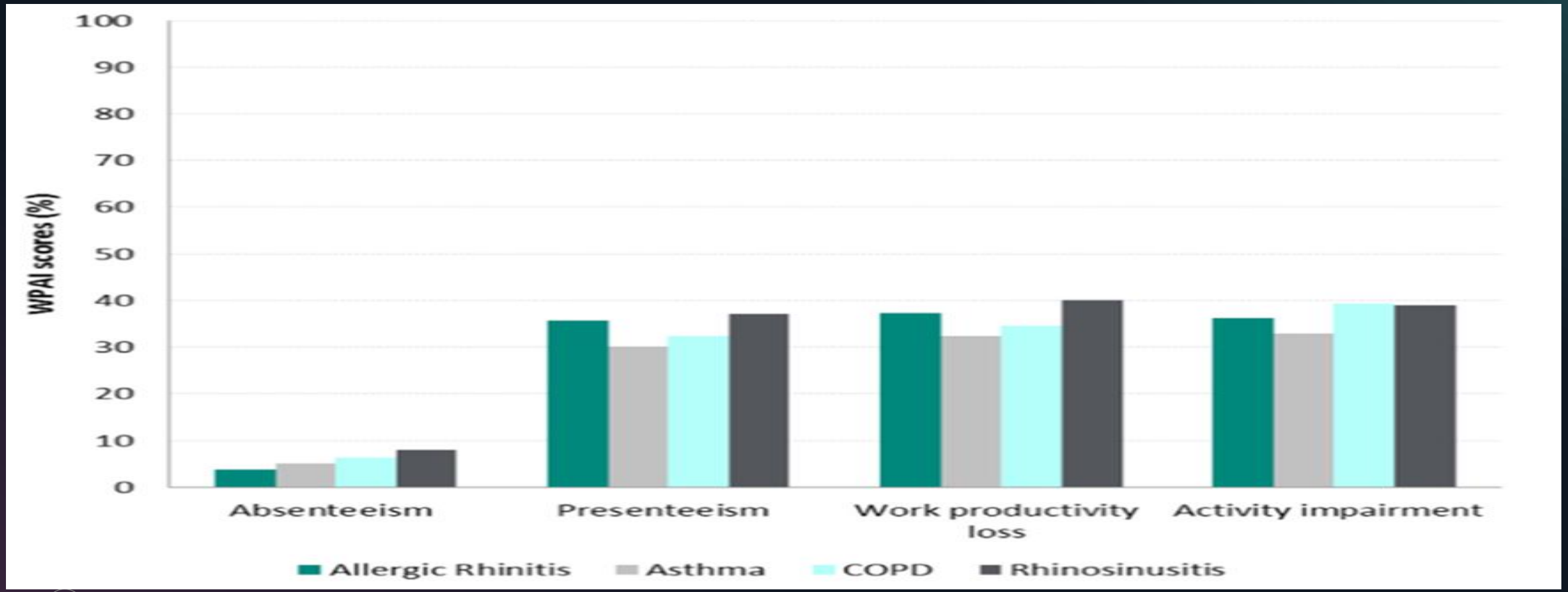
Overprescribing of antibiotics



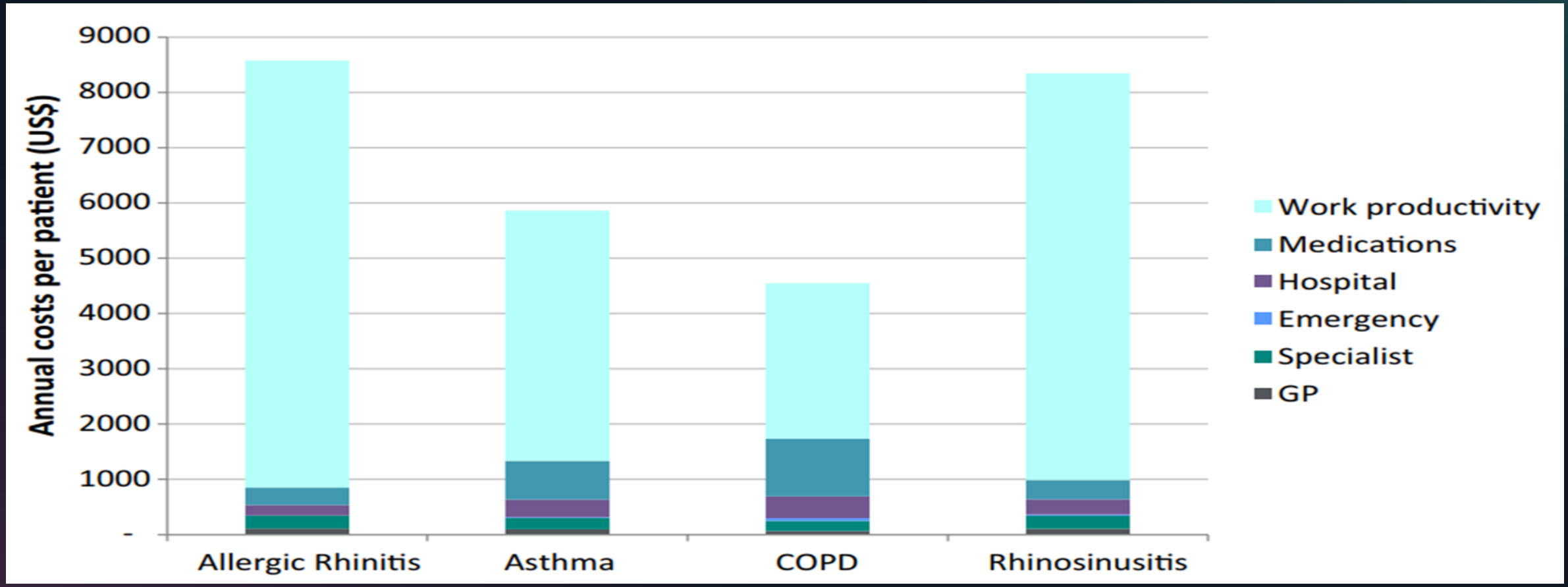
Percentage of patients by primary diagnosis



