Clalit Research Institute

Real people. Real data. Real change.

Integrating Digital Health into Clinical Practice

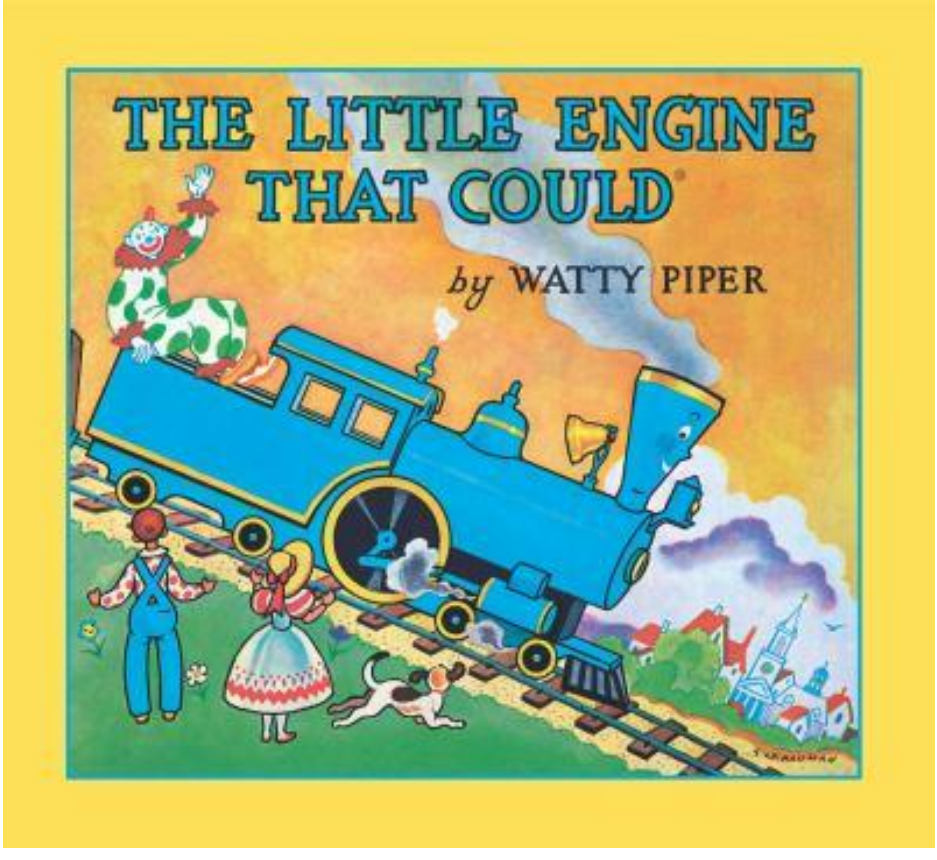
Maya Leventer-Roberts, MD, MPH

Deputy Director, Clalit Research Institute, Israel

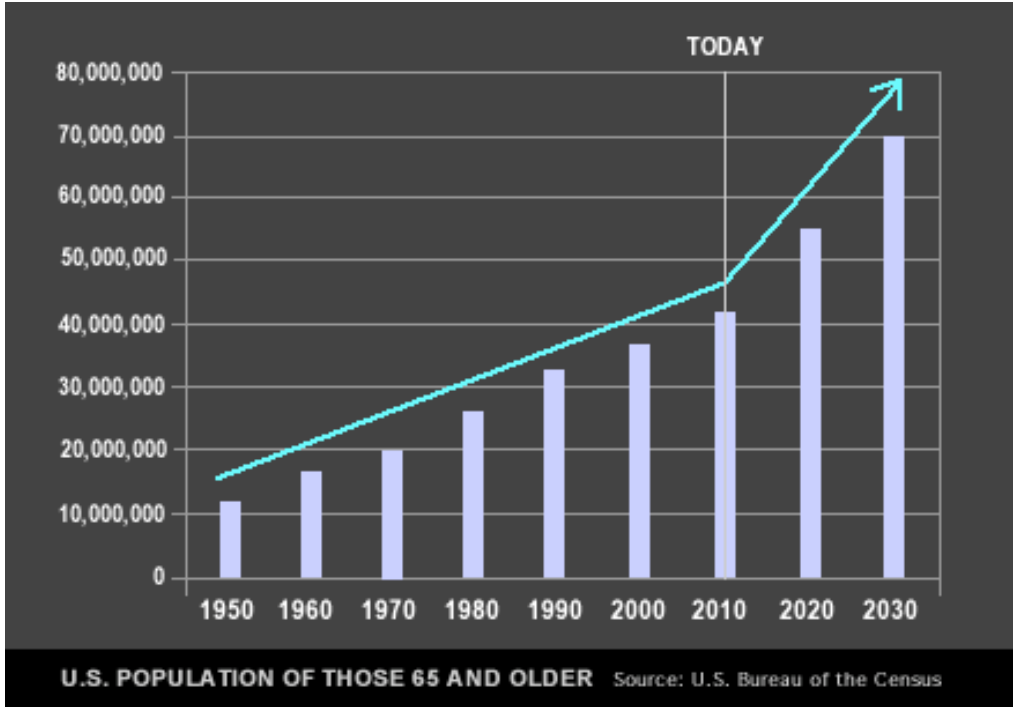
The Web of Health, 15 May 2019

The Web Conference, San Francisco

Arnold Munk


THE LITTLE ENGINE THAT COULD
by WATTY PIPER

Challenge #1:
High demand.



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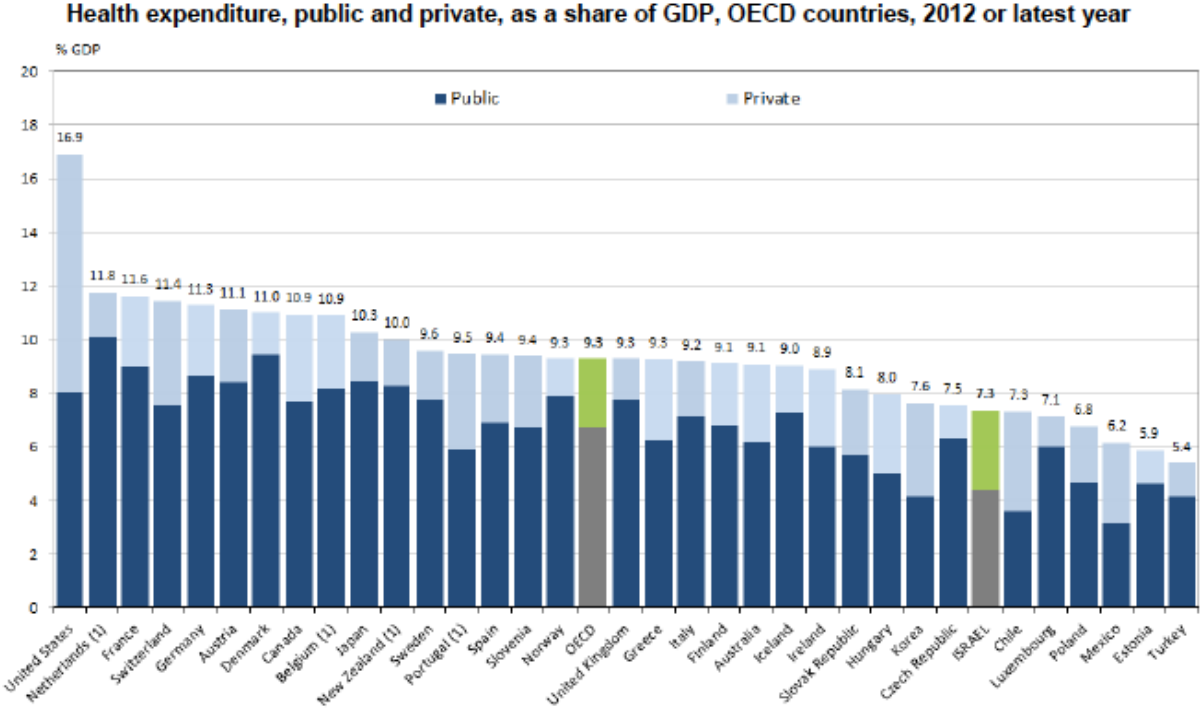
Challenge #2:
High cost.



