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HELP

- Healthcare Logistics Education and Learning Pathways -

Care Pathways, Lean Management, Process Mining

Walter Sermeus, RN, PhD
Professor in Healthcare Management
KU Leuven

Our care pathway experience

- Belgian-Dutch Clinical Pathway Network
  - Since 2000, more than 100 organizations, more than 1200 pathways developed
- European Pathway Association (www.e-p-a.org)
  - EQCP-study on COPD and Hip fracture (BE, IT, PT)
  - CP4ACS study on STEMI (BE)
  - Colorectal cancer surgery (BE, NL, FR, DE)
- ALS-Care (IE, BE, NL, IT, UK, DE)
  - Funded by JPND (2014-17)

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Outline

- What are care pathways ?
- Why care pathways ?
- How are care pathways developed ?
  - Some general principles
- How are care pathways evaluated?
  - What is the available evidence ?
  - Evaluation of the evaluation

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On care pathways

We hear a lot about guidelines, which are supposed to ensure that the right patients gets the right treatment. This is a rather glib statement, but is underpinned by some interesting ideas, including:

Clinical/Care

- **Diagnosis**: Treating the right patient
- **Treatment:** Treating the right patient right

pathway

- **Organisation**: Treating the right patient right at the right time
- **Pathway**: Treating the right patient right at the right time and in the right way

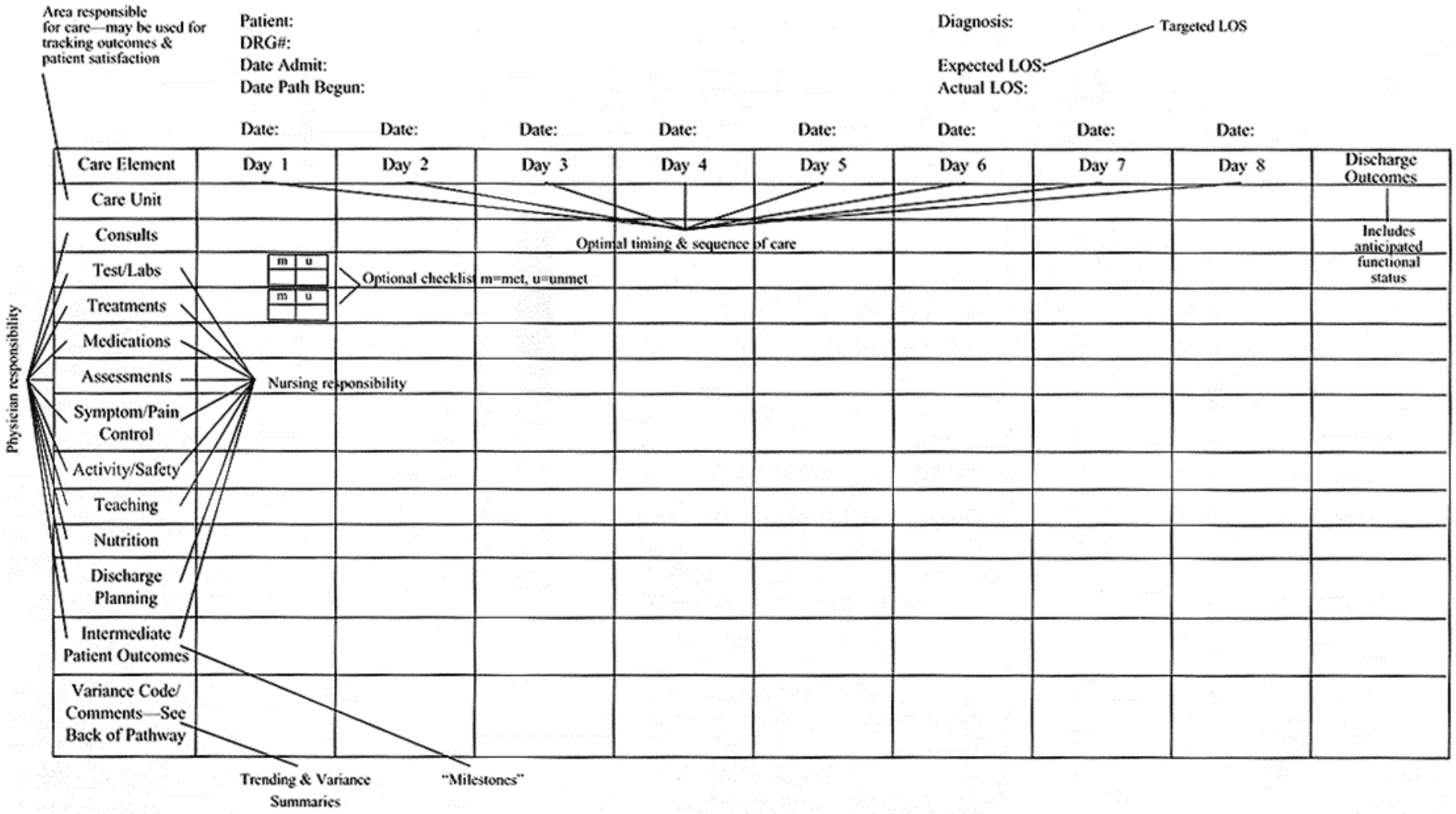
Guidelines are supposed to cover this, but they mostly cover just the first two steps. There is more to delivering good care than that. It requires good organisation - what one might call management, except that many of us now see that word as meaning anything but organisation. And it requires that we perform actions in ways that are known to deliver good quality care.

Definition of a Care Pathway

- Care pathways are a complex intervention for the mutual decision making and organization of predictable care for a well-defined group of patients during a well defined period.
- Defining characteristics of care pathways include:
  - an explicit statement of the goals and key elements of care based on evidence, best practice, and patient expectations.
  - the facilitation of the communication, coordination of roles, and sequencing the activities of the multidisciplinary care team, patients and their relatives.
  - the documentation, monitoring, and evaluation of variances and outcomes; and
  - the identification of the appropriate resources.
- The aim of a care pathway is to enhance the quality of care by improving patient outcomes, promoting patient safety, increasing patient satisfaction, and optimizing the use of resources."

Source: European Pathway Association, 2006, www.E-P-A.org

Care Pathway Template



Example: care pathway for hip arthroplasty

Figuur

Admitting diagnosis: _____ History: _____

Surgery: _____ IV: _____

Consulting physicians: _____ Procedure: _____ Room number: _____

Allergies: _____

	Pre-hospital	Post-op Amit	Post-op day 1	PO day 2	PO day 3	PO day 4	PO day 5	PO day 6	PO day 7
Consults	Medical clearance if necessary Evaluate need for SS consult		PT consult & therapy; BID Re-evaluate SS needs	PT BID Home Care Evaluation	PT BID	PT BID One visit by OT to assist with ADLs as indicated	PT BID	PT BID	
Tests	CXR, CBC, UA, PT, SMA20, EKG, Labs appropriate for age & health 72 hrs before	T & C2 units X-ray	H & H PT (if on coumadin)	H & H PT	H & H PT	PT	PT	PT	PT
Mobility		Bedrest; tip unaffected side 30° HOB pm	Hip exercises Chair BID Stand/amb...	Continue exercises Chair BID Amb BID	Continue mobility BRP with ETS	Continue mobility	Continue mobility	Continue mobility Stairs	Continue mobility
Treatments		ABD pillow, trapeze Drain .... IV therapy, triflow q2° DVT prophylaxes: (TED, coumadin, ASA, thrombogards)	ABD pillow, Drain, Trapeze .... IV therapy, triflow q2° DVT prophylaxes:	ABD pillow, trapeze DC Drain DC IV DVT proph	ABD pillow, Triflow DVT proph	ABD pillow, Triflow DVT proph	ABD pillow, Triflow DVT proph	ABD pillow, Triflow DVT proph	ABD pillow, Triflow DVT proph
Meds		Pain Med (PCA, IM) Antibiotics	DC Antibiotics	Evaluate PCA PO pain meds	PO pain meds pm				
Nutrition metabolic		DAT ...	DAT ...	DAT ...	DAT ...	DAT ...	DAT ...	DAT ...	DAT ...
Elimination		Catheter of choice pm st cath ... foley after 3rd time		DC foley Eval. bowel function (BCOC)	Maintain normal bowel pattern	Maintain normal bowel pattern	Maintain normal bowel pattern	Maintain normal bowel pattern	Maintain normal bowel pattern
Health/home management	Tour ECF	High risk assessment Assess need for ECF			Complete transfer from identify Dr. to follow	Prescription for home equipment identified by PT To ECF (if approp.)		Order Equipment	Equipment delivered
Health perception	THA pre-op teaching by Ortho. Clinician	Instruct on post-op teaching	Instruct on hip precautions		Discharge teaching if to ECF		Discharge teaching	Reinforce D/C teaching	
signature									

To ECF: Outcomes:	Date met:	**If Home: Outcomes:**	Date Met:
1. In-out of bed with assistance.		1. In-out of bed independently or with minimal assist.	
2. On-off commode or chair with assistance.		2. On-off commode or chair independently or with minimal assist.	
3. Ambulate 25 feet with assistive devices with assistance.		3. Ambulates 75 feet independently with assistive devices	
4. Temperature below 100° for 24 hours		4. Utilizes oral analgesics for pain control.	
5. Utilizes oral analgesics for pain control		5. Evidence of wound healing, no drainage.	
6. Evidence of wound healing, no drainage.		6. Demonstrates safe hip precautions by appropriately answering questions.	
7. Demonstrate safe hip precautions by appropriately answering questions		7. Re-establish elimination pattern.	
8. Voiding without difficulty and has moved bowels at least once.			