WPAI: work productivity and impairment



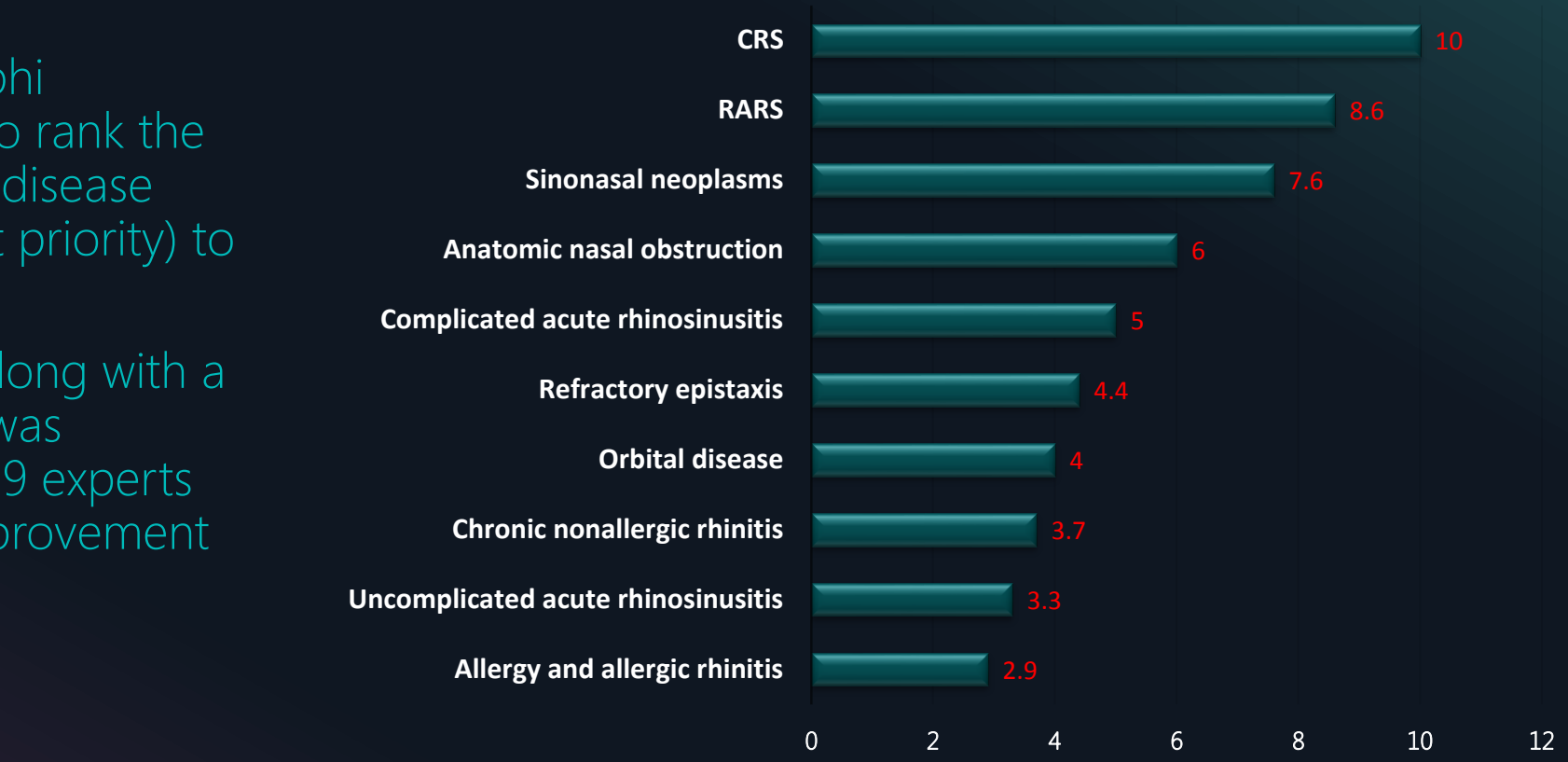
Annual direct and indirect costs for study population by primary diagnosis