Source: OECD

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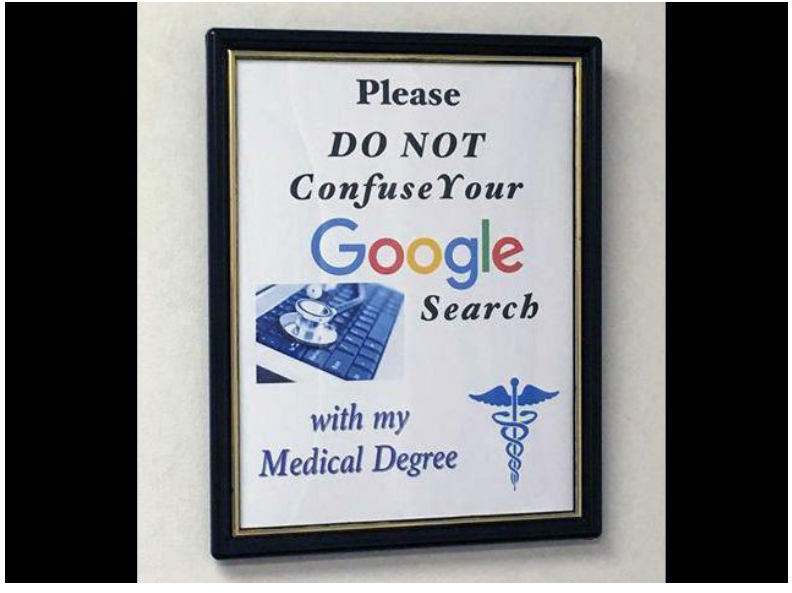
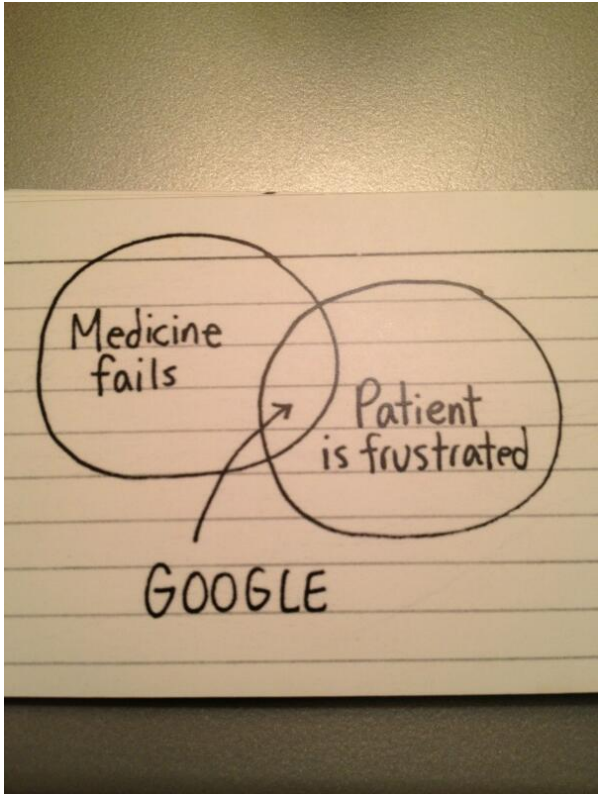
Challenge #3:
Doctors and patients are struggling.



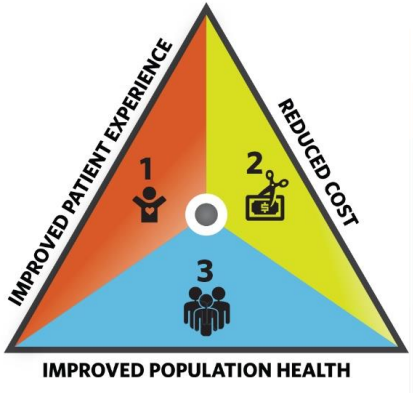
The system is struggling.

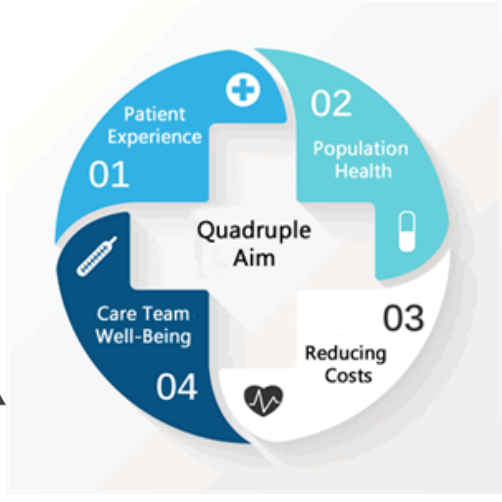


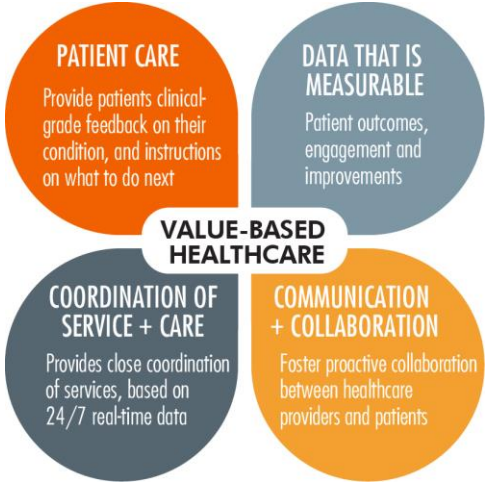
People are turning elsewhere for help.

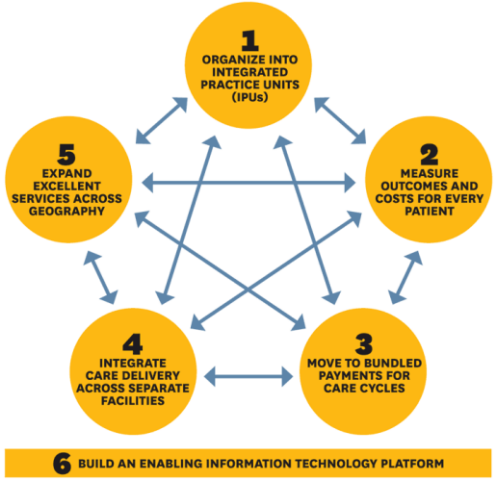
We all want:
Better care, for more people, in a new era.

There are many models suggesting this should work.









Source: IHI, Europuls, HBR

Healthcare can be elegant.

But how does that happen, exactly?