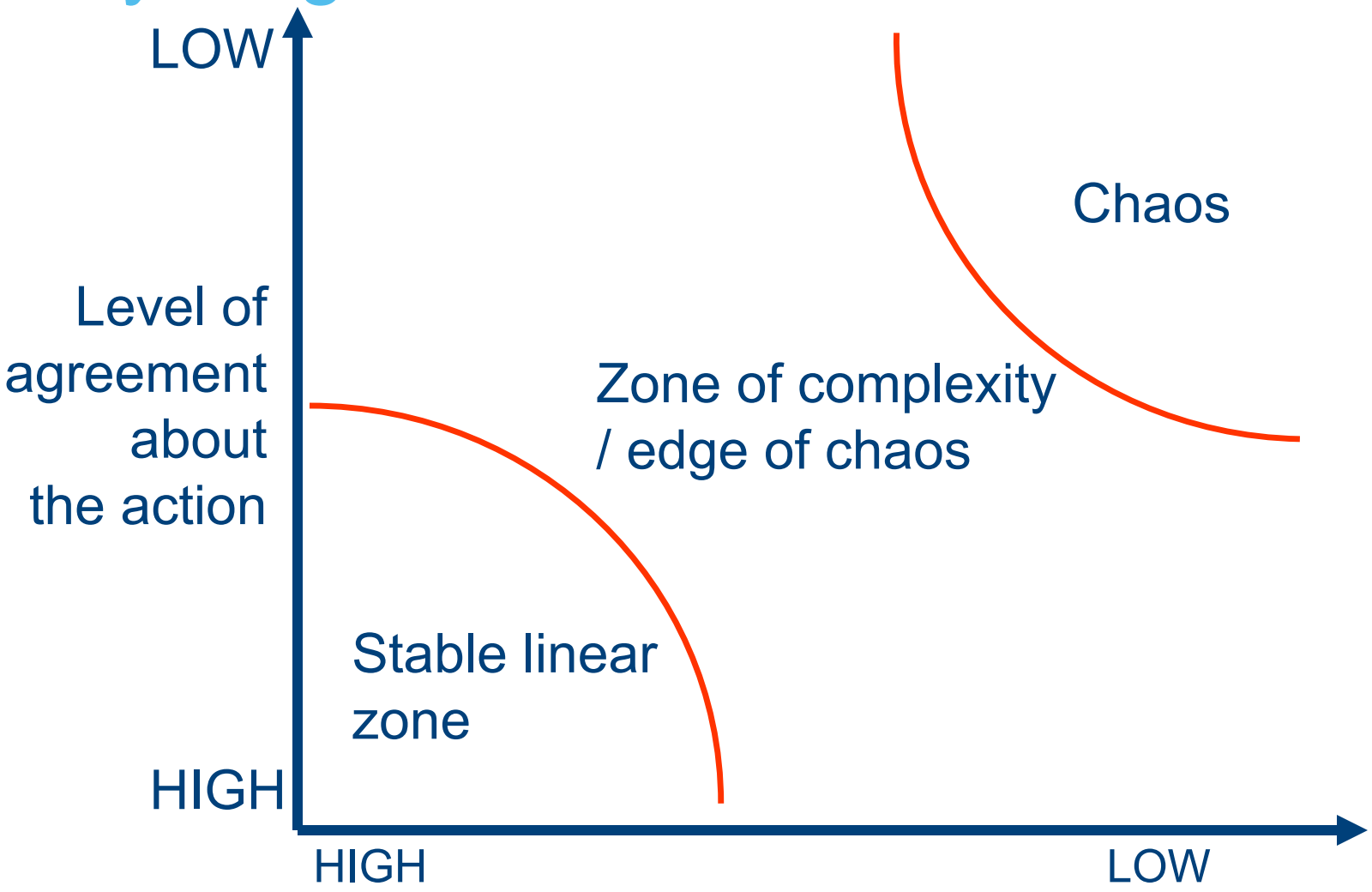
Date clinical path reviewed by MD _____ Admitting RN _____

Care pathways for patients

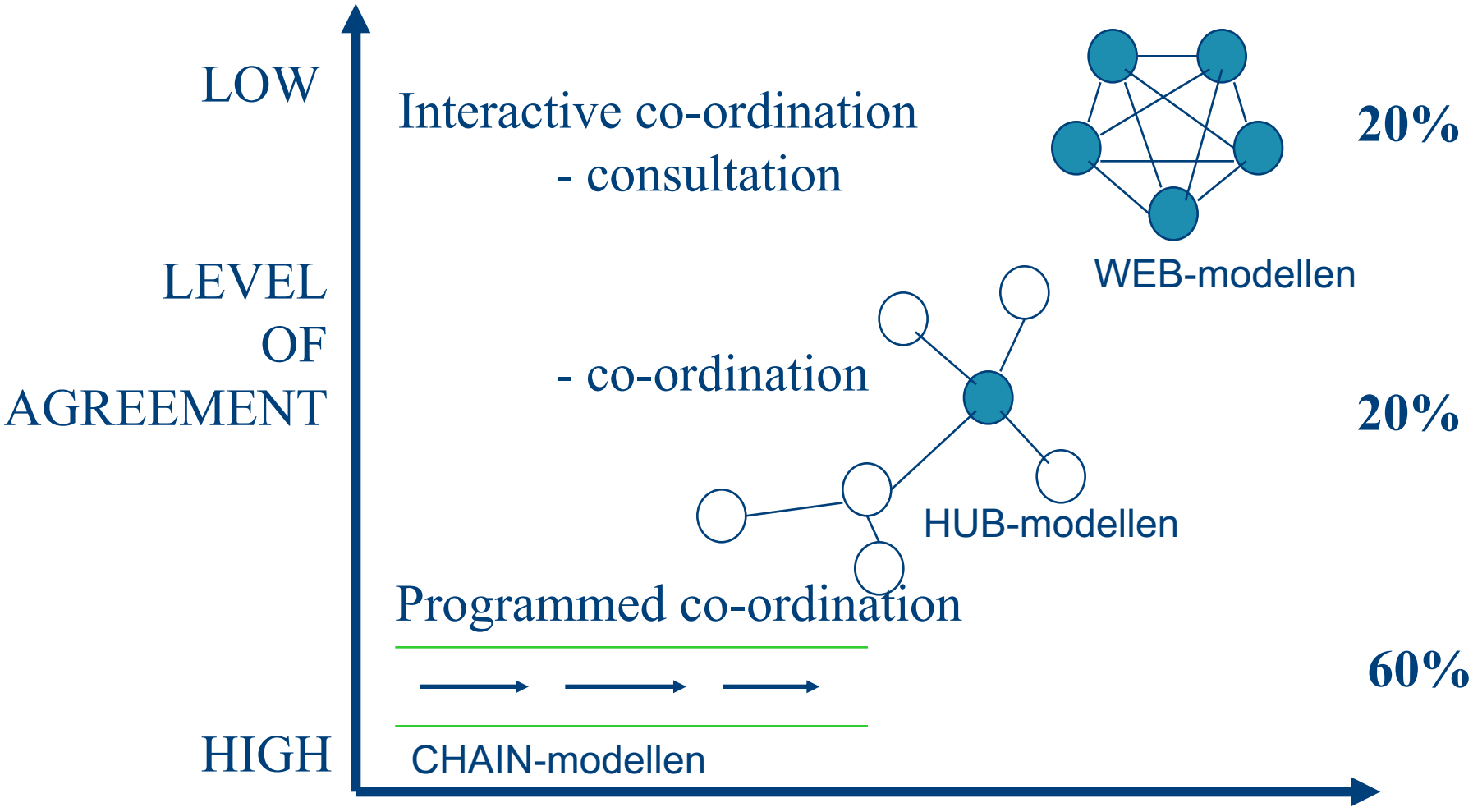
So should you be on a patient pathway?

If you are admitted for a high risk or complex procedure, you should ask if your hospital can provide you with a pathway. Be sure to ask your doctor or hospital if you will be on a pathway before you are admitted to the hospital. The pathway can answer many questions you may not know to ask. You will also be able to familiarize yourself with the likely schedule of care.

Stacey-diagram



Care pathway models for coordination



Glouberman & Mintzberg, 2001

How do care pathways work?