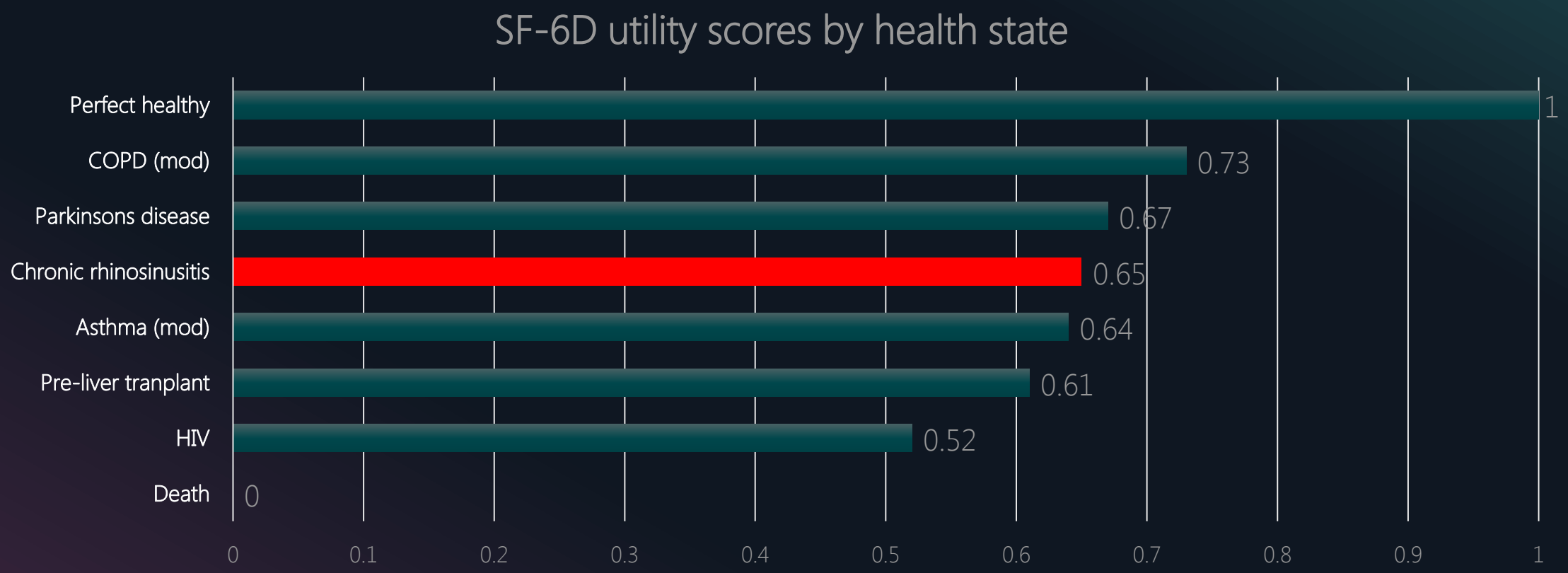
Questionnaire	Specific Or Generic	Type	Original Language	Number Of Score Domains	Items	Range
RSOM	Specific	Self-report	English	7	31	0–155
SNOT-22	Specific	Self-report	English	4-5	22	0–110
SNOT-20	Specific	Self-report	English	-	20	0–100
SNOT-16	Specific	Self-report	English	-	16	0–48
RhinoQoL	Specific	Self-report	English	3	17	0–100
SN-5	Specific	Self-report	English	-	5	5–35
SOQ	Specific	Self-report	English	5	26	0–130
RQLQ	Specific	Self-report/ Inter-viewer-administered	English	7	28	0–168
CSS	Specific	Self-report	English	2	6	0–100
EQ-5D	Generic	Self-report	Dutch, Swedish, English, Finnish, Norwegian	5	15	0–100
MPQ	Generic	Interviewer	English	20	78	0–78
SF-36	Generic	Self-report	English	8	36	0–100
SF-12	Generic	Self-report	English	8	12	0–100
GBI	Generic	Self-report	English	3	18	-100–100
CHQ-PF50	Generic	Self-administered	English	14	50	0–100

Ordinal ranking outcomes for quality improvement

- The RAND modified Delphi methodology was used to rank the priority of nine sinonasal disease categories from 1 (lowest priority) to 10 (highest priority).
- Two rounds of ranking along with a teleconference meeting was performed by a panel of 9 experts from the ARS Quality Improvement Committee.



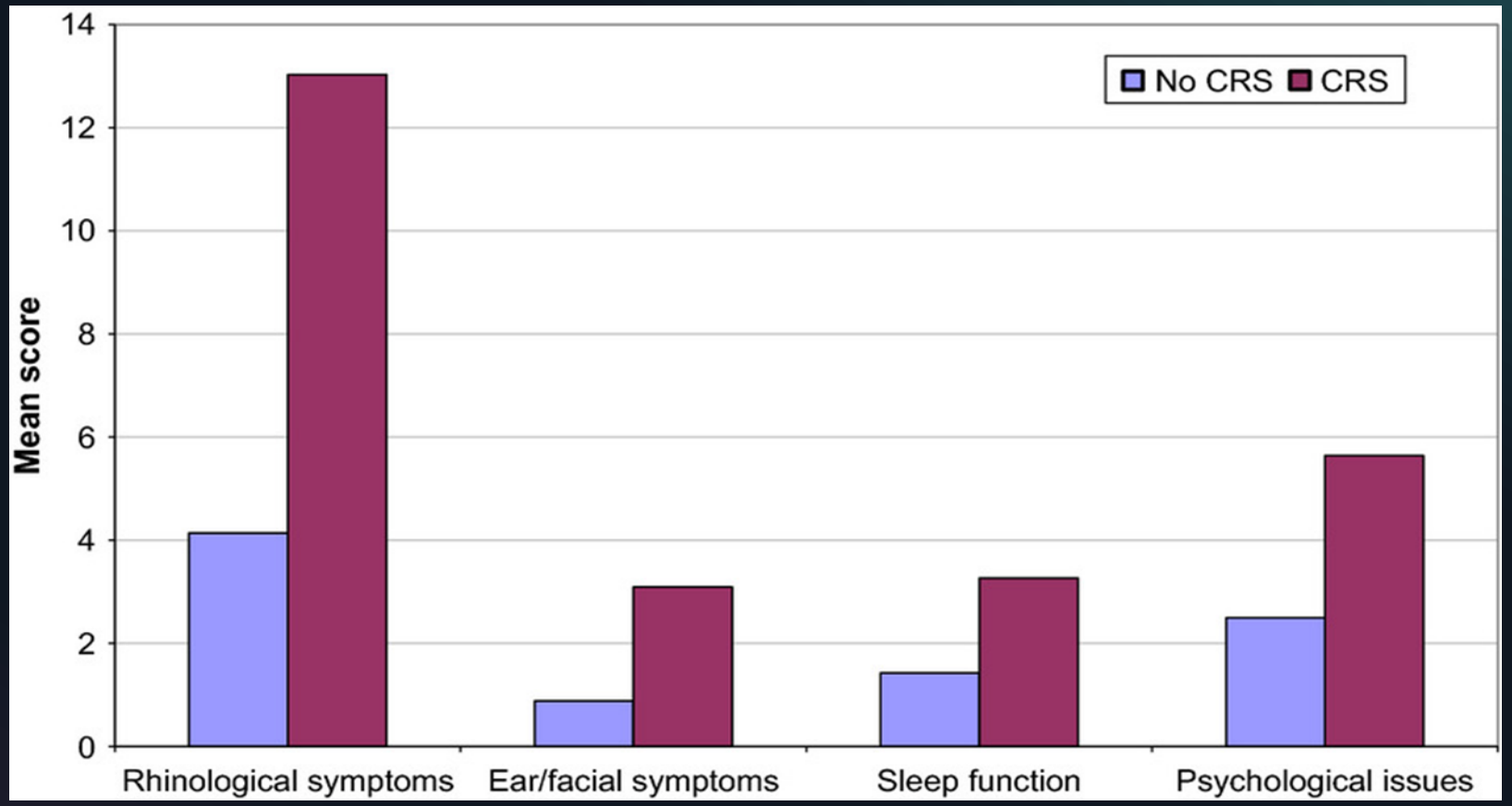
SF-6D


SF-6D utility scores by health state
Perfect healthy
COPD (mod)
Parkinsons disease
Chronic rhinosinusitis
Asthma (mod)
Pre-liver tranplant
HIV
Death
1
0.73
0.67
0.65
0.64
0.61
0.52
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