OO + NT = EOO

Source: Michael Hammer

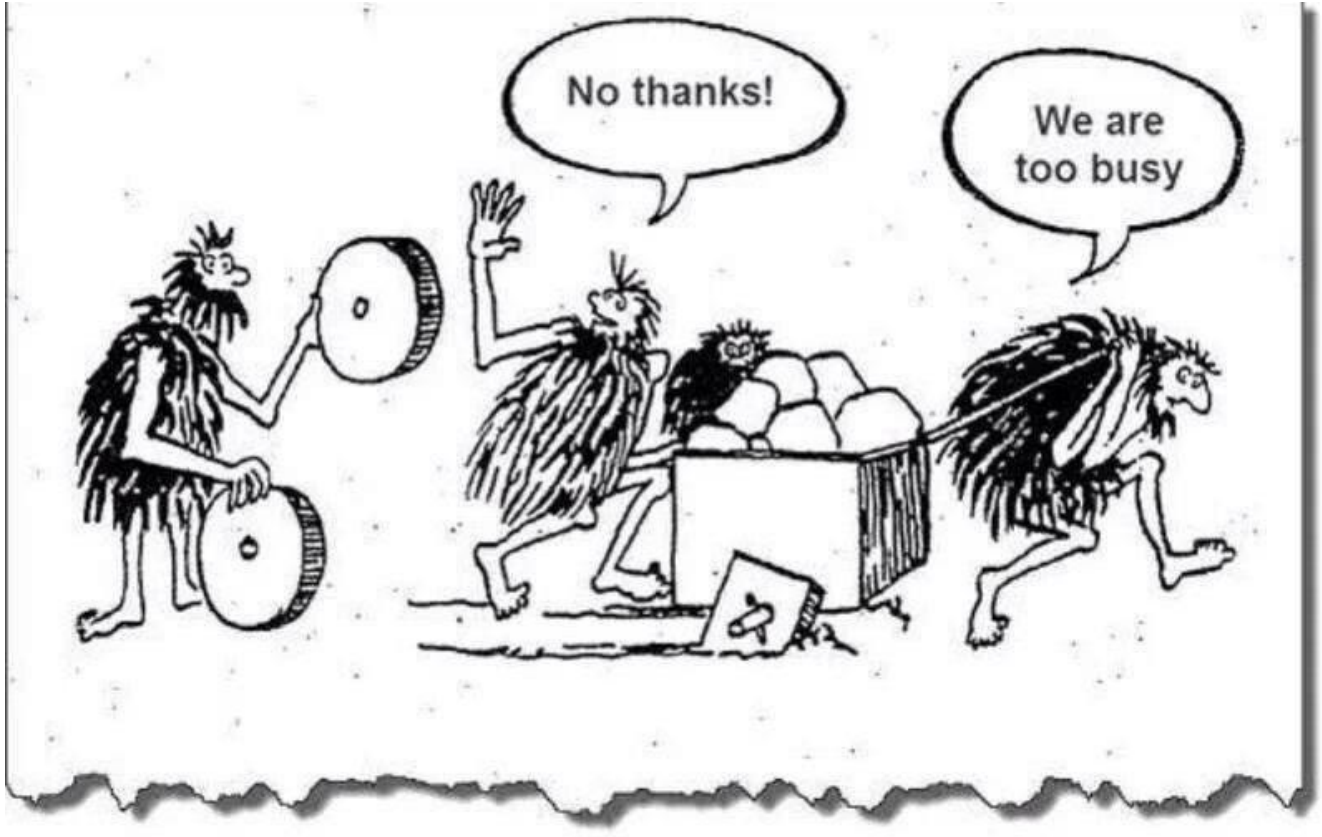
OO + NT = EOO

Old organization + New Technology =

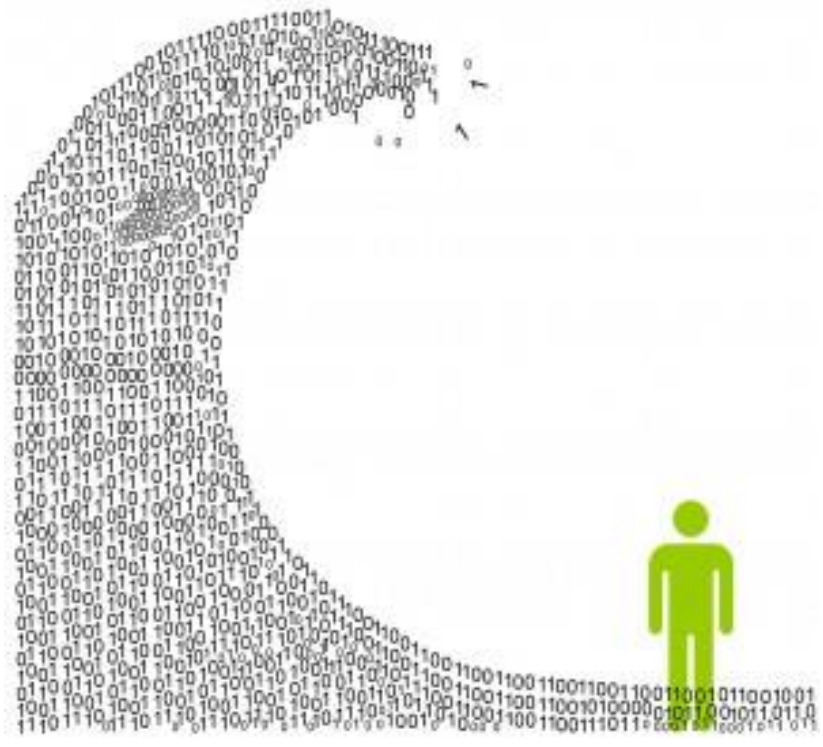
Expensive old organization

Source: Michael Hammer

Change is hard to embrace.



Reality is hard to embrace.



We are here.

Diverse landscape

National Health Insurance Law

Mandatory, universal coverage

Every one of the over 8 million residents belongs to one of four health funds

Single, comprehensive system

Every fund provides the same basic services, which are updated yearly by an independent committee

Universal access

Funded by the government through capitation

Clalit Health Services

Largest health fund:

- 4.5+ million members
- 53% of population
- >1,500 clinics
- 14 hospitals

Potential for excellence

Comprehensive digital warehouse

Hospital inpatient, ED and discharge data

Community primary care clinic data

Laboratory data

Administrative data (costs)

Allied health services data

Pharmacy, medications data

Disease registries

Diagnostic and imaging data

Linked to Ministry of Health

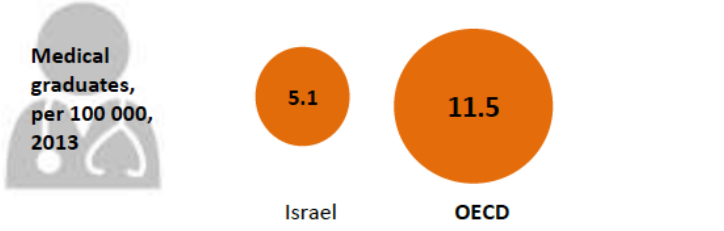
National Cancer registry

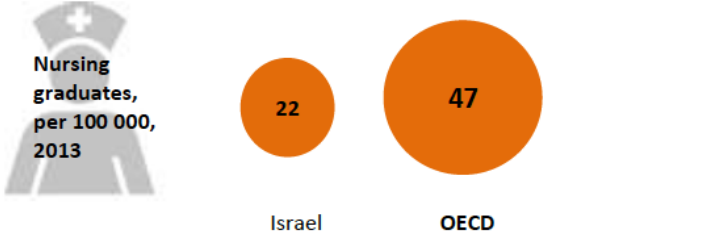
Dental, complementary health services data

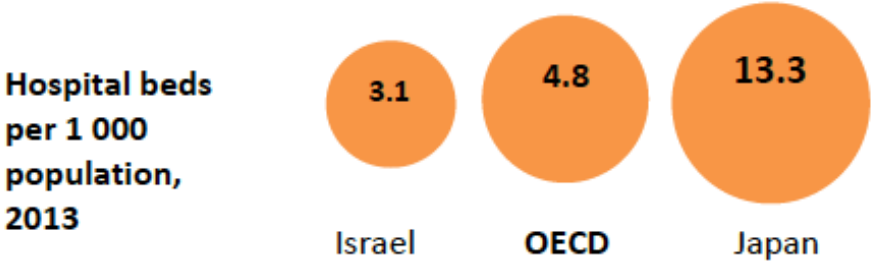
Linked to national database

Socio-demographic data

Resources are scarce.







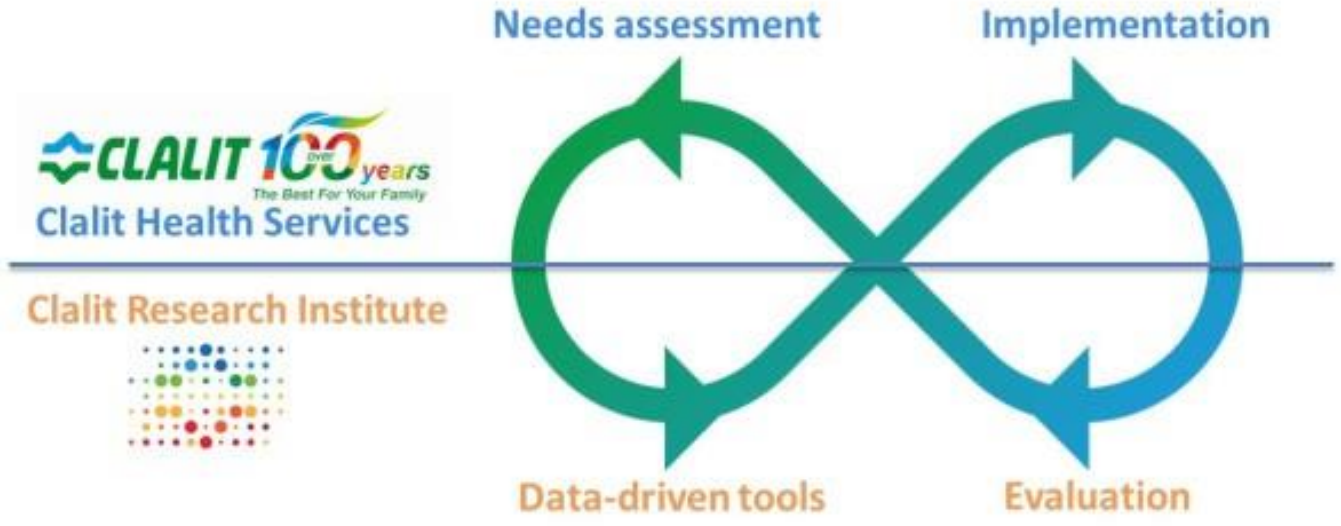
Source: Taub Center

Even with all our potential, we were missing something.

Clalit Research Institute

- Established in March 2010, nearly 100 years after Clalit
- Mandate: Turn data to insights, insights to policy
  - Real world outcomes
  - Risk stratification
  - Personalization
- Interdisciplinary teams
- Multidisciplinary collaborations