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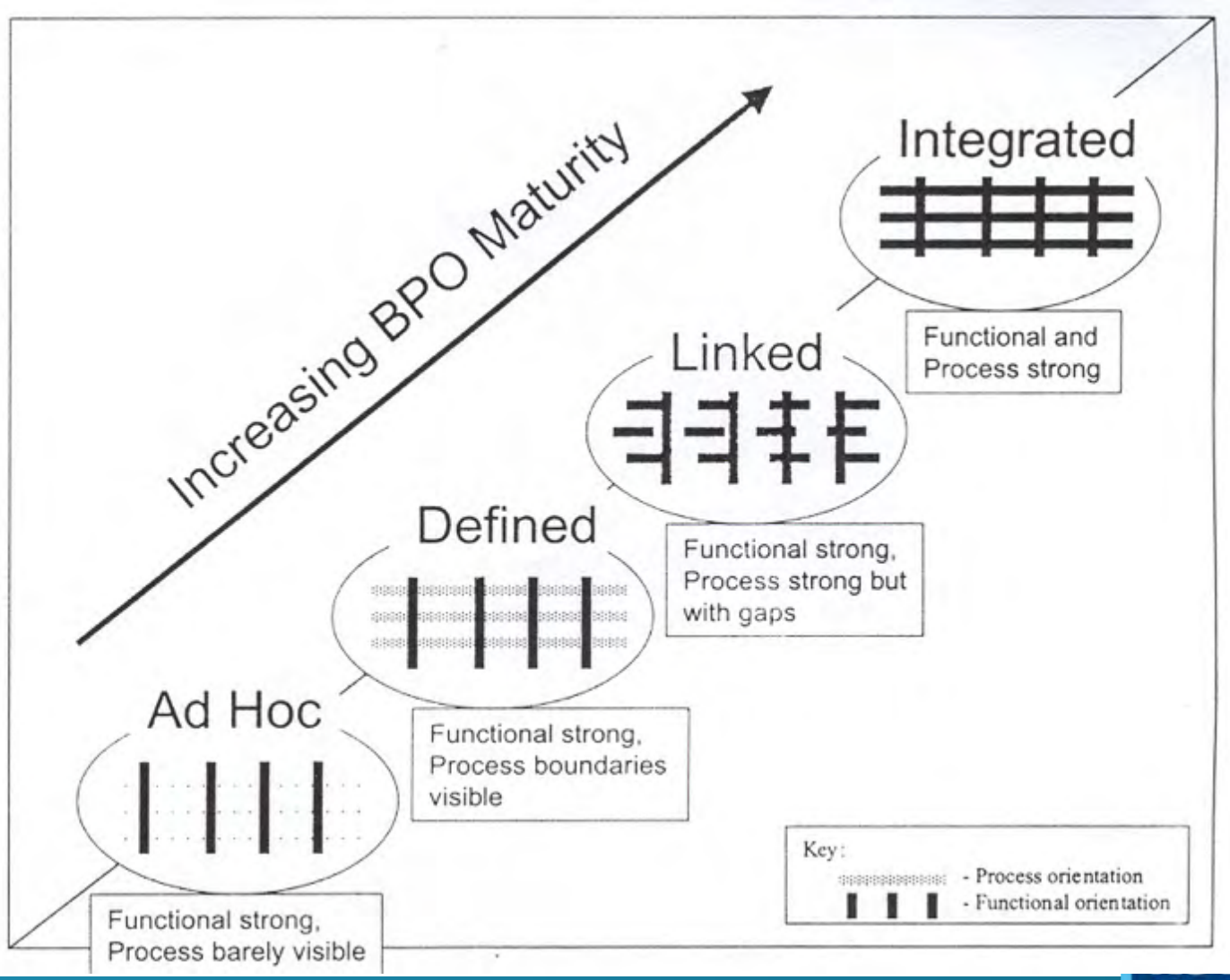
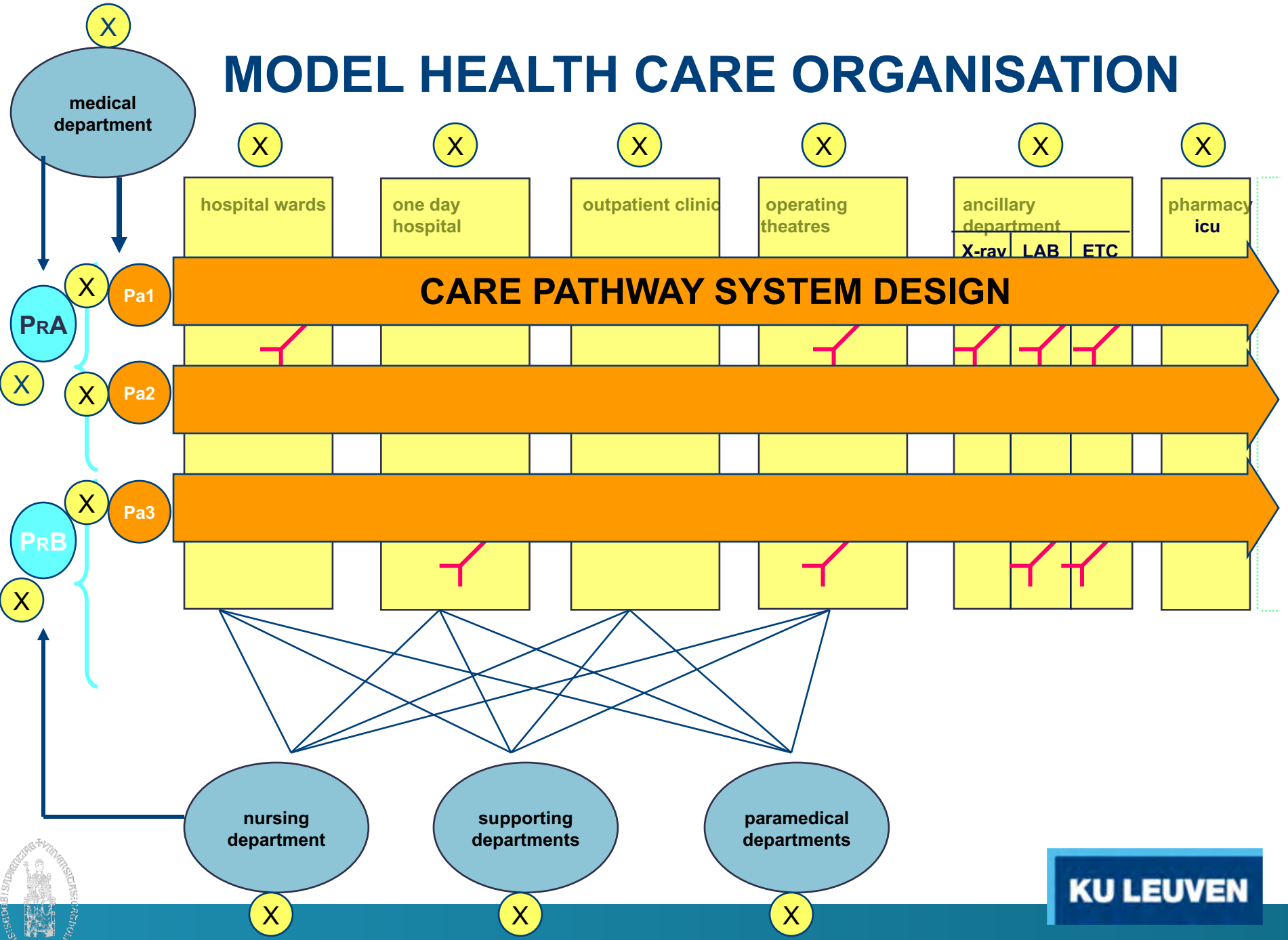
Business Process Orientation



Mc Cormack & Johnson , 2001

MODEL HEALTH CARE ORGANISATION

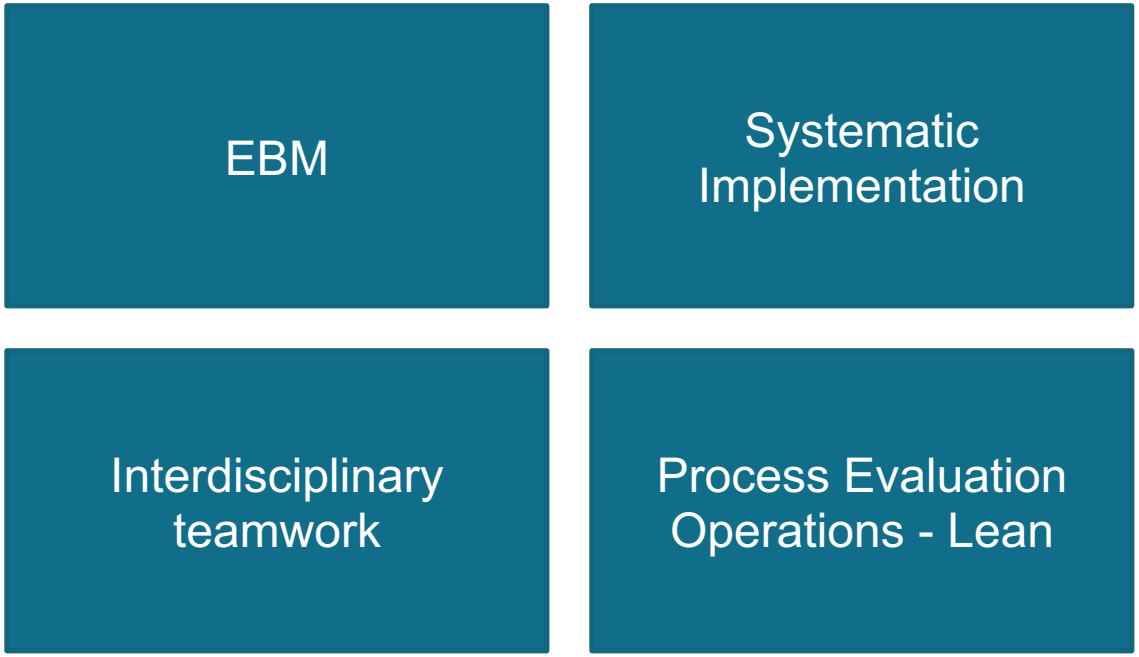


Patient n°86: CEO Glenn Steele

- In the meantime, Geisinger continues to compile success stories, including that of CEO Steele, who became patient No. 86 in the ProvenCare CABG program. "I was in and out of the hospital in two-and-a-half days," he says. Casale, who was Steele's surgeon, says the case opened his eyes to how complex a routine operation really is: "Two weeks after, the head of our IT group called me and said, 'Al, I just looked through [Steele's] chart, and I want to send you a list of everybody that accessed the medical record from the time he was seen in the clinic to two weeks post-op.' There were 113 people listed -- and every one had an appropriate reason to be in that chart. It shocked all of us. We all knew this was a team sport, but to recognize it was that big a team, every one of whom is empowered to screw it up -- that makes me toss and turn in my sleep."

http://www.geisinger.org/sites/provencare/

Active components of Care Pathways: how do they work?



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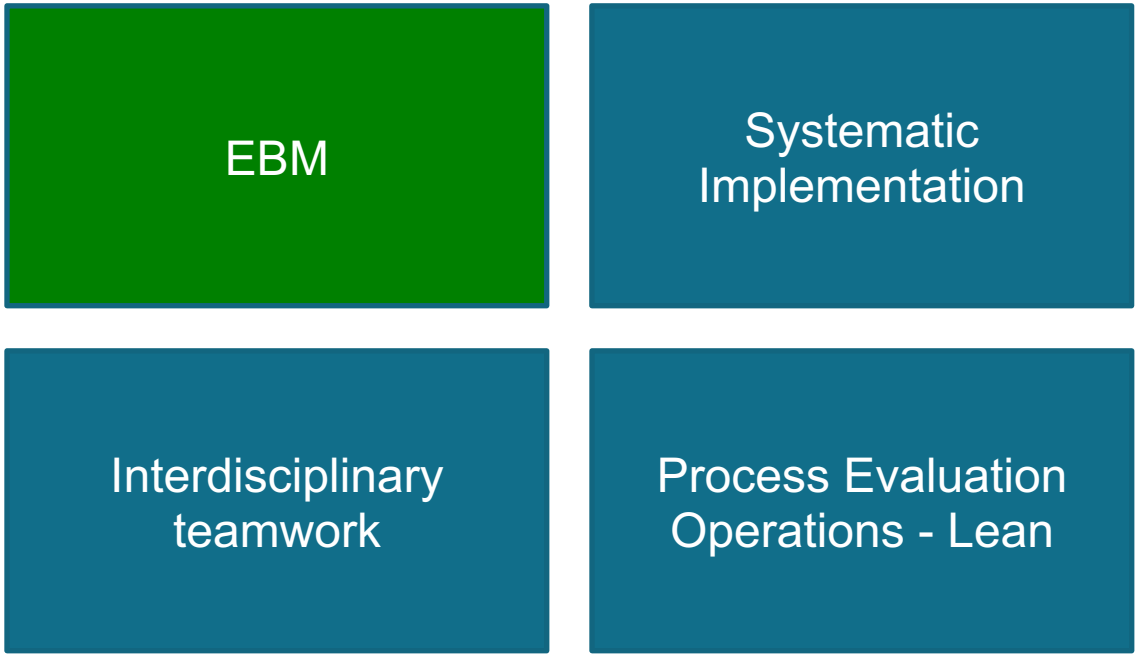
Active components of Care Pathways: how do they work?



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Effectiviness: Adherence to evidence-based guidelines

SPECIAL ARTICLE

The Quality of Health Care Delivered to Adults in the United States

Elizabeth A. McGlynn, Ph.D., Steven M. Asch, M.D., M.P.H., John Adams, Ph.D., Joan Keesey, B.A., Jennifer Hicks, M.P.H., Ph.D., Alison DeCristofaro, M.P.H., and Eve A. Kerr, M.D., M.P.H.