SNOT-22 mean scores for each subgroup

- The four subscales in the SNOT-22 showed that persons with CRS were significantly more troubled in all four subscales and especially in the rhinological symptoms

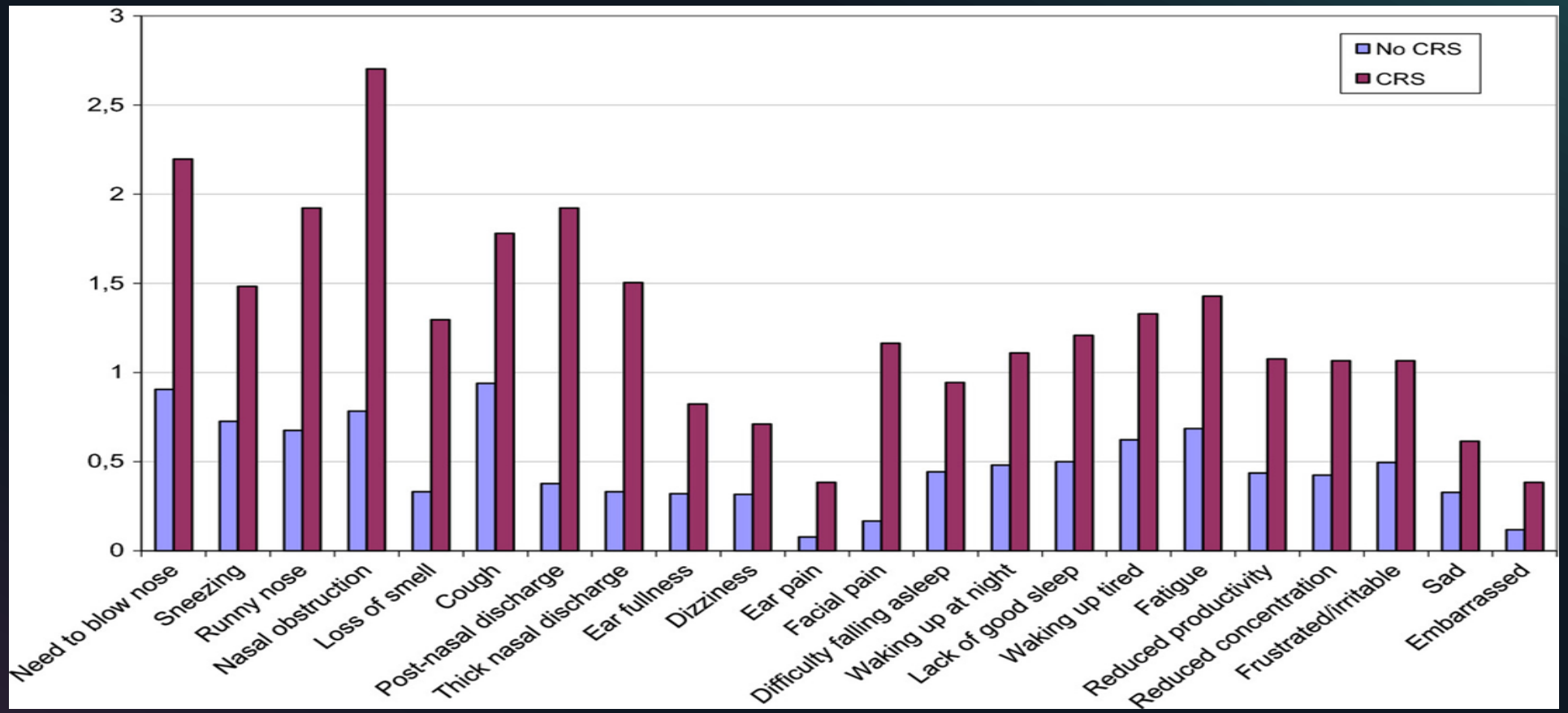
The mean sum score for each SNOT-22 subgroup comparing persons with and without CRS