Clalit Research Institute



Our method of integration

- Deliver the right intervention,

Using real world outcomes to guide clinical decision support

- at the right time,

Empowering providers to intervene efficiently with risk stratification

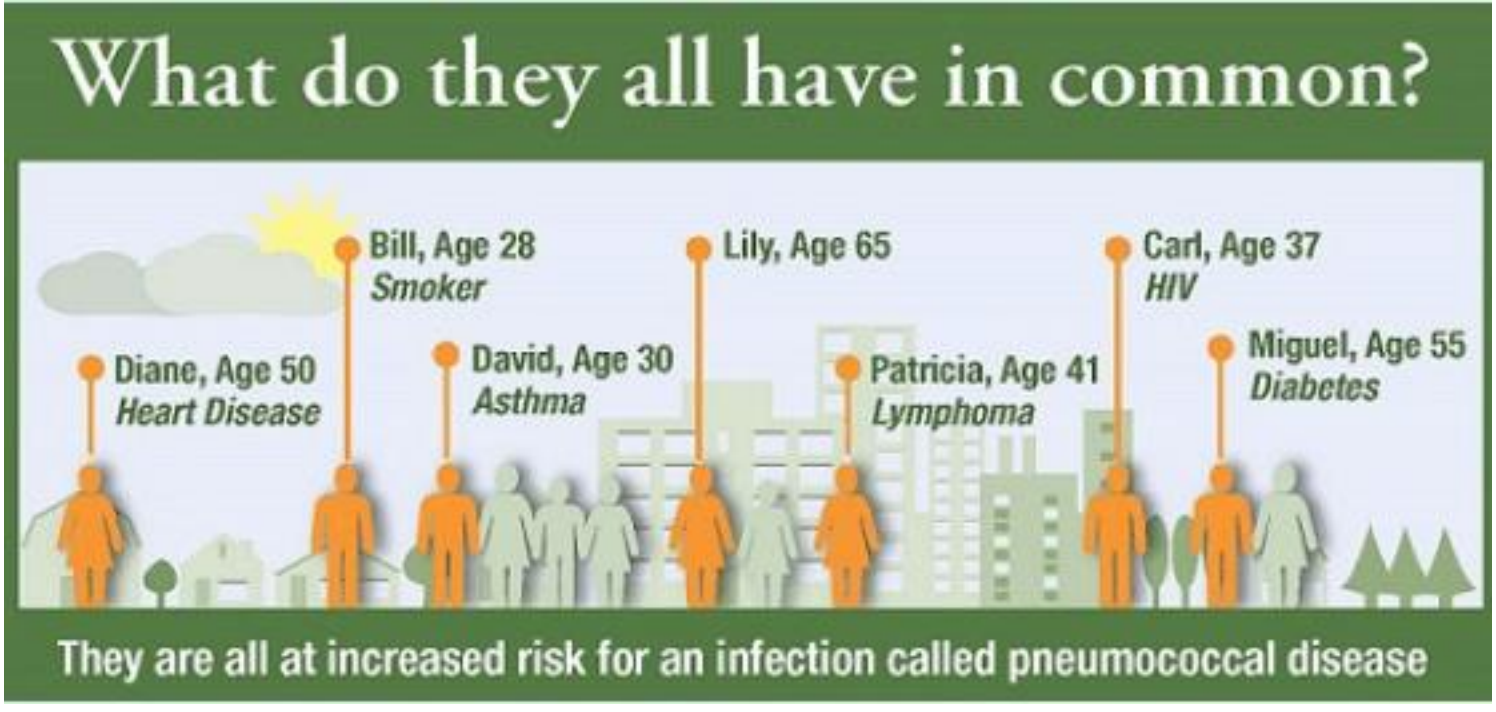
- to the right patient.

Integrating personalization into clinical practice

Clalit Research Institute

Real World Outcomes

Pneumococcal disease



Source: CDC

Medscape Multispecialty

News & Perspective Drugs & Diseases CME & Education

Journal Watch > Journal Watch (General)

Pneumococcal Polysaccharide Vaccine: Efficacy Remains Controversial

Allan S. Brett, MD

Disclosures

Does the vaccine work or not?

Effectiveness of 23-Valent Pneumococcal Polysaccharide Vaccine Against Invasive Disease and Hospital-Treated Pneumonia Among People Aged ≥65 Years: A Retrospective Case-Control Study

Maya Leventer-Roberts,[1,2] Becca S. Feldman,[1] Ilan Brufman,[1] Chandra J. Cohen-Stavi,[1] Moshe Hoshen,[1] and Ran D. Balicer[1,3]

[1]Chief Physician's Office, Clalit Health Services, Clalit Research Institute, Tel Aviv, Israel; [2]Department of Preventive Medicine, Icahn School of Medicine at Mount Sinai, New York, New York; and [3]Department of Epidemiology, Faculty of Health Sciences, Ben Gurion University, Be'er Sheva, Israel

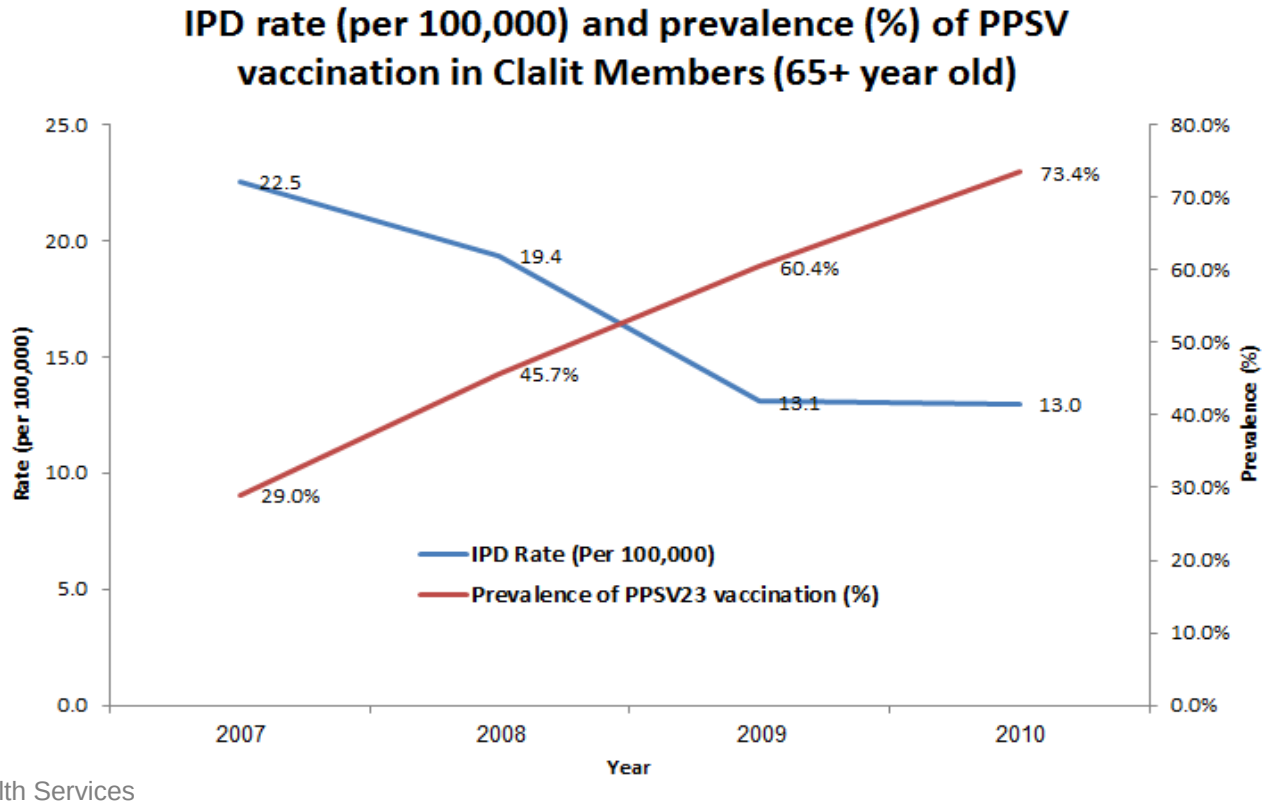
Table 3. Odds Ratio for Invasive Pneumococcal Disease and Hospital-Treated Pneumonia Morbidity in Patients Vaccinated With 23-Valent Pneumococcal Polysaccharide Vaccine, Matched by Age, Sex, and Risk

	IPD			HTP		
Group	No. of Subpopulation (No. of Cases)	Adjusted[a] OR (95% CI)	*P* Value	No. of Subpopulation (No. of Cases)	Adjusted[a] OR (95% CI)	*P* Value
Age group, y						
65–74	420 (84)	0.54 (.32–.90)	.02	20 217 (6739)	1.12 (1.03–1.21)	.01
≥75 (75–84, ≥85)	615 (123)	0.80 (.53–1.22)	.30	49 521 (16 507)	0.97 (.92–1.01)	.18
Risk group						
Low	200 (40)	0.63 (.30–1.33)	.23	9140 (1951)	1.00 (.85–1.16)	.56
Moderate + high	835 (167)	0.70 (.49–.99)	.05	60 598 (21 295)	1.01 (.97–1.06)	.97

Abbreviations: CI, confidence interval; HTP, hospital-treated pneumonia; IPD, invasive pneumococcal disease; OR, odds ratio.

[a] All models adjusted for ethnicity, socioeconomic status, John Hopkins Adjusted Clinical Groups morbidity, smoking status, pre-existing pulmonary disease, influenza vaccination, previous general hospitalization, and hospitalization in long-term care.

It works in practice.



Source: Clalit Health Services

It works however you target it.