Table 5. Adherence to Quality Indicators, According to Condition.*

Condition	No. of Indicators	No. of Participants Eligible	Total No. of Times Indicator Eligibility Was Met	Percentage of Recommended Care Received (95% CI)
Senile cataract	10	159	602	78.7 (73.3–84.2)
Breast cancer	9	192	202	75.7 (69.9–81.4)
Prenatal care	39	134	2920	73.0 (69.5–76.6)
Low back pain	6	489	3391	68.5 (66.4–70.5)
Coronary artery disease	37	410	2083	68.0 (64.2–71.8)
Hypertension	27	1973	6643	64.7 (62.6–66.7)
Congestive heart failure	36	104	1438	63.9 (55.4–72.4)
Cerebrovascular disease	10	101	210	59.1 (49.7–68.4)
Chronic obstructive pulmonary disease	20	169	1340	58.0 (51.7–64.4)
Depression	14	770	3011	57.7 (55.2–60.2)

nformation about the extent to which standard processes in-
key element of quality — are delivered in the United States.

ample of adults living in 12 metropolitan areas in the United
ut selected health care experiences. We also received written
ical records for the most recent two-year period and used this
rformance on 439 indicators of quality of care for 30 acute and
as preventive care. We then constructed aggregate scores.

percent (95 percent confidence interval, 54.3 to 55.5) of rec-
l little difference among the proportion of recommended pre-
9 percent), the proportion of recommended acute care pro-
the proportion of recommended care provided for chronic
Among different medical functions, adherence to the process-
from 52.2 percent for screening to 58.5 percent for follow-up
ntially according to the particular medical condition, ranging
unended care (95 percent confidence interval, 73.3 to 84.2) for
ent of recommended care (95 percent confidence interval, 6.8
dence.

RAND:
- 30 conditions
- 439 indicators
- 54.9%

N Engl J Med 2003;348:2635-45.

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An International Study of Adherence to Guidelines for Patients Hospitalised with a COPD Exacerbation

Deborah Seys, Luk Bruyneel, Marc Decramer, Cathy Lodewijckx, Massimiliano Panella, Walter Sermeus, Paulo Boto & Kris Vanhaecht

To cite this article: Deborah Seys, Luk Bruyneel, Marc Decramer, Cathy Lodewijckx, Massimiliano Panella, Walter Sermeus, Paulo Boto & Kris Vanhaecht (2016): An International Study of Adherence to Guidelines for Patients Hospitalised with a COPD Exacerbation, COPD: Journal of Chronic Obstructive Pulmonary Disease, DOI: 10.1080/15412555.2016.1257599

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Table 2. Overview process indicators for the in-hospital management of a COPD exacerbation.

	Patients n/N (%)	Hospital Median (Q1–Q3)	Expert consensus rate (12)
Diagnostic management			
Performance of arterial blood gas (ABG) measurement during first 24 hours of admission	325/378 (86.0)	77.5% (55.3–88.7)	82.9
Performance of chest X-ray during first 24 hours of admission	232/378 (61.4)	80.0% (0.0–100.0)	68.6
Pharmacological management			
Prescription of antibiotics	231/378 (61.1)	76.0% (0.0–93.8)	88.6
Prescription of short-acting bronchodilators during hospitalisation	229/378 (60.6)	63.1% (17.5–95.0)	60.0
Prescription of long-acting bronchodilators during hospitalisation	166/378 (43.9)	21.3% (0.0–84.9)	88.6
Prescription of 30–40 mg of oral prednisolone daily for 7–10 days	19/378 (5.0)	0.0% (0.0–0.0)	85.7
Non-pharmacological management			
Administration of controlled oxygen therapy in patients hypoxemic during admission	81/84 (96.4)	100.0% (100.0–100.0)	100.0
Assessment of smoking status	332/378 (87.8)	93.1% (80.2–100.0)	91.4
Patient received influenza vaccination within the past year	230/378 (60.8)	64.3% (52.6–79.4)	68.6
ABG measurement 1 or 2 days prior to discharge in patients hypoxemic during a COPD exacerbation	54/93 (58.1)	60.0% (16.7–100.0)	82.9
Patient received pneumococci vaccination within the past five years	168/378 (44.4)	43.3% (29.6–67.6)	68.6
Prescription of home oxygen therapy in patients with hypoxemic at discharge	10/24 (41.7)	50.0% (0.0–100.0)	100.0
Nutritional assessment (BMI)	115/378 (30.4)	9.4% (0.0–73.2)	51.4
Referral to pulmonary revalidation during the past year	109/378 (28.8)	14.2% (9.2–49.0)	100.0
Nutritional management in patients with overweight	9/53 (17.0)	0.0% (0.0–12.5)	65.7
Adequate discharge management	42/378 (11.1)	0.0% (0.0–17.4)	80.0
Education regarding inhaler therapy in patients in which inhaler therapy is prescribed	36/339 (10.6)	0.0% (0.0–0.0)	94.3
Performance of revalidation tests during the past year (inclusive current hospitalisation)	23/378 (6.1)	0.0% (0.0–8.3)	94.3
Nutritional management in patients with underweight	4/88 (4.5)	0.0% (0.0–0.0)	60.0
Education regarding home oxygen therapy in patients in which home oxygen is prescribed	5/132 (3.8)	0.0% (0.0–0.0)	88.6
Smoking cessation intervention in active smokers at admission	2/78 (2.6)	0.0% (0.0–0.0)	91.4

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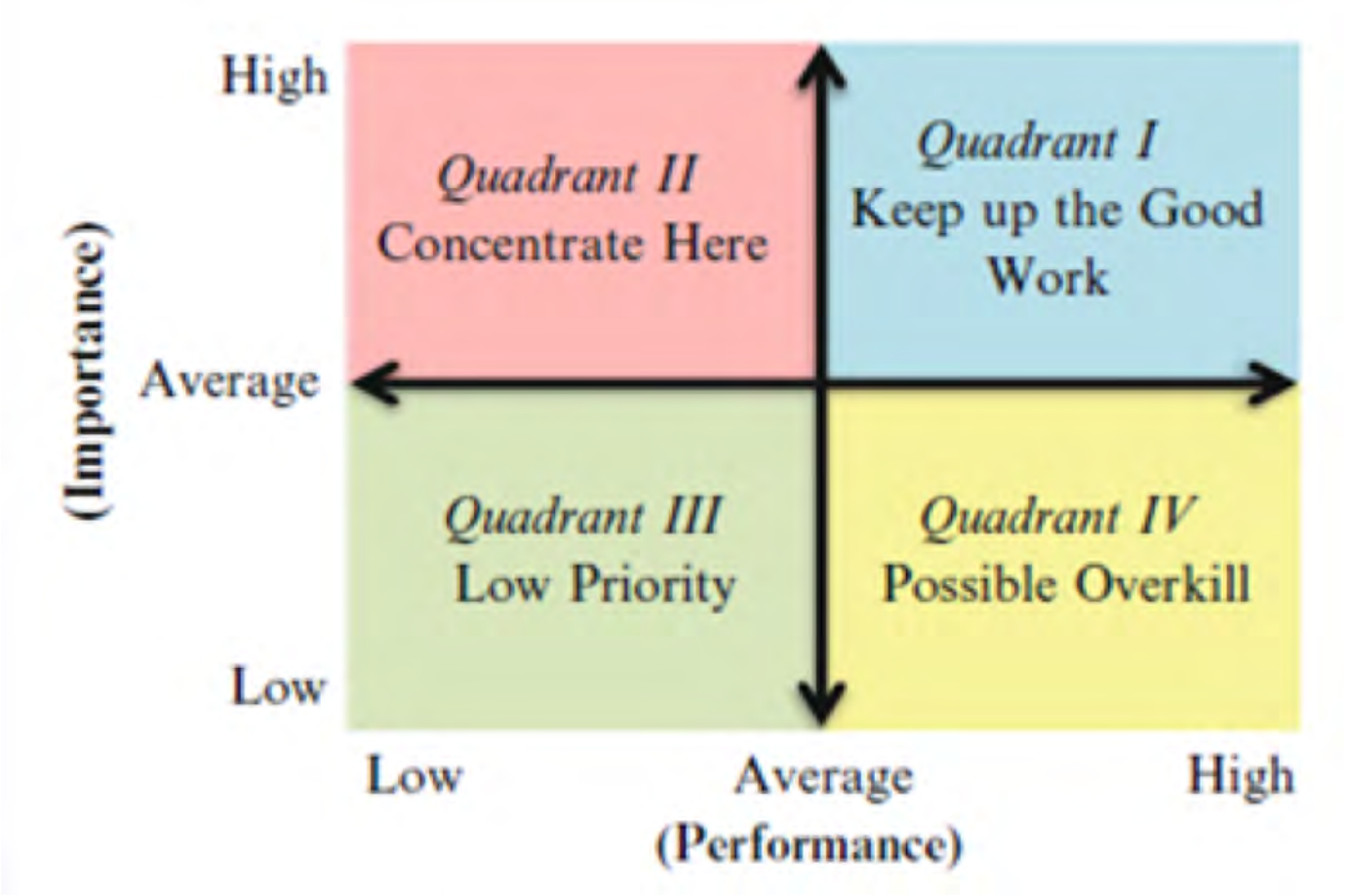
Seys et al., 2016

Importance – Performance Analysis (IPA)