Sinonasal Outcome Test-22

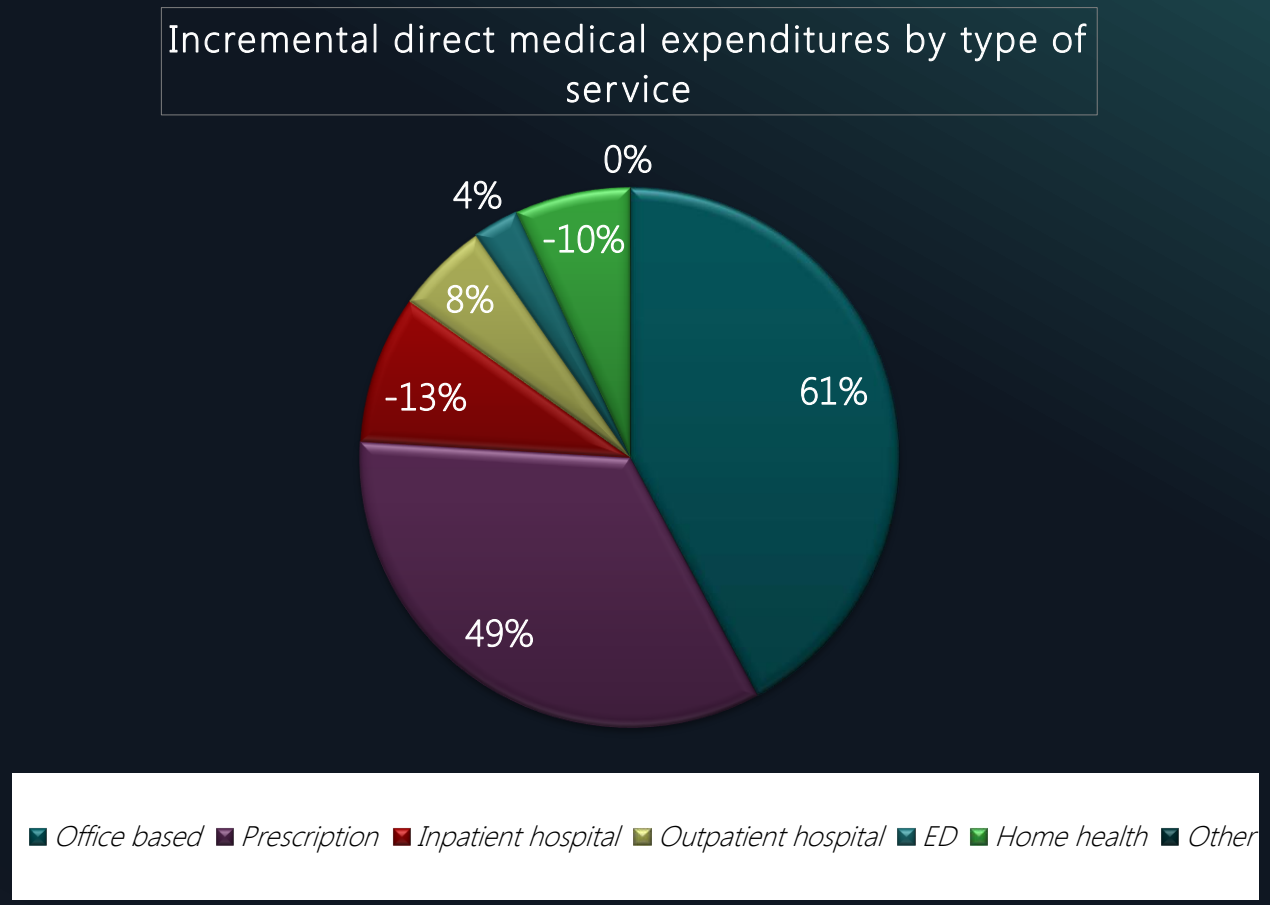
- The difference was significant across all items

The mean sum score for each SNOT-22 item comparing persons with and without CRS

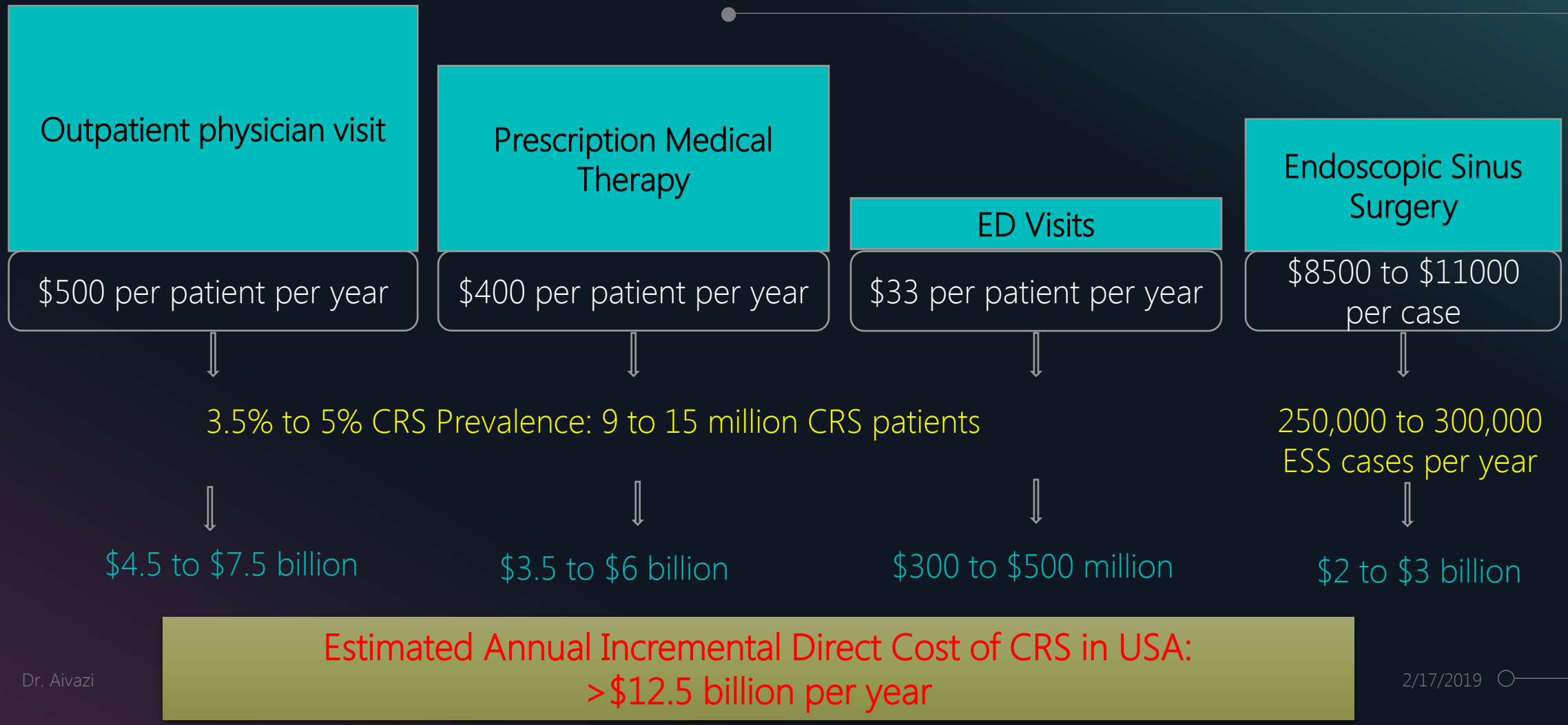


Total annual direct COI (2011 USD) of CRS by category of service (attribution model)