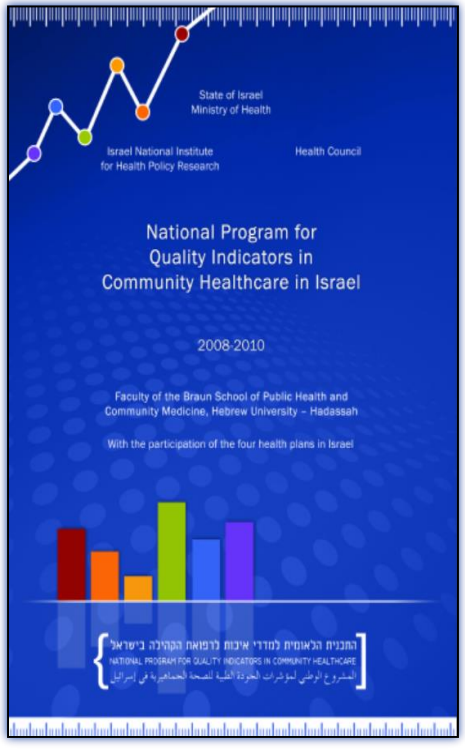
Vaccine
Volume 32, Issue 8, 12 February 2014, Pages 990–995

Pneumococcal vaccine targeting strategy for older adults: Customized risk profiling

Ran D. Balicer[a,b], Chandra J. Cohen[a], Morton Leibowitz[a], Becca S. Feldman[a], Ilan Brufman[a], Craig Roberts[c], Moshe Hoshen[a]

	Vaccination strategy	% of 50+ population targeted (n=526,717)	% of HTP cases in 2009-10 identified (n=10,423)	% of IPD cases in 2009-10 identified (n=90)	% of CTP cases in 2009-10 identified (n=4,603)
1	High and Moderate risk groups and all aged 65+	66% (347,008)	94% (9,818)	89% (80)	78% (3,572)
2	High and Moderate ACIP-based risk groups	51% (268,616)	83% (8,609)**	80% (72)	65% (2,980)*
3	Clalit model, 51% highest risk scores	51% (267,744)	85% (8,896)**	80% (72)	66% (3,045)*
4	ACIP-based highest risk group (Immunosuppressed)	17% (88,142)	35% (3,634)‡	41% (37)	21% (971)‡
5	Clalit model, 17% highest risk scores	17% (87,853)	54% (5,667)‡	46% (41)	27% (1,246)‡
6	Clalit model, 8.6% highest risk scores	8.6% (45,521)	35% (3,634)	31% (28)	15% (692)
7	Clalit model, 5% highest risk scores	5% (25,580)	23% (2,390)	18% (16)	9% (421)

The vaccine remains a national priority.



Pneumoccocal vaccination for older adults

Description: The percentage of individuals aged 65–71 years who received a pneumococcal vaccination.

Rationale: Improvement of pneumococcal vaccination coverage in older adults likely reduces morbidity and mortality that is caused by the *Pneumococcus* bacterium.

Denominator: Individuals aged 65–71 years

Numerator: The number of individuals in the denominator who received a pneumococcal vaccination once after age 65 years or within the past five years.

Comments: This indicator relates to the 23-valent formulation of the pneumococcal polysaccharide vaccine. The age range used for the present report (2008–2010) is a function of data availability.

National Program for Quality Indicators in Community Healthcare in Israel Report · 2008-2010

Source: Ministry of Health

Bariatric Surgery

Is bariatric surgery worth it?

Home

Weight-loss Surgery Becoming Increasingly Popular in Israel, the Land of Milk and Honey

But while obesity has been spreading, Israelis are still notably trimmer than many of their Western counterparts.

Judy Maltz | Apr 27, 2015 1:05 PM

Weight loss surgery: do the benefits really outweigh the risks?

By Honor Whiteman | Published Thursday 28 November 2013

It works.

JAMA | Original Investigation

Association of Bariatric Surgery Using Laparoscopic Banding, Roux-en-Y Gastric Bypass, or Laparoscopic Sleeve Gastrectomy vs Usual Care Obesity Management With All-Cause Mortality

Orna Reges, PhD; Philip Greenland, MD; Dror Dicker, MD; Morton Leibowitz, MD; Moshe Hoshen, PhD; Ilan Gofer; Laura J. Rasmussen-Torvik, PhD; Ran D. Balicer, MD

Table 3. Description of Additional Outcomes

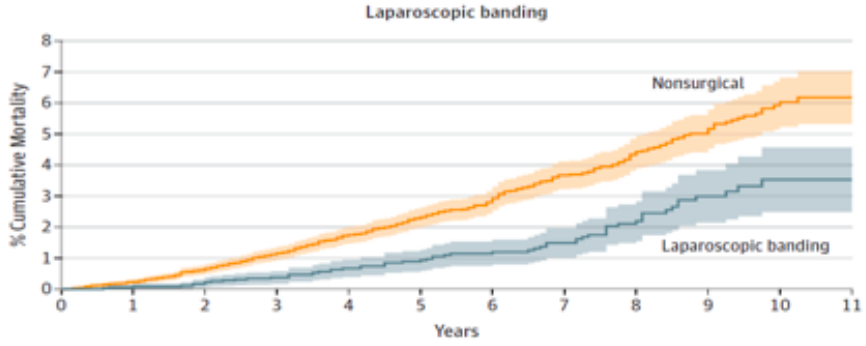
	Laparoscopic Banding		Gastric Bypass		Sleeve Gastrectomy		Total	
	Surgical Patients	Nonsurgical Patients	Surgical Patients	Nonsurgical Patients	Surgical Patients	Nonsurgical Patients	Surgical Patients	Nonsurgical Patients
No. at risk	3635	10 905	1388	4164	3362	10 086	8385	25 155
Follow-up, median (IQR), y	6.2 (4.3-8.5)	5.7 (3.7-8.2)	5.5 (3.0-6.7)	4.8 (2.6-6.6)	3.2 (2.2-4.1)	3.0 (2.0-4.0)	4.3 (2.8-6.6)	4.0 (2.6-6.2)
BMI								
Last measurement, median (IQR)[a]	32.5 (28.3-37.2)[b]	39.8 (35.6-44.1)[b]	30.9 (27.3-35.5)[b]	39.3 (35.4-43.4)[b]	29.8 (26.6-33.3)[b]	39.3 (35.6-43.1)[b]	31.0 (27.3-35.4)[b]	39.6 (35.6-43.6)[b]
Reduction from baseline, mean (SD)	8.1 (6.3)[b]	1.2 (6.3)[b]	9.4 (5.6)[b]	1.4 (6.3)[b]	10.6 (4.9)[b]	1.3 (5.8)[b]	9.3 (5.8)[b]	1.2 (6.1)[b]
Individuals with ≥20% reduction, No. (%)	1702 (48.2)[b]	854 (8.2)[b]	829 (60.9)[b]	287 (7.3)[b]	2278 (70.8)[b]	645 (7.1)[b]	4809 (59.3)[b]	1786 (7.6)[b]

It saves lives.

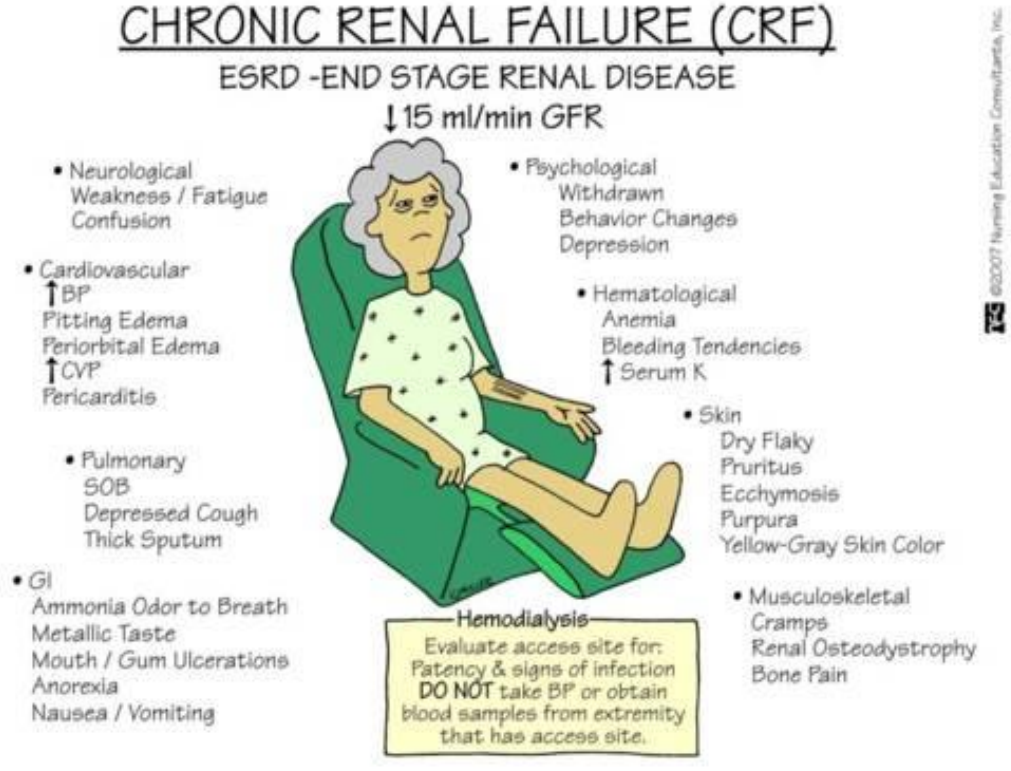
Table 2. Association Between Bariatric Surgery and Mortality