Martilla and James, 1977

IPA OF A SELECTION OF CARE PATHWAYS

COPD

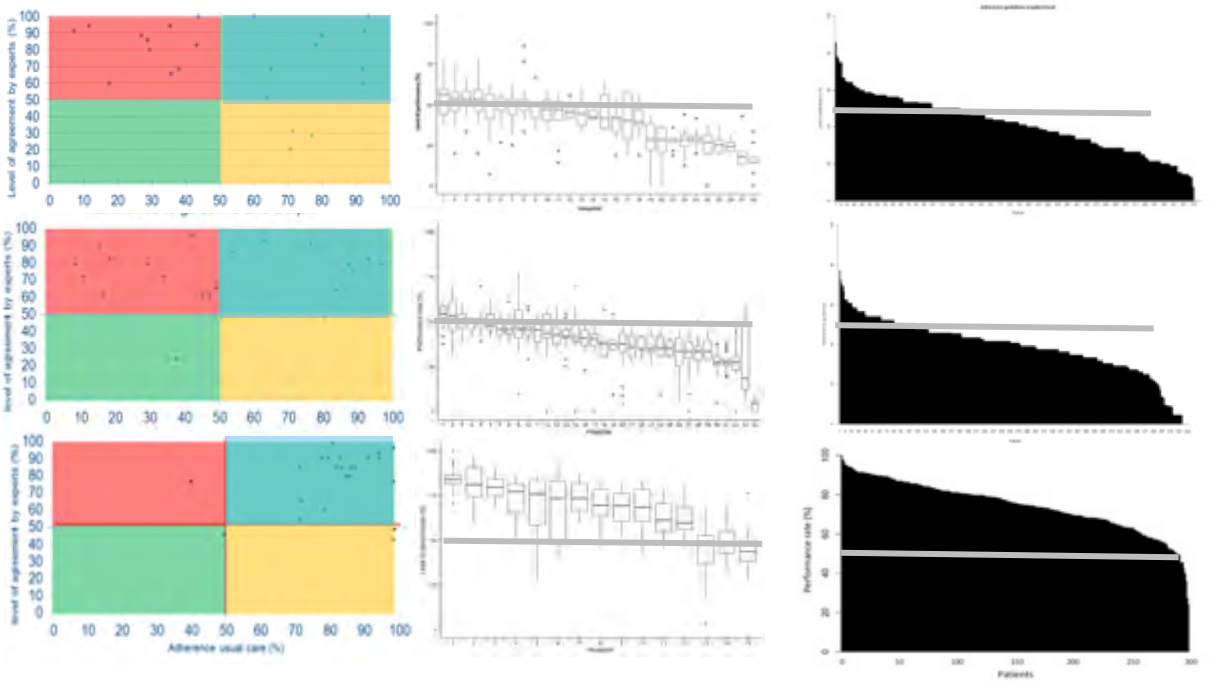
Seys et al, 2017

HIP#

Seys et al, 2017

STeMI

Aeyels et al, 2017



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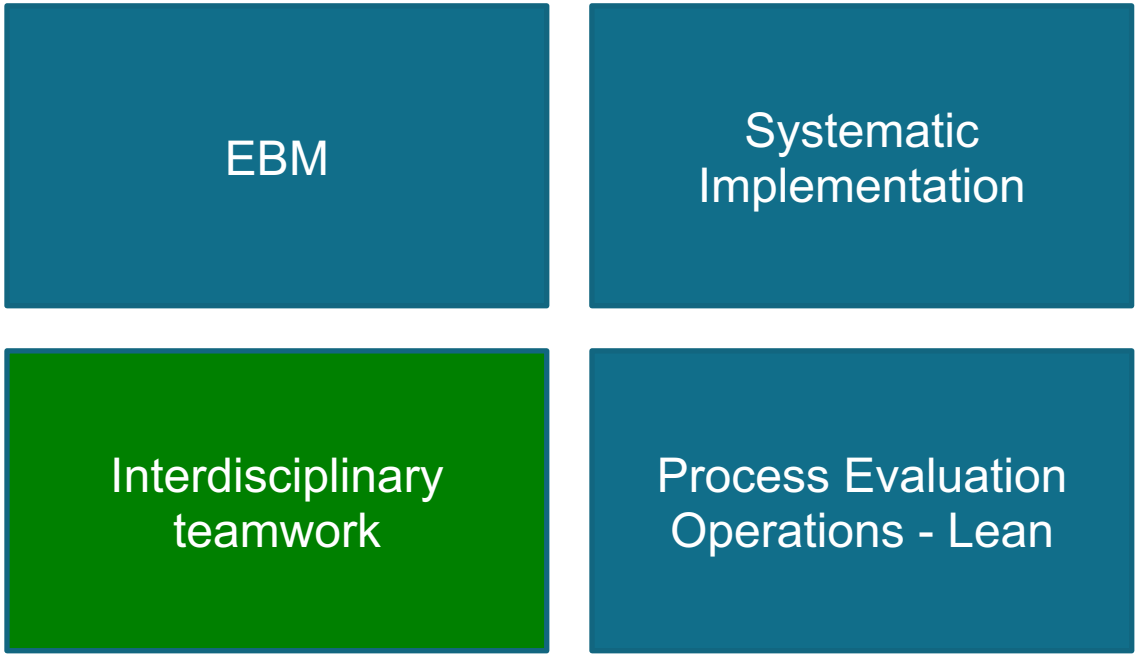
Active components of Care Pathways: how do they work?



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GRPI-model of team effectiveness

FIGURE 2

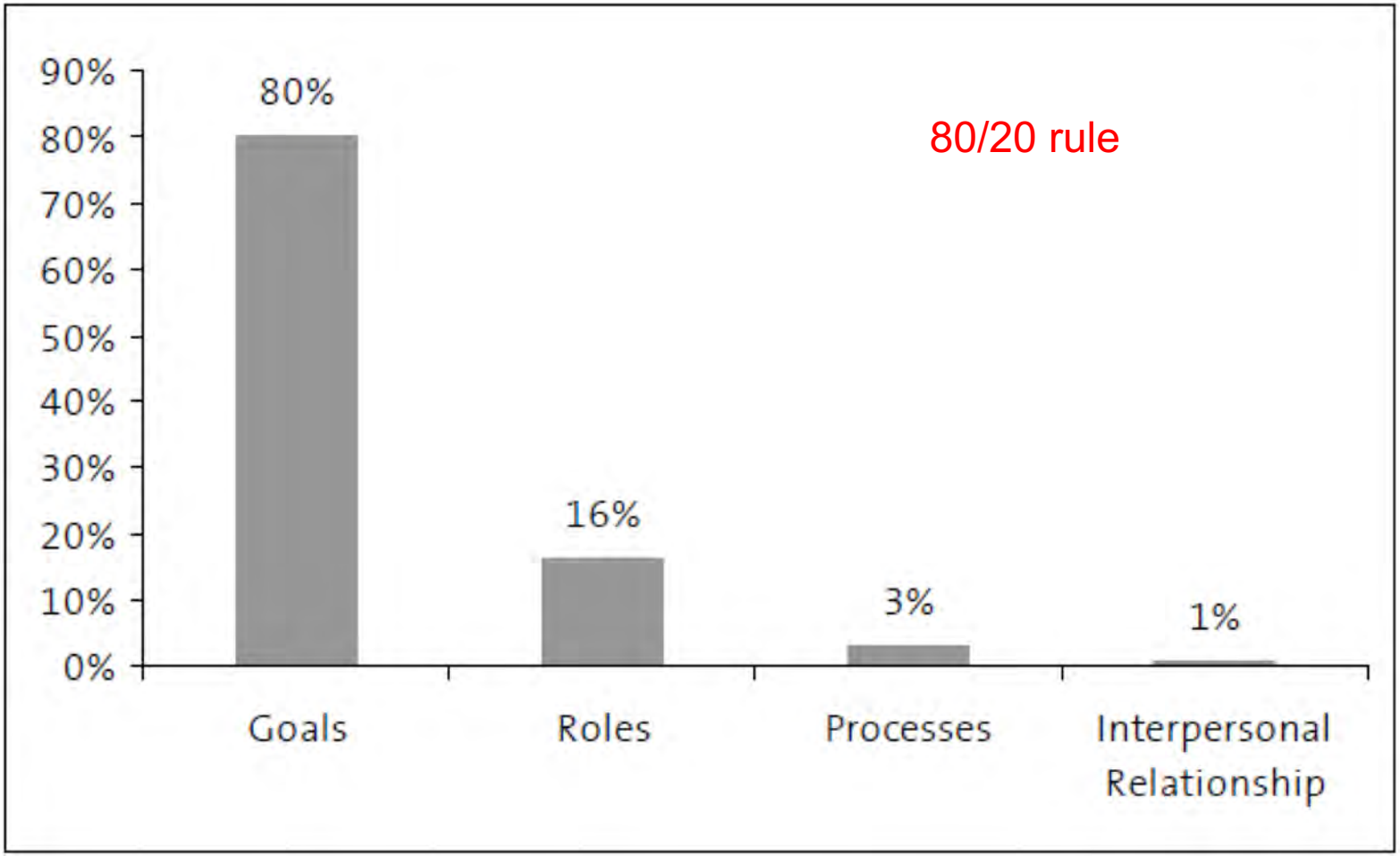
The GRPI Model of Team Effectiveness–Rubin, Plovnick, and Fry Model (1977)

Rubin, Plovnick, and Fry Model—The GRPI Model of Team Effectiveness

This model by Rubin, Plovnick, and Fry (1977) is one of the oldest models of team effectiveness. It is sometimes referred to as the "GRPI Model," which stands for Goals, Roles, Processes, and Interpersonal Relationships. The authors present their model in terms of a pyramid similar to Maslow's Hierarchy of Needs Theory (1954). However, unlike Maslow's theory, this model starts at the top of the pyramid.

According to the model, a team always should begin with a team-level goal. After the goal is defined, the roles and responsibilities will become clearer. As individuals work together (processes), they will see that goals and responsibilities often are not sufficiently clear. Consequently, team members will need to redefine them. That redefinition enables them to adjust and readjust team processes, such as decision making, conflict resolution, and work flow. When doing all that, they will be developing the interpersonal relationships needed to relate to other team members and the team leader. See Figure 2.

% conflicts attributed to each level



Source: Tang & Wenzlik, 2008

ORIGINAL ARTICLE

Better Interprofessional Teamwork, Higher Level of Organized Care, and Lower Risk of Burnout in Acute Health Care Teams Using Care Pathways

A Cluster Randomized Controlled Trial

Svin Deneckere, RN, MSc, PhD (Cand), Martin Euwema, MSc, PhD,† Cathy Lodewijckx, RN, MSc, PhD,* Massimiliano Panella, MD, PhD,‡§ Timothy Mutsvari, PhD,‖ Walter Sermeus, RN, MSc, PhD,*‡ and Kris Vanhaecht, RN, MSc, PhD*‡*

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Deneckere S et al. Med Care. 2013 Jan;51(1):99-107.