Direct cost	CRS	Non-CSR	Incremental
Office based	1,683	1,180	503
Prescription	1,563	1,160	403
Inpatient hospital	1,364	1,470	-106
Outpatient hospital	520	454	66
ED	222	189	33
Home health	112	194	-82
Other	96	96	0
Total	5,560	4,742	818

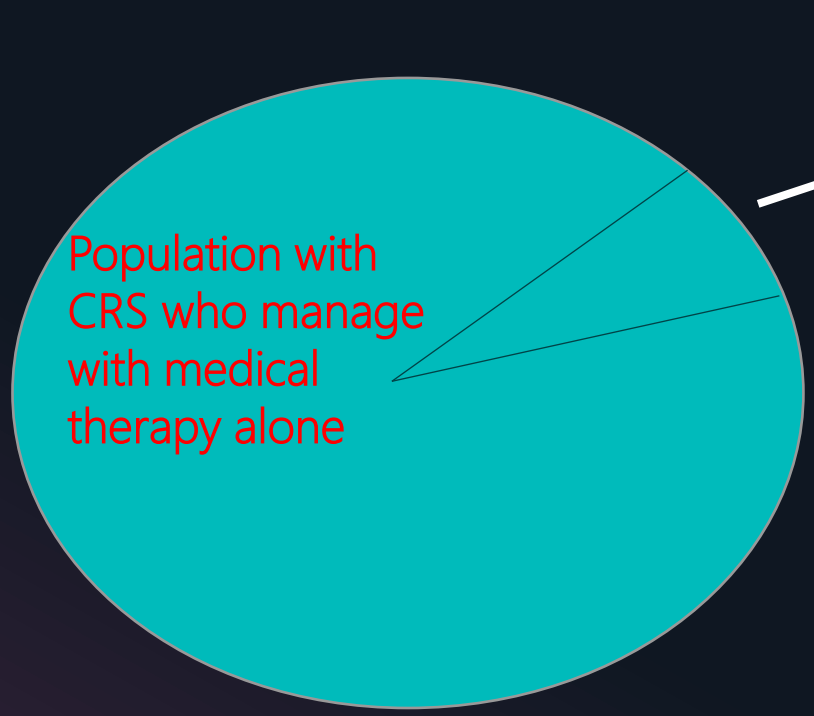


Estimated annual incremental direct costs attributed to CRS in the USA



Estimated Annual Incremental Direct Cost of CRS in USA:
>$12.5 billion per year

Estimated annual indirect costs attributed to CRS in the USA



$10,000 indirect cost per patient per year

250,000 to 300,000 ESS cases per year

$2.5 to $3 billion per year

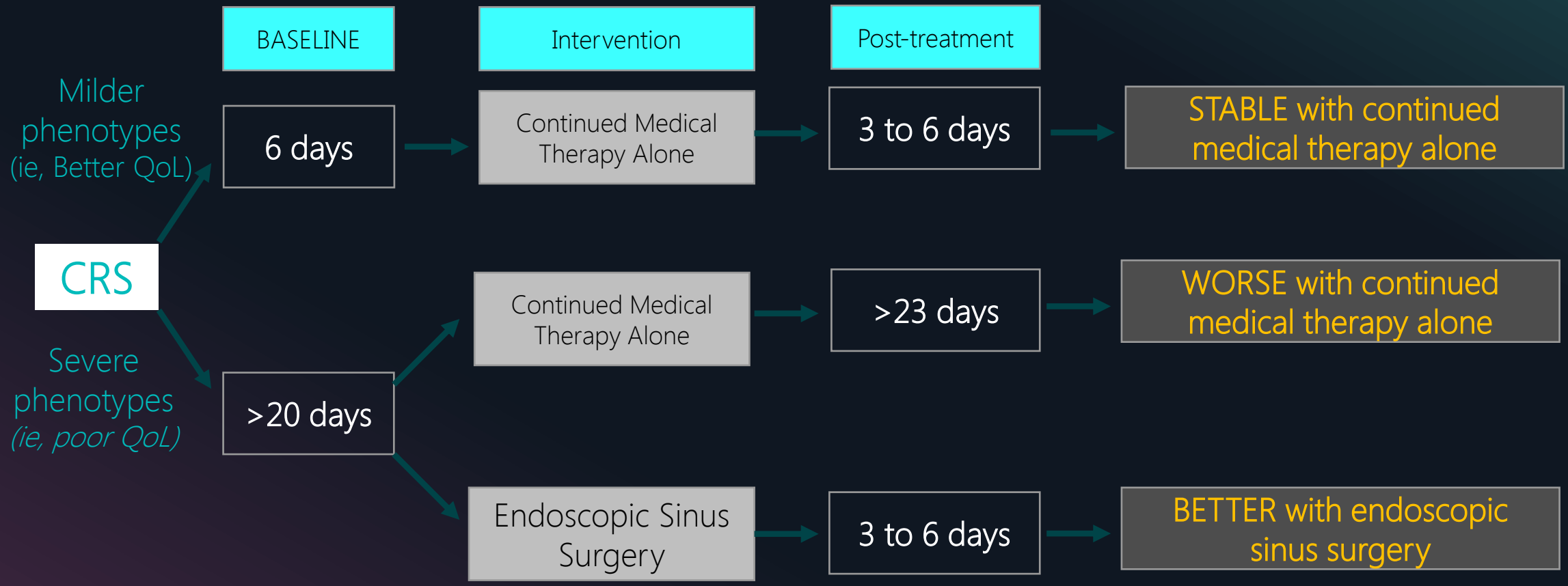
$2,000 to $3,000 indirect cost per patient per year