	Laparoscopic Banding		Gastric Bypass		Laparoscopic Sleeve Gastrectomy		Total	
	Surgical Patients (n = 3635)	Nonsurgical Patients (n = 10 905)	Surgical Patients (n = 1388)	Nonsurgical Patients (n = 4164)	Surgical Patients (n = 3362)	Nonsurgical Patients (n = 10 086)	Surgical Patients (n = 8385)	Nonsurgical Patients (n = 25 155)
Follow-up, median (IQR), y	6.2 (4.3-8.5)[a]	5.7 (3.7-8.2)[a]	5.5 (3.0-6.7)[a]	4.8 (2.6-6.6)[a]	3.2 (2.2-4.1)[a]	3.0 (2.0-4.0)[a]	4.3 (2.8-6.6)[a]	4.0 (2.6-6.2)[a]
Total deaths, No. (%)	61 (1.7)[a]	338 (3.1)[a]	18 (1.3)[a]	116 (2.8)[a]	26 (0.8)[a]	129 (1.3)[a]	105 (1.3)[a]	583 (2.3)[a]
Mortality/1000 person-years (95% CI)	2.6 (2.0-3.4)	5.3 (4.7-5.8)	2.6 (1.6-4.2)	6.0 (5.0-7.2)	2.4 (1.6-3.6)	4.2 (3.5-5.0)	2.6 (2.1-3.1)	5.1 (4.7-5.5)
Mortality rate difference/1000 person-years, mean (95% CI)	[Reference]	2.6 (1.7-3.5)	[Reference]	3.4 (1.7- 5.0)	[Reference]	1.8 (0.6-3.0)	[Reference]	2.51 (1.86-3.15)
Nonsurgical patients vs surgical, hazard ratio (95% CI) for mortality								
Unadjusted	1 [Reference]	2.00 (1.52-2.63)	1 [Reference]	2.29 (1.39-3.76)	1 [Reference]	1.66 (1.09-2.54)	1 [Reference]	1.97 (1.59-2.42)
Adjusted, before multiple imputation[b,c]	1 [Reference]	2.13 (1.47-3.09)	1 [Reference]	2.46 (1.43-4.24)	1 [Reference]	1.59 (1.00-2.53)	1 [Reference]	2.03 (1.58-2.61)
Adjusted, after multiple imputation[c]	1 [Reference]	2.01 (1.50-2.69)	1 [Reference]	2.65 (1.55-4.52)	1 [Reference]	1.60 (1.02-2.51)	1 [Reference]	2.02 (1.63-2.52)

Figure 3. Kaplan-Meier Estimated Mortality Curves for 3 Types of Surgical Patients and Matched Nonsurgical Obese Patients

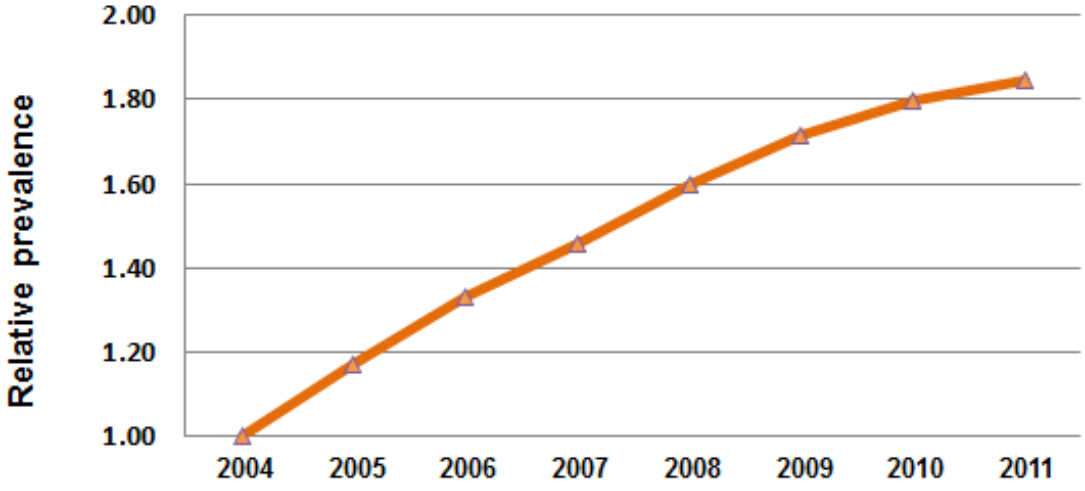


Risk Stratification


CHRONIC RENAL FAILURE (CRF)
ESRD -END STAGE RENAL DISEASE
↓15 ml/min GFR
• Neurological
Weakness / Fatigue
Confusion
• Cardiovascular
↑BP
Pitting Edema
Periorbital Edema
↑CVP
Pericarditis
• Pulmonary
SOB
Depressed Cough
Thick Sputum
• GI
Ammonia Odor to Breath
Metallic Taste
Mouth / Gum Ulcerations
Anorexia
Nausea / Vomiting
• Psychological
Withdrawn
Behavior Changes
Depression
• Hematological
Anemia
Bleeding Tendencies
↑Serum K
• Skin
Dry Flaky
Pruritus
Ecchymosis
Purpura
Yellow-Gray Skin Color
• Musculoskeletal
Cramps
Renal Osteodystrophy
Bone Pain
Hemodialysis
Evaluate access site for:
Patency & signs of infection
DO NOT take BP or obtain
blood samples from extremity
that has access site.
©2007 Nursing Education Consultants, Inc.

Trends: Renal Replacement Therapy

Prevalence rates (per 1,000 members):
Relative increase vs. 2004, Clalit



Source: Clalit Health Services

Identify patients at:

Pre-clinical stage (Pre-disease)

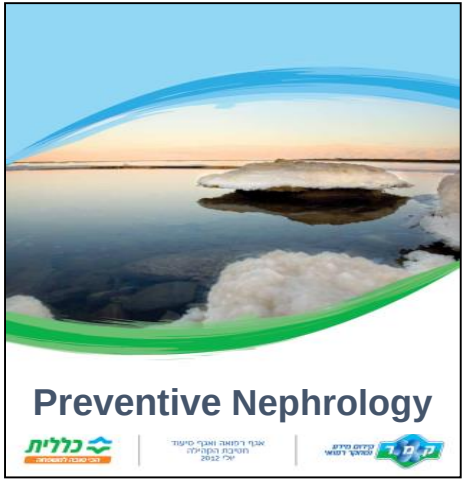
Risk for acquiring the condition

Tailor interventions to:

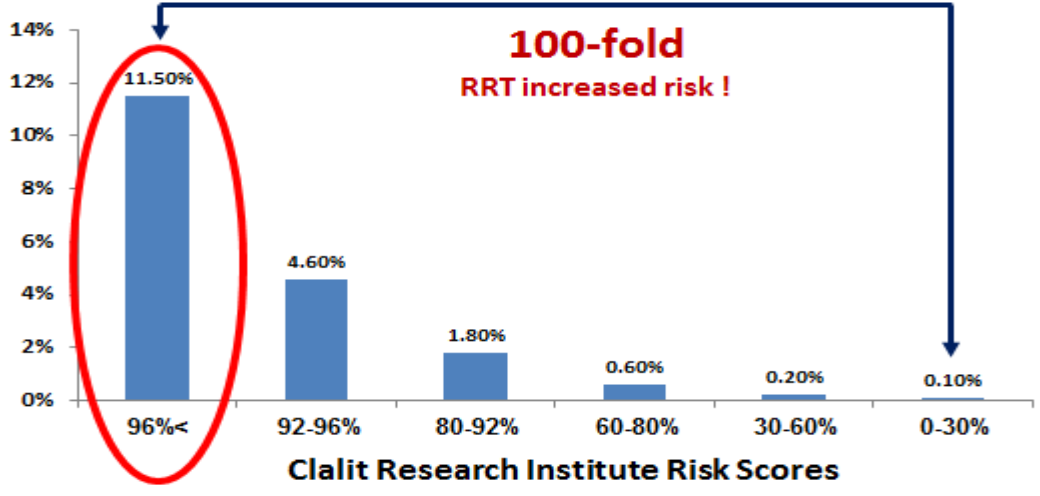
Prevent progression to chronic disease

Treat when treatment most effective

Preventing Renal Failure

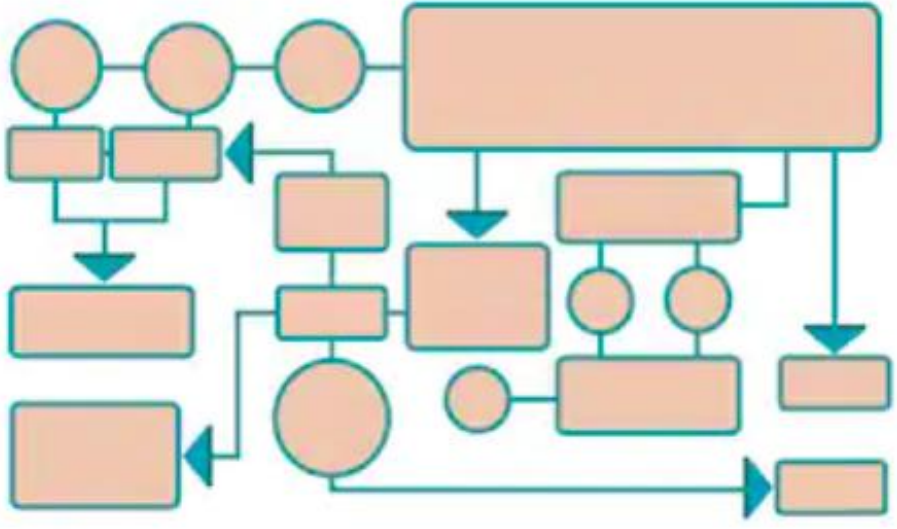


5-year deterioration rates to RRT among CKD stage 3 patients, Clalit

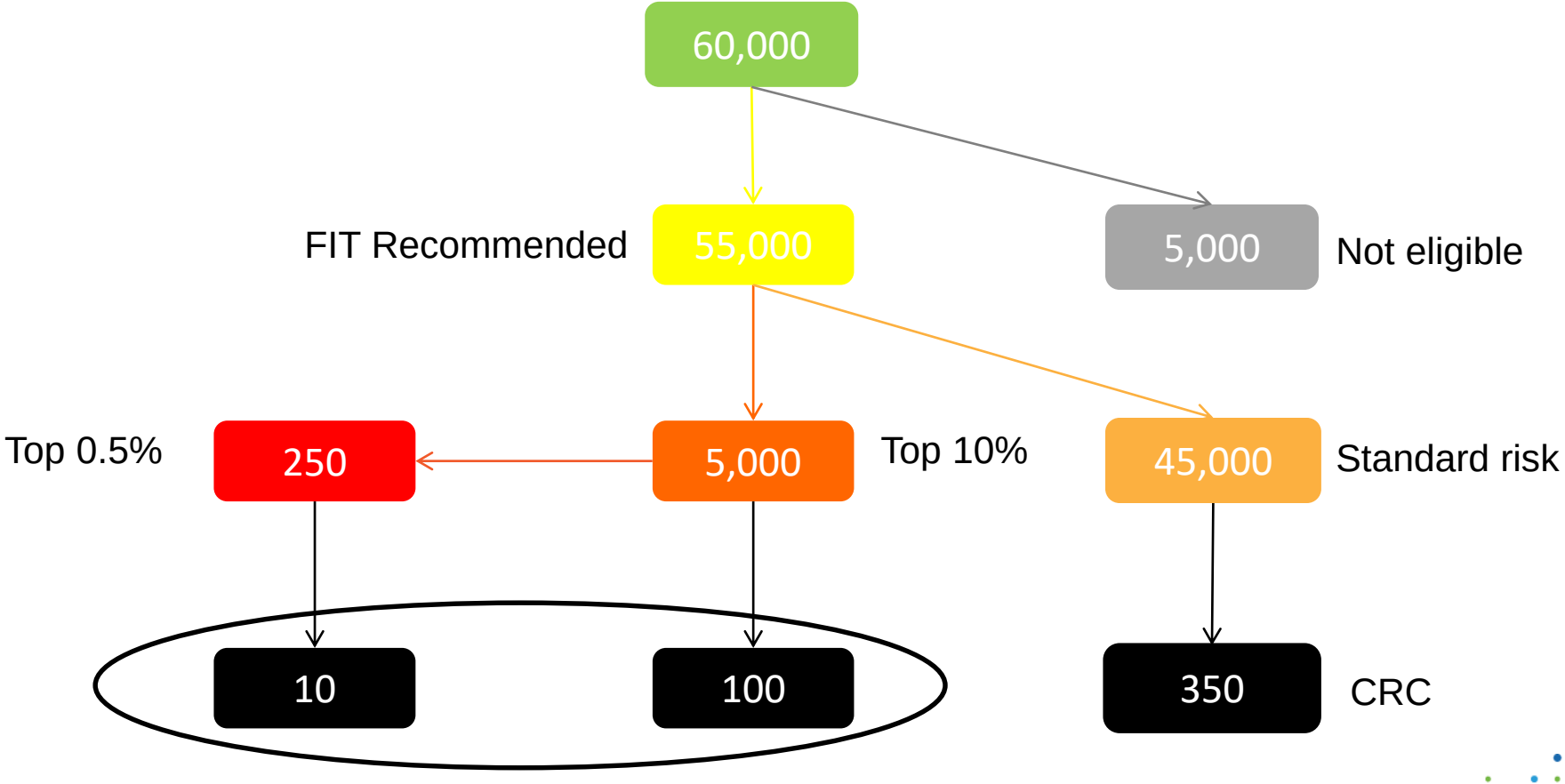


Screening for Colorectal Cancer

The 14 easy steps to doing a FIT.

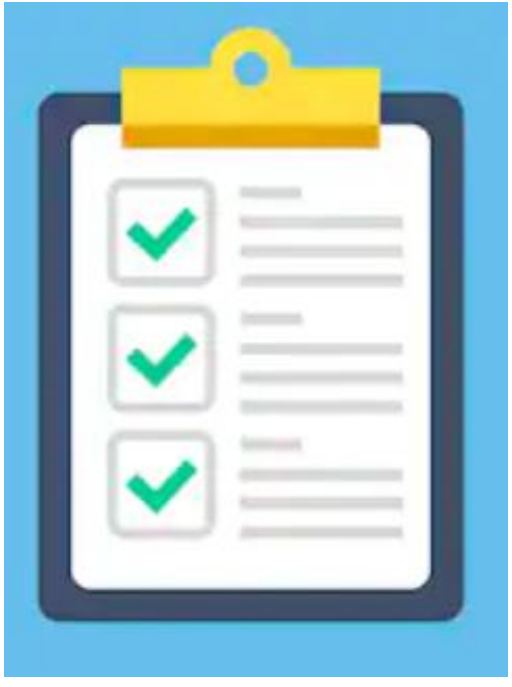


No FIT in the last year

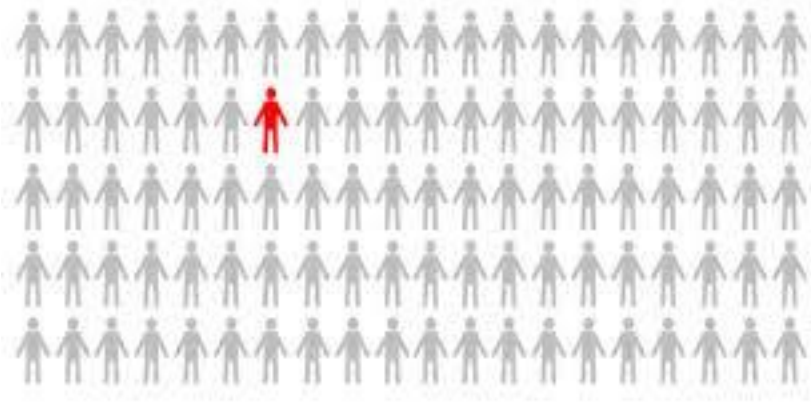


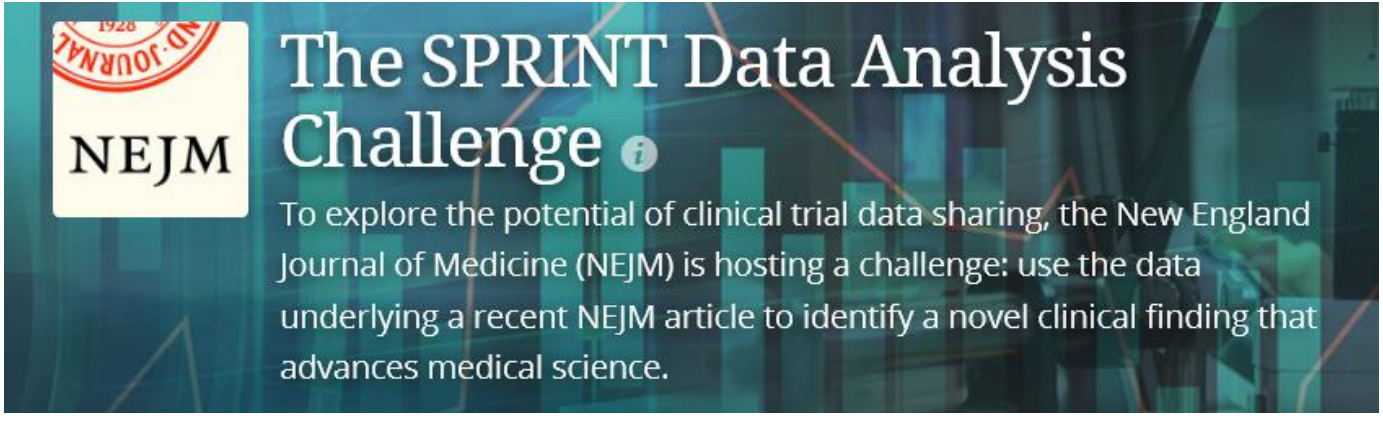
Source: Clalit Health Services, approximate counts from one district

Patient engagement is sorted based on risk.



Personalization




NEJM
The SPRINT Data Analysis Challenge
To explore the potential of clinical trial data sharing, the New England Journal of Medicine (NEJM) is hosting a challenge: use the data underlying a recent NEJM article to identify a novel clinical finding that advances medical science.