TABLE 4. Results of the Multilevel Logistic Regression Model for Ordinal or Binary Outcomes at the Cluster Level: Odds Ratios Explaining the Differences Between the Intervention and Control Group on (1) Effect of the Randomization Group, and Thus, the Effect of the Care Pathway; and (2) Effect of the Patient Group for Which the Care Pathway was Developed (COPD or PFF), that is a Covariate in the Multilevel Model

Indicators	Intervention	Control	Odds Ratio Random-ization Group†	Confidence Interval	Odds Ratio Patient Group‡	Confidence Interval
Team input indicators						
Leadership structure: No team leader/1 team leader/ shared leadership	No team leader: 4/17 1 team leader: 3/17 Shared leadership: 10/17	No team leader: 7/13 1 team leader: 3/13 Shared leadership: 3/13	4.271	1.021 to 17.861*	0.747	0.183 to 3.045
Coordinating mechanism (yes/no)						
Use of guidelines	Yes: 14/17	Yes: 5/13	7.683	1.387 to 42.548*	0.453	0.082 to 2.497
Use of interdisciplinary	Yes: 8/17	Yes: 8/13	0.562	0.122 to 2.589	3.195	0.687 to 14.87
IT-system						
Presence of a case manager	Yes: 6/17	Yes: 5/13	0.878	0.196 to 3.930	1.139	0.254 to 5.095
Team-training initiatives	Yes: 10/17	Yes: 4/13	3.218	0.700 to 14.791	1.022	0.226 to 4.624
Team process indicators						
Frequency of team meetings: Never/almost never/every month/every 2 wk/weekly/ daily	Never: 0/17 Almost never: 2/17 Every month: 2/17 Every 2 wk: 0/17 Weekly: 13/17 Daily: 0/17	Never: 3/13 Almost never: 4/13 Every month: 1/13 Every 2 wk: 1/13 Weekly: 3/13 Daily: 1/13	5.834	1.325 to 25.684*	1.089	0.284 to 4.168

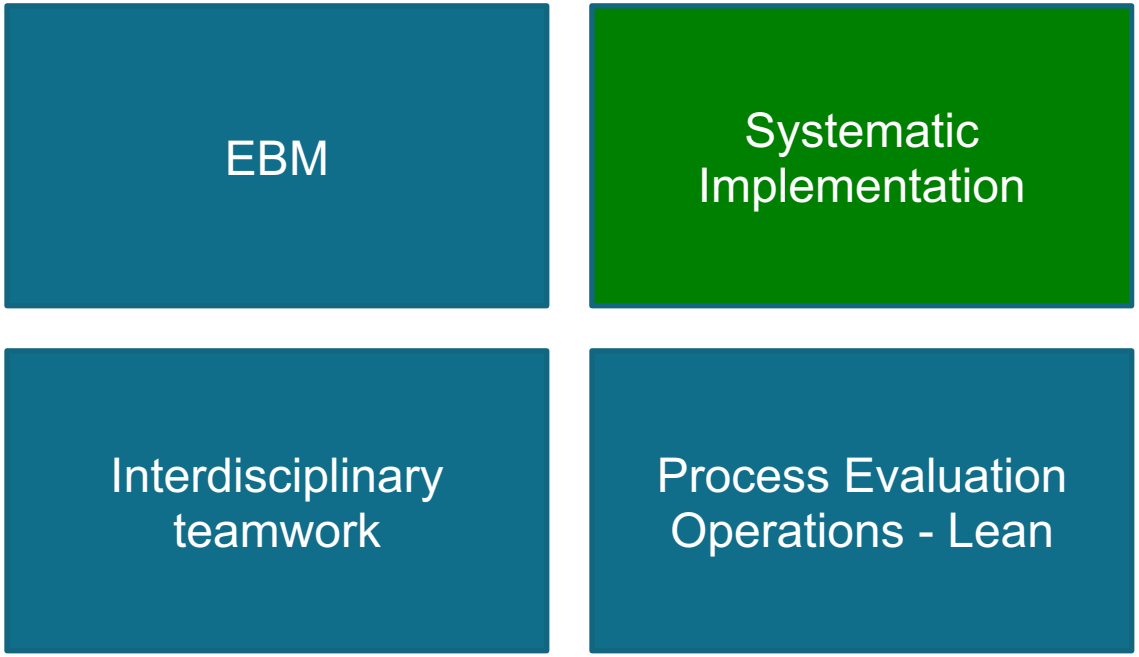
*$P<0.05$.

†The odds ratios, with its confidence interval, present the difference between the intervention and control group in: (a) for binary outcomes: the chance that the indicator is present or not; and (b) for ordinal outcomes: the chance of being in a higher category for this indicator.

‡The odds ratios, with its confidence interval, present the difference between both patient groups for each indicator.

COPD indicates chronic obstructive pulmonary disease; PPF, proximal femur fracture.

Active components of Care Pathways: how do they work?



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The International Journal of Person Centered Medicine Vol 2 Issue 3 pp 341-351

ARTICLE

The 7-phase method to design, implement and evaluate care pathways

Kris Vanhaecht RN MSc PhD[a], Eva Van Gerven MSc[b], Svin Deneckere RN MSc[c], Cathy Lodewijckx RN MSc[d], Ingrid Janssen MSc[e], Ruben van Zelm RN MSc[f], Paulo Boto MSc PhD[g], Rita Mendes MSc[h], Massimiliano Panella MD MPH PhD[i], Eva Biringer MD PhD[j] and Walter Sermeus RN MSc PhD[k]

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Figure 1 The 7-Phase method

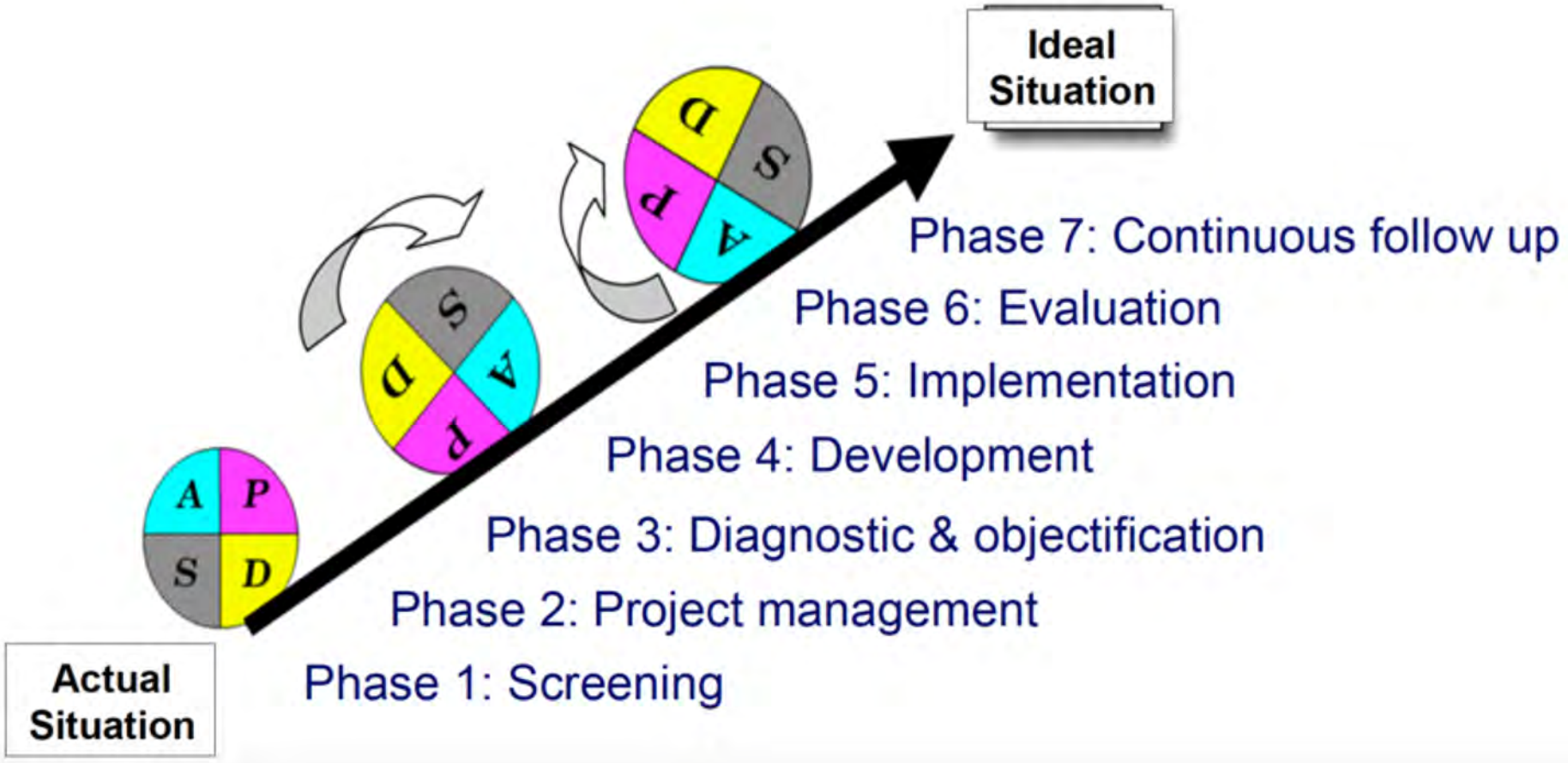
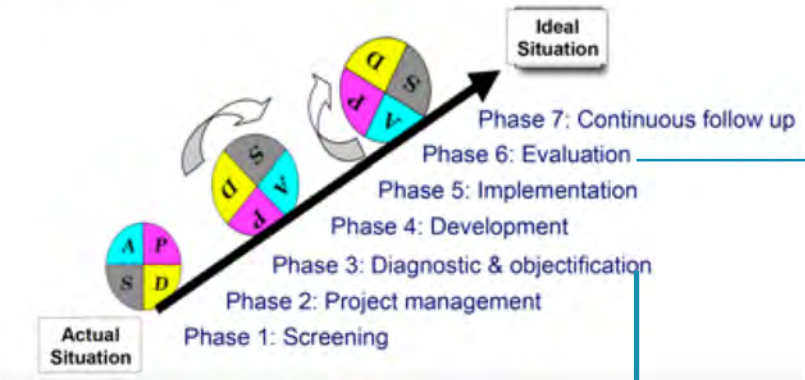


Figure 1 The 7-Phase method



Exploratory pathway analysis

Functional analysis	*Process analysis*	*Organizational analysis*	*Case data analysis*
• Existence/absence of activities • Activity co-existence • Additional analyses	• Clinical pathway discovery • Process variant analysis • Recurring patterns • Additional analyses	• Social network analysis (teams, hand-overs, interactions) • Task allocation • Additional analyses	• Data-driven conditions • Correlations data and pathway structure • Additional analyses

Advanced pathway analysis

Efficiency analysis	*Quality and conformance analysis*
• Bottleneck analysis • Performance analysis and comparison of variants • Number and duration of diagnosis and treatment cycles • Additional analyses	• Rule-based pathway analysis • Conformance analysis • Analysis of adverse events • Root-cause analysis for variation • Additional analyses