9 to 15 million CRS patients

$18 to $45 billion per year

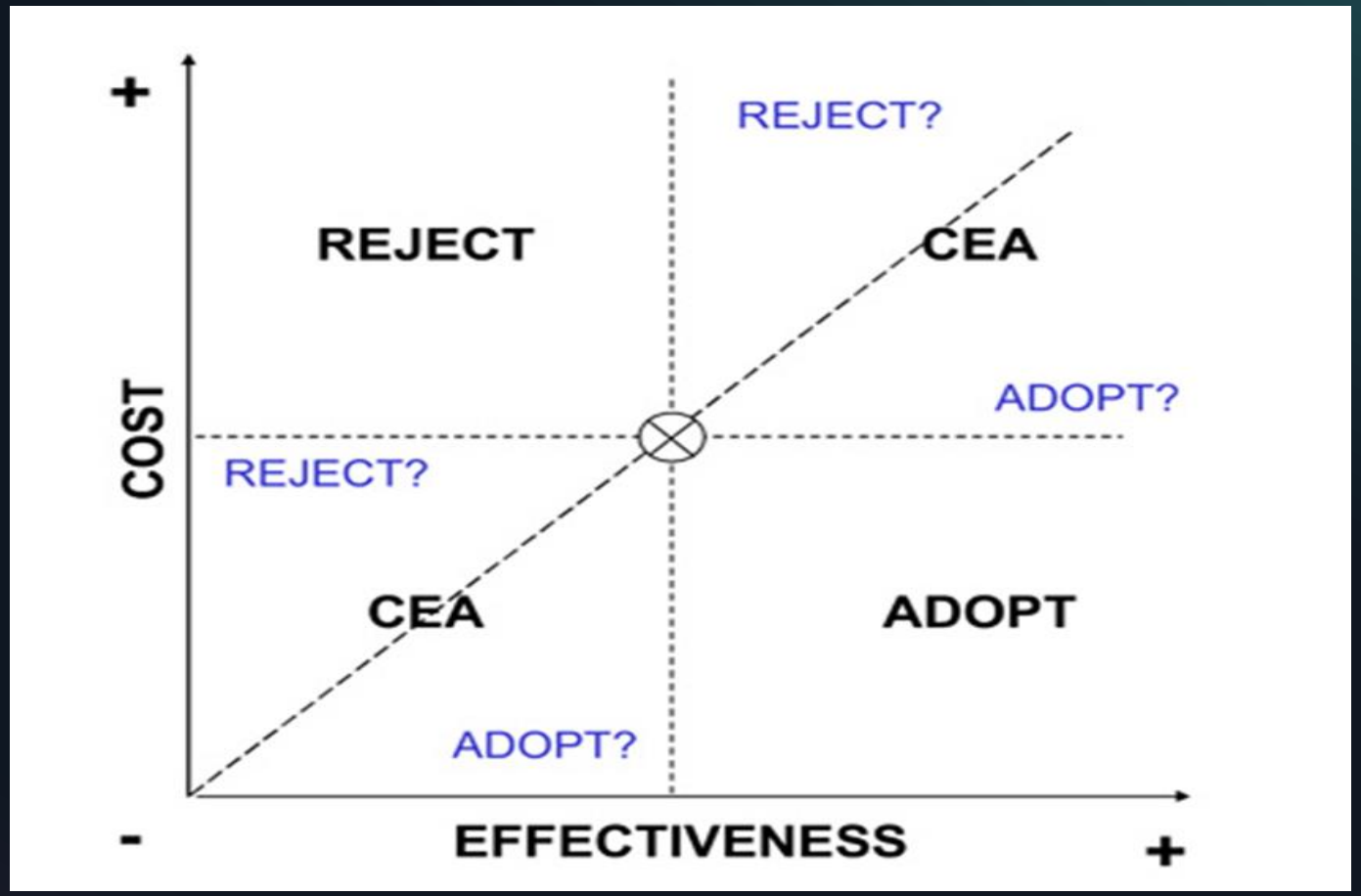
Estimated Annual Indirect Cost of CRS in USA: >$20 billion per year

Impact of medical therapy alone and ESS on indirect costs (work productivity) for CRS



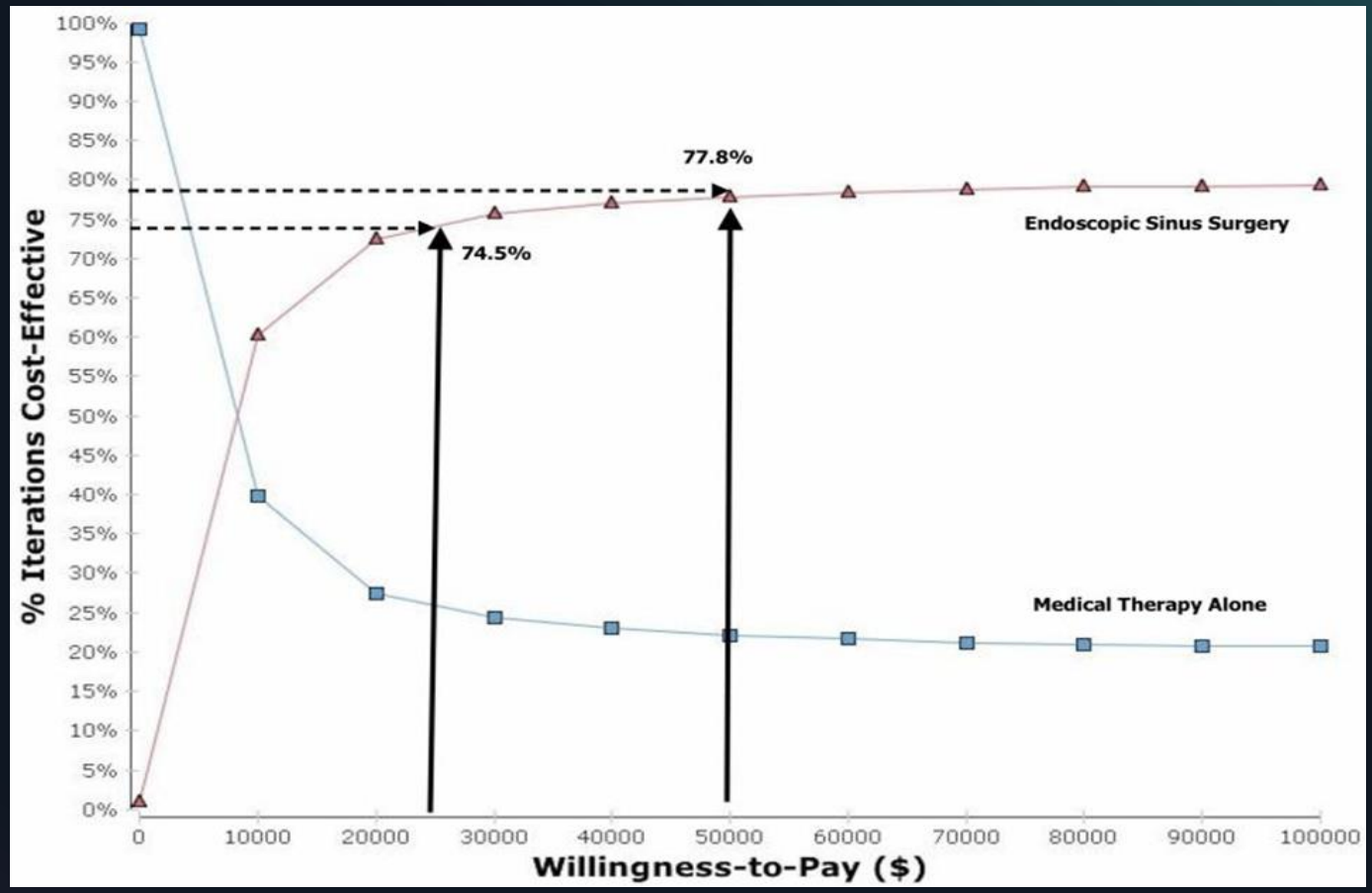
Incremental cost effectiveness ratio scatter plot on the cost-effectiveness plane