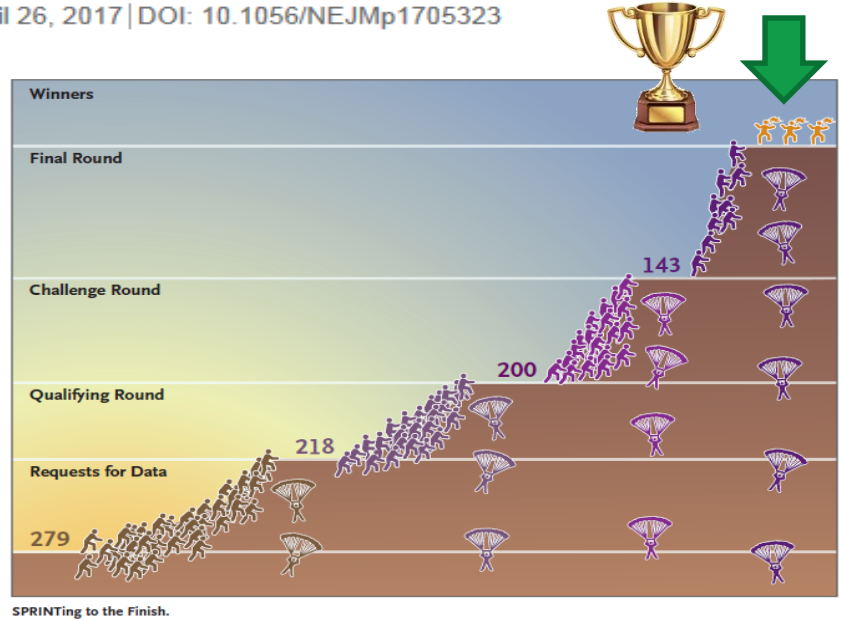
Clalit Res

The NEW ENGLAND JOURNAL of MEDICINE

Learning What We Didn't Know — The SPRINT Data Analysis Challenge

Nancy S. Burns and Pamela W. Miller

April 26, 2017 | DOI: 10.1056/NEJMp1705323



SPRINTing to the Finish.
A total of 279 groups requested data from BioLINCC, 218 individuals and teams entered the qualifying round, 200 qualified, and 143 of the entries to the Challenge round were judged.

ognized experts who represented the three primary constituencies — clinical trialists, data analysts, and patients. In addition to being reviewed by one representative from each constituency, all entries were opened to the public

The team that won first place was made up of physicians and data analysts from the Clalit Research Institute in Tel Aviv, Israel. They developed a weighted risk–benefit calculator for examining the pluses and minuses of intensively treating an individual patient

Personalizing clinical trials outcomes

Age	78
Sex	Female
Weight (Kg)	77
Height (M)	1.63
Black Race	No
Smoking Status	Former Smoker
Systolic blood pressure (mmHg)	55
	7
Blood pressure lowering medications (number)	0
Cardio-vascular disease (clinical or subclinical)	No
eGFR (mL/min/1.73 m²)	47
Total cholesterol (Mg/dL)	212
High density cholesterol (HDL) (Mg/dL)	5

Outcome-specific Predictive model (1000 bootstraps)

Acute Myocardial Infarction (iNNT=384)

I-PREDICT HTN Individualized Predictive Risk Evaluation & Decision Integration Clinical Tool for Hypertension

INTENSIVE VS. NON-INTENSIVE HYPERTENSION TREATMENT

Clalit Research Institute
Real people. Real data. Real change.

ENTER PATIENT'S DATA

Age: 78
Sex: Female
Weight: Kg 77
Height: M 1.63
Black Race: No
Smoking Status: Former Smoker
Systolic blood pressure (mmHg): 155
Blood pressure lowering medications (number): 0
Cardio-vascular disease (clinical or subclinical): No
eGFR (mL/min/1.73 m²): 47
Total cholesterol: Mg/dL 212
High density cholesterol (HDL): Mg/dL 75

CALCULATE RISK

RESULTS

Severity rank	Cardiovascular improvement due to intensive treatment*	Severity rank	Adverse events due to intensive treatment*
	Acute Myocardial Infarction (iNNT=384)		**Serious Hypotension (iNNH=61)**
	1.4% ← -0.3%		2.5% → +1.6%
	Acute Decompensated Heart Failure (iNNT=113)		**Serious Syncope (iNNH=75)**
	2.2% ← -0.9%		4.5% → +1.3%
	Stroke (iNNT=442)		**Serious Electrolyte Abnormality (iNNH=47)**
	1.9% ← -0.2%		6.4% → +2.1%
	Cardio-Vascular Death (iNNT=101)		**Serious Acute Renal Failure (iNNH=32)**
	2.3% ← -1.0%		3.0% → +3.1%

RECOMMENDATION

Do Not Treat BP Intensively
Systolic blood-pressure target: ≤140 mmHg

The recommendation is based on the ratio between the individual ARRs and ARIs, weighted by severity ranks assigned to the different outcomes.

The current ranks are averages of ranks given by several physicians. You can change the ranks and update the recommendation.

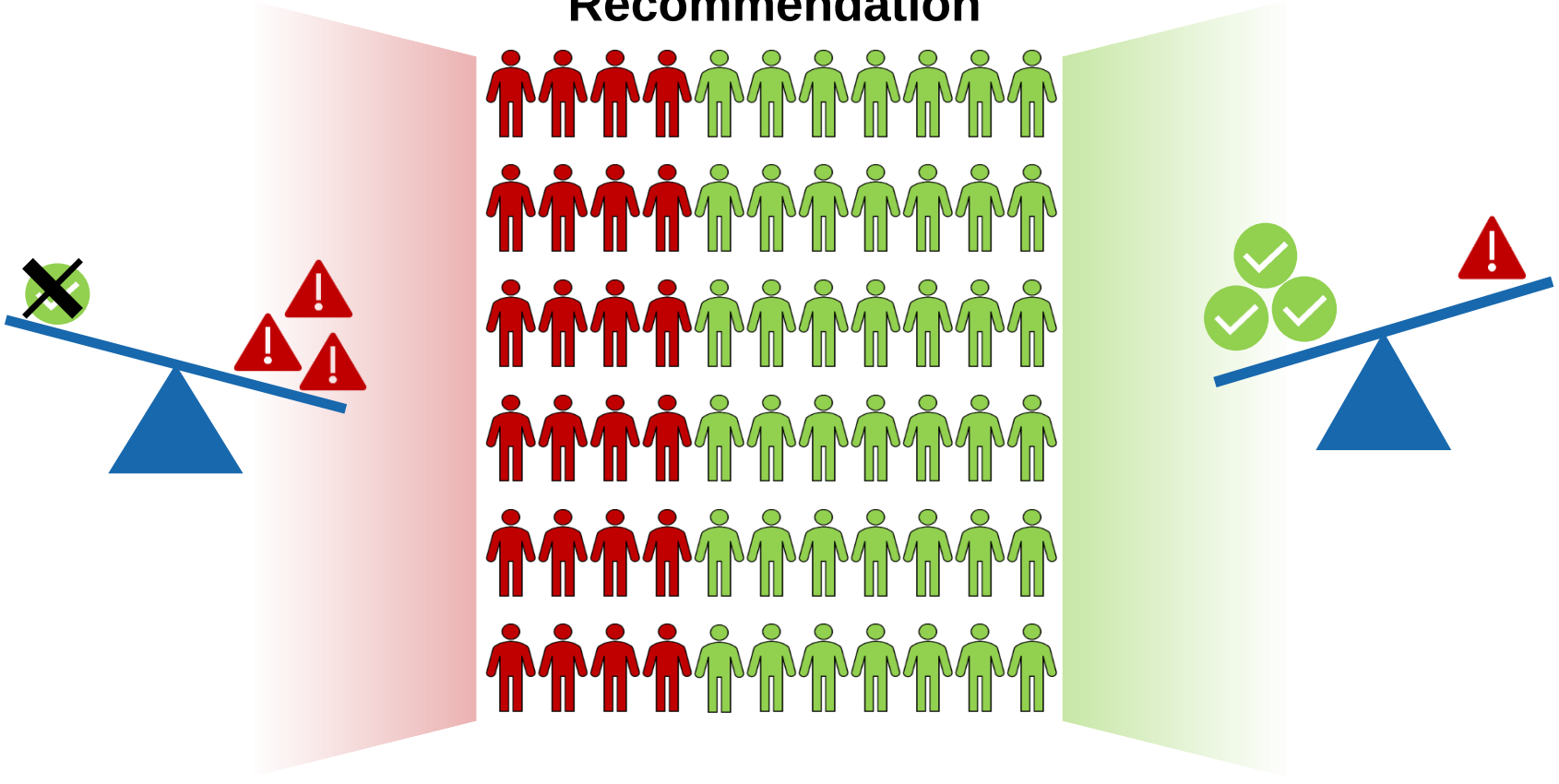
UPDATE RECOMMENDATION
with new severity ranks

* For a time period of 3 years

Initial risk | Individual Absolute risk reduction (iARR) | Individual Absolute risk increase (iARI)

iNNT/H: individual Number Needed to Treat/Harm

I-PREDICT Recommendation



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