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Caron et al., 2014

Examples of data analysis

Computers in Biology and Medicine 44 (2014) 88–96

Contents lists available at ScienceDirect

Computers in Biology and Medicine

journal homepage: www.elsevier.com/locate/cbm

Monitoring care processes in the gynecologic oncology department

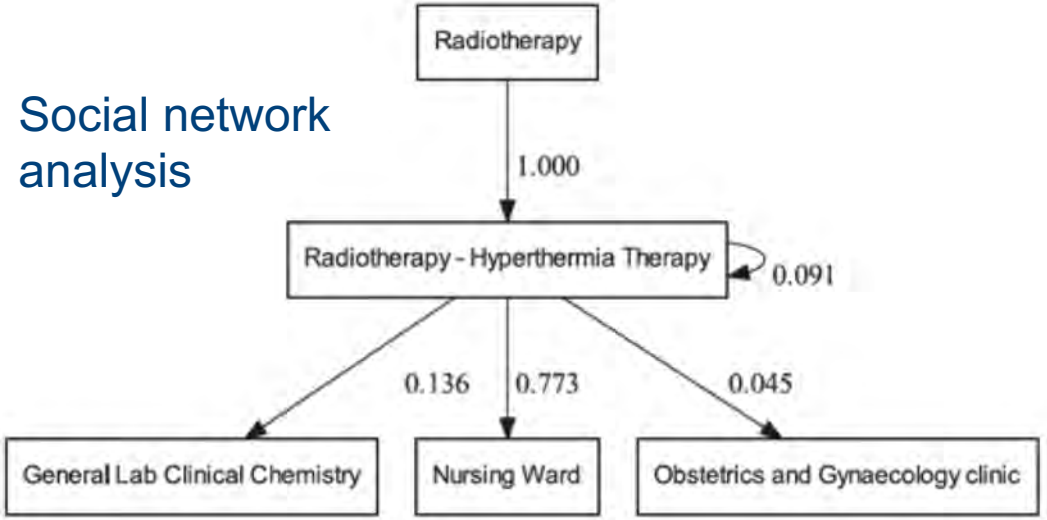
Filip Caron [a,*], Jan Vanthienen [a], Kris Vanhaecht [b,c,d], Erik Van Limbergen [e], Jochen De Weerdt [a,f], Bart Baesens [a,g,h]

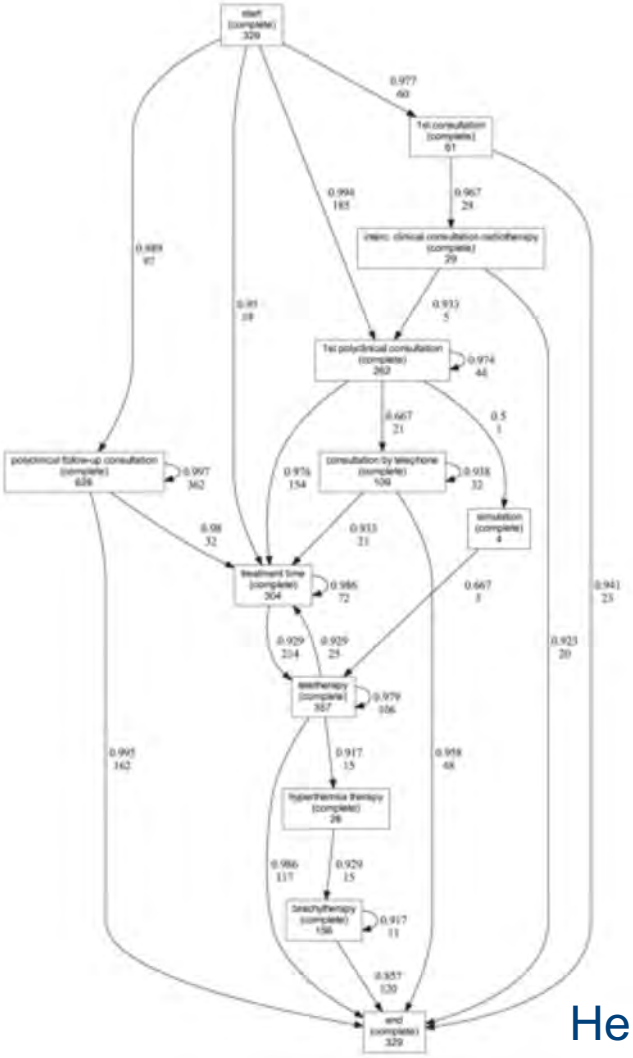
	Analysis sub type	Analysis	Techniques/tools	Description
Exploratory analysis	Functional analysis	Activity existence in a clinical pathway	Heuristics miner [13] and LTL-checker [14]	Presence of hyperthermia
	Process analysis	Clinical pathway discovery	Heuristics miner [13]	Radiotherapy workflow
		Clinical pathway variant analysis	Heuristics miner [13]	Radiotherapy workflow variant with hyperthermia
		Recurring patterns in individual patient care	Trace alignment [15]	Medical tests preceding the administration of paclitaxel
	Organizational analysis	Standard interaction and coordination between medical experts	Performance sequence diagram [16,17], Social network miner [18]	Interaction between radiotherapists and other medical specialists
	Case data analysis	Correlation between the activity log data and the activity sequence for individual patients	Custom-made rule patterns and process exploration	Correlation between (1) the presence of hyperthermia and the diagnosis codes, (2) the administration of paclitaxel and the diagnosis codes, (3) the administration of paclitaxel for ovarian cancer
Advanced analysis	Efficiency analysis	*Timestamps were to imprecise for efficiency analyses*		
	Quality and Conformance analysis	Rule-based pathway analysis	LTL-checker [14]	Compliance with treatment sequence
		Analysis of exceptional events	Custom-made rule patterns and process exploration	Absence of platinum agents for treating ovarian cancer with taxanes

Caron et al., 2014

Examples

Social network analysis





Heuristic Miner

Caron et al., 2014

Examples

International Journal for Quality in Health Care 2011; Volume 23, Number 1: pp. 83–93
Advance Access Publication 30 November 2010
10.1093/intqhc/mzq071

Exploring the relation between process design and efficiency in high-volume cataract pathways from a lean thinking perspective

ELLEN J. VAN VLIET[1], EELCO BREDENHOFF[2], WALTER SERMEUS[1], LUCAS M. KOP[2], JOHANNES C.A. SOL[3] AND WIM H. VAN HARTEN[2]

	Lean framework	Hospital 1 ($n = 9195$)	Hospital 2 ($n = 8761$)	Hospital 3 ($n = 4093$)
Lead time in days	1	109.2	15.0	91.0
Access time	0	31.5	0.0	25.0
Waiting time for surgery	0	77.7	15.0	66.0
Number of hospital visits per patient	1.0	3.0	3.6	3.2
Patients with 1 hospital visit	100%	0 (0%)	0 (0%)	0 (0%)
Patients with 2 hospital visits	0%	4376 (48%)	0 (0%)	1274 (31%)
Index number direct costs per patient[a]	100.0	128.6	153.0	139.7

The outcomes in the lean framework column represent the ideal scores as achieved in Fig. 1.
[a]The direct costs per patient in the lean framework equalled an index value of 100.

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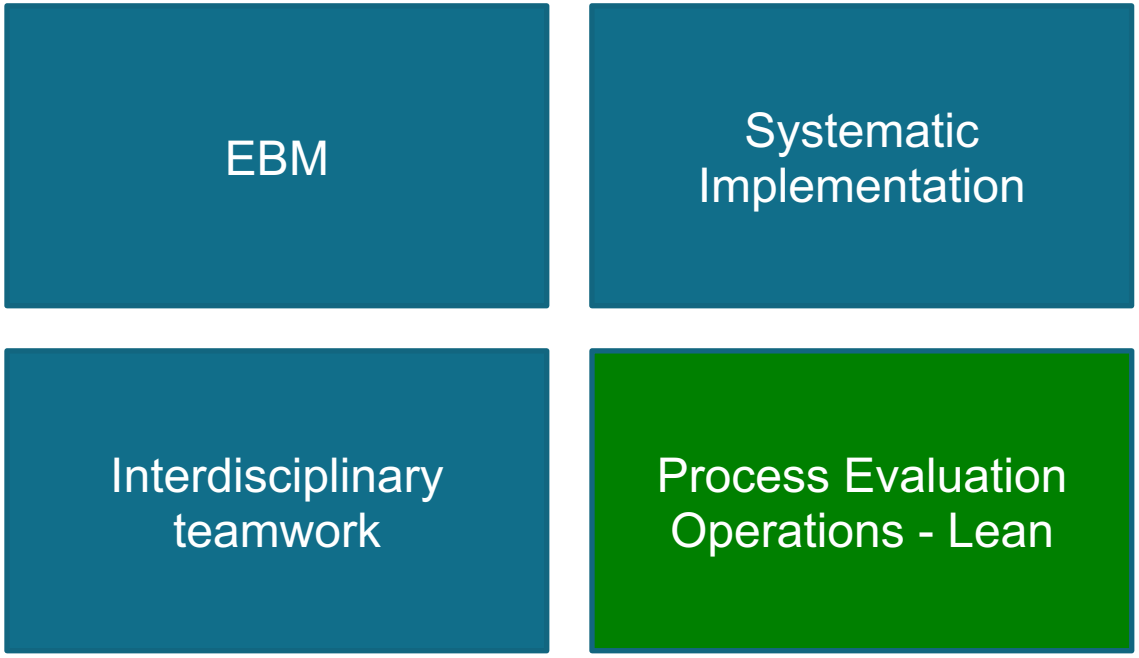
Van Vliet et al., 2010

Active components of Care Pathways: how do they work?



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Original research

Efficacy and efficiency of a lean cataract pathway: a comparative study

Ellen Joan van Vliet,[1,2] Walter Sermeus,[1] Claudia M van Gaalen,[2] Johannes C A Sol,[2] Jan M H Vissers[3]