- Results from this study suggest that employing an ESS treatment strategy is the most cost-effective intervention compared to continued medical therapy alone for the long-term management of patients with refractory CRS.



Economic Evaluation of Endoscopic Sinus Surgery Versus Continued Medical Therapy for Refractory Chronic Rhinosinusitis

- The reference case demonstrated that the ESS strategy cost a total of $48,838 and produced a total of 20.50 QALYs. The medical therapy alone strategy cost a total of $28,948 and produced a total of 17.13 QALYs.
- The incremental cost effectiveness ratio for ESS versus medical therapy alone is $5,901 per QALY.



Summary of economic evaluations for ESS versus continued medical therapy alone for refractory CRS

Key Metrics

Study/year	Economic perspective	Methodology	Time horizon	Reference case discounting	Reference case ICER	Certainty of outcomes based on PSA
Rudmik et al. 2015	US third-party payer	Markov decision-tree mode	30 years	Cost=3.5% Effectiveness: 0%	$5901/QALY	74%
Scangas et al. 2016	US third-party payer	Markov decision-tree mode	31 years	Cost=3% Effectiveness: 3%	$13,851/QALY	98%
Scangas et al. 2017	US third-party payer	Markov decision-tree mode	36 years	Cost=3% Effectiveness: 3%	$5687/QALY	95%

Rhinology-related disease	Prevalence of disease	Annual direct and indirect cost
Uncomplicated acute rhinosinusitis	12% to 15% of adults	Direct: 5.1 million ambulatory office visits; direct cost range between $200 to $500 per patient per episode. Indirect: Estimated to be $250 to $8005 per patient per episode
Complicated acute rhinosinusitis	2.5 to 4.3 episodes per million population	Direct: In children estimated top be $21,000 per episode. Indirect: Unknown; however, expected to be larger than direct cost given prolonged hospital admission and recovery period
RARS	0.035% in MarketScan database	Direct: Estimated to be $1900 to $2100 per patient per year.Indirect: 4.4 work days missed per patient per year
CRS	3% to 11% of adults	Direct cost: Estimated overall cost of $12 billion per year in the United States. Indirect cost: Estimated overall cost of >$20 billion per year in the United States
Allergy and allergic rhinitis	10% to 30% of adults; 40% of children	Direct: Estimated overall cost of $3.4 billion per year in the United States.Indirect: Estimated overall cost of $2.4 to $11.6 billion per year in the United States
Chronic nonallergic rhinitis	15% of the U.S. population	Highly variable given the heterogeneous group of nonallergic etiologies of rhinitis
Refractory epistaxis	Epistaxis accounts for 1/200 ED encounters and 20% of all epistaxis patients will be refractory to first-line control (ie, cauterization or anterior packing)	Direct: Hospitalization with posterior packing for 3 days estimated to be $7000 to $8300 per patient per episode; SPA ligation range between $6,500 to $12,500 per procedure; arterial embolization $22,300 per procedure. Indirect: Unknown; common to miss 3 to 5 days of work
Anatomic nasal obstruction	Septal deviation: up to 90% of population but 30% of people with septal deviation are symptomatic	Direct: Septoplasty with turbinate reduction range between $1700 and $7000 per procedure. Indirect: Unknown; often 3 to 7 days lost work for recovery
Sinonasal neoplasms	1% of all malignancies; 3% to 5% of head and neck malignancies	Direct: Endoscopic pituitary adenoma resection estimated to be $17,000 to $24,000 per procedure; endoscopic anterior skull-base resection expected to exceed $30,000 per procedure. Indirect: Unknown; depends on diagnosis (benign vs malignant) and extent of surgery required; head and neck cancer indirect cost estimated to be in excess of $200,000 per patient
Orbital disease	Prevalence of symptomatic acquired/adult epiphora25 = 0.5%; prevalence of Grave's orbitopathy27 = 0.1% of population	Direct: Epiphora = unknown; Graves orbitopathy estimated to be $11,000 to $13,00 per case. Indirect: Epiphora estimated to be $5500 per patient per year

- I can’t do anything for you but I’d still like to see you every two weeks until you run out of money

THANK YOU!

Dr. M. Ali Aivazi

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