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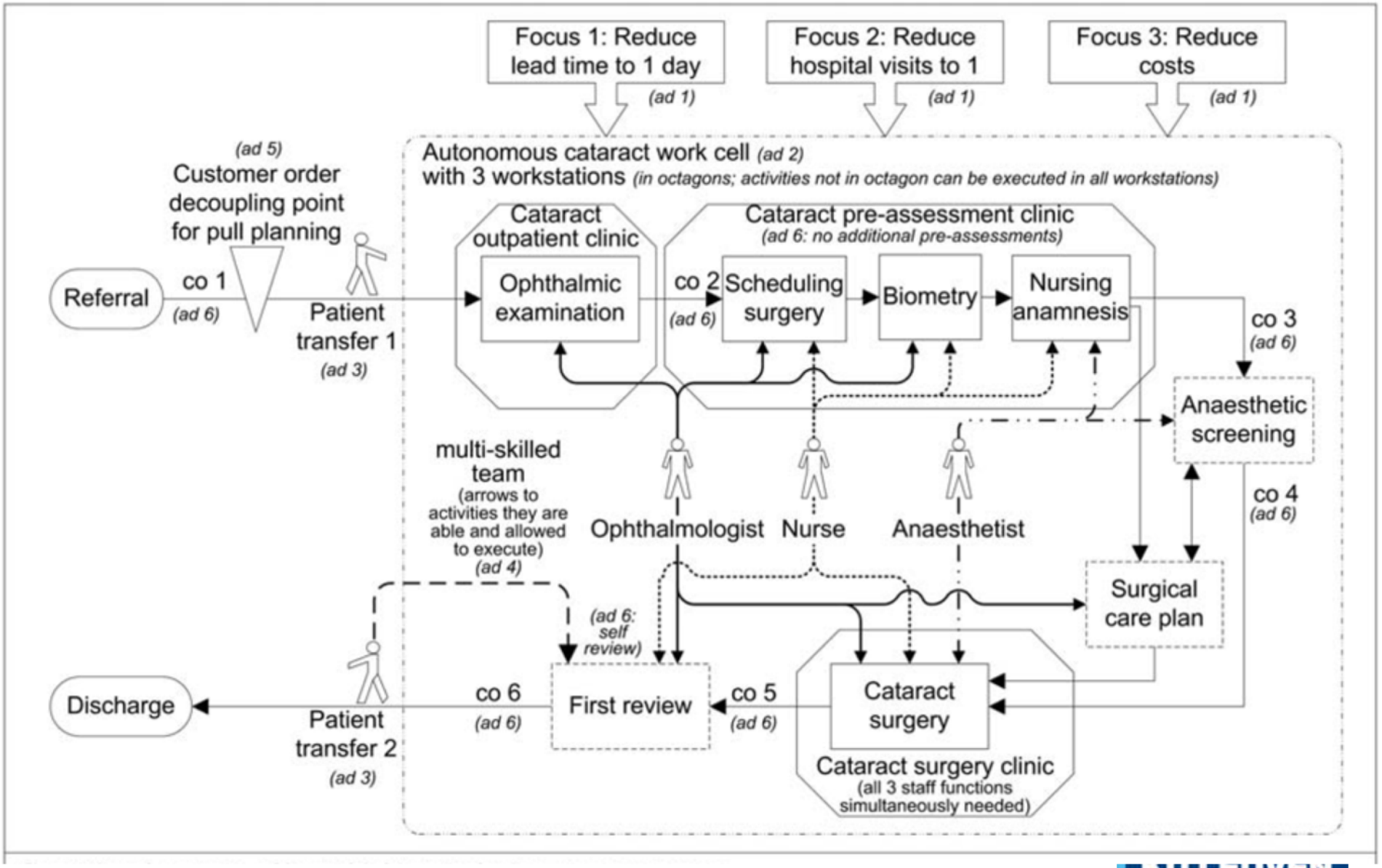
Focus 1: Reduce lead time to 1 day
(ad 1)
Focus 2: Reduce hospital visits to 1
(ad 1)
Focus 3: Reduce costs
(ad 1)
(ad 5)
Customer order decoupling point for pull planning
Autonomous cataract work cell (ad 2)
with 3 workstations (in octagons; activities not in octagon can be executed in all workstations)
Cataract outpatient clinic
Cataract pre-assessment clinic
(ad 6: no additional pre-assessments)
Referral
co 1
(ad 6)
Patient transfer 1
(ad 3)
Ophthalmic examination
co 2
(ad 6)
Scheduling surgery
Biometry
Nursing anamnesis
co 3
(ad 6)
Anaesthetic screening
co 4
(ad 6)
multi-skilled team
(arrows to activities they are able and allowed to execute)
(ad 4)
Ophthalmologist
Nurse
Anaesthetist
Surgical care plan
(ad 6: self review)
Discharge
Patient transfer 2
(ad 3)
co 6
(ad 6)
First review
co 5
(ad 6)
Cataract surgery
Cataract surgery clinic
(all 3 staff functions simultaneously needed)

Process flow of cataract pathway

Key interventions:

1. One-stop pre-assessment
2. Formulating surgical care plan based on patient record only
3. Next day telephone review by nurse
4. Final review 4 weeks after surgery by optometrist

5. Note: protocol exceptions for 2,3 and 4 so that patient is seen by eye surgeon

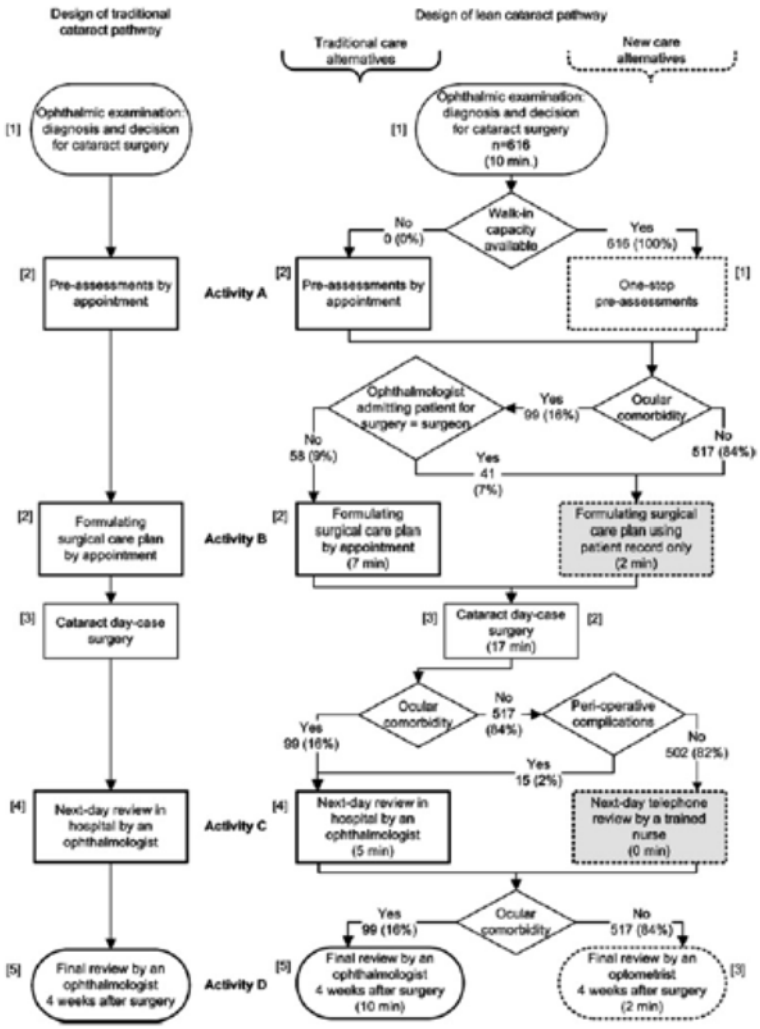

Table 1 Efficacy and efficiency of the lean cataract pathway

	Traditional pathway n=591	Lean pathway n=616	p Value††	p Value‡‡
Efficacy				
A. One-stop preassessments			<0.001‡	<0.001§
Actual care delivery*	188 (31.8%)	362 (58.8%)		
Expected care delivery*	NA	616 (100.0%)		
B. Formulating surgical care plan using the patient record only			<0.001‡	<0.001§
Actual care delivery*	72 (12.2%)	418 (67.9%)		
Expected care delivery*	NA	558 (90.6%)		
C. Next-day telephone review			<0.001‡	<0.001§
Actual care delivery*	0 (0%)	367 (59.5%)		
Expected care delivery*	NA	502 (81.5%)		
D. Final review by an optometrist			<0.001‡	<0.001§
Actual care delivery*	0 (0%)	257 (41.7%)		
Expected care delivery*	NA	517 (83.9%)		
Efficiency				
1. No of hospital visits per patient			<0.001¶	<0.001**
Actual care delivery†	5.7 (1.1)	4.4 (1.3)		
Expected care delivery†	NA	3.4 (0.6)		
2. Amount of ophthalmologist's time spent per patient in minutes			<0.001¶	<0.001**
Actual care delivery†	48.2 (2.2)	35.3 (6.7)		
Expected care delivery†	NA	28.6 (6.7)		
3. No of patients treated, related to ophthalmologist's time needed to treat one patient in traditional pathway			<0.001¶	<0.001**
Actual care delivery†	1.00 (0.0)	1.42 (0.3)		
Expected care delivery†	NA	1.76 (0.3)		

Actual care delivery in the lean pathway (2007) is compared with (1) actual care delivery in the traditional pathway (2004) and with (2) expected care delivery in the lean pathway, that is, care according to decision rules and service specifications, as stated in the lean pathway design.
*Number and percentage; †Mean with SD; ‡χ^2; §McNemar; ¶Independent-samples t test; **Paired-samples t test; ††p Value of statistical testing between actual care delivery in the traditional pathway and actual care delivery in the lean pathway; ‡‡p Value of statistical testing between actual care delivery and expected care delivery in the lean pathway; NA, not applicable.

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Van Vliet et.al., Qual Saf Health Care, April 22, 2010

Effect on patient experiences

Table 2 Patients' experiences with quality of care in a cataract pathway with postoperative contact with ophthalmologists (control group with first-day review and final review conducted by ophthalmologists, ie, traditional care pathway) and a cataract pathway without postoperative contact with ophthalmologists (experimental group with telephone first-day review by a nurse and final review by an optometrist, ie, co-managed care pathway)

	Q#	Control group (n=194)	Experimental group (n=289)	p Value	Multiple linear regression analysis**		Multiple logistic regression analysis**	
					B (SE)	p Value	OR (95% CI)	p Value
Patient experience with ophthalmologists								
Communication with ophthalmologist*	Q1–8	3.7 (0.4)	3.8 (0.4)	0.33§	0.01 (0.04)	0.75	NA	
Global rating—ophthalmologist†	Q9	9.1 (1.3)	8.9 (1.3)	0.07§	−0.15 (0.12)	0.22	NA	
Yes, enough contact with ophthalmologist‡	Q10	187 (96.4%)	267 (92.4%)	0.08¶	NA		0.51 (0.21 to 1.27)	0.15
Patient experience with overall care								
Global rating—hospital†	Q11	9.1 (1.3)	9.0 (1.0)	0.32§	−0.01 (0.11)	0.95	NA	
Willingness-to-recommend*	Q12	3.9 (0.3)	3.9 (0.4)	0.14§	−0.05 (0.04)	0.21	NA	
Patient experience with patient education								
Yes, emergency information provided‡	Q13	163 (84.0%)	254 (87.9%)	0.21¶	NA		1.20 (0.69 to 2.10)	0.53
Yes, postoperative instructions provided‡	Q14	119 (61.3%)	213 (73.7%)	<0.01¶	NA		1.78 (1.18 to 2.69)	<0.01

*Mean (SD) based on a Likert-scale response scores ranging from 1 (never/definitely not) to 4 (always/definitely).
†Mean (SD) based on a scale ranging from 0 (worst possible care) to 10 (best possible care).
‡Number and percentage of "yes" responses.
§Mann–Whitney test.
¶χ^2 test.
**Statistical testing of the experimental group to the control group (reference group=control group), adjusted for age, health, sex, education, logMAR equivalent of postoperative corrected distance visual acuity, number of increased visual acuity lines and difference between intended and achieved refractive error in diopters.
Q#, number of the question in questionnaire (see figure 2); B (SE), β coefficient (SE).

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van Vliet EJ, et al., Patients' experiences and preferences with co-managed care in a cataract pathway. Br J Ophthalmol. 2010 Oct;94(10):1363-8

Results of care pathways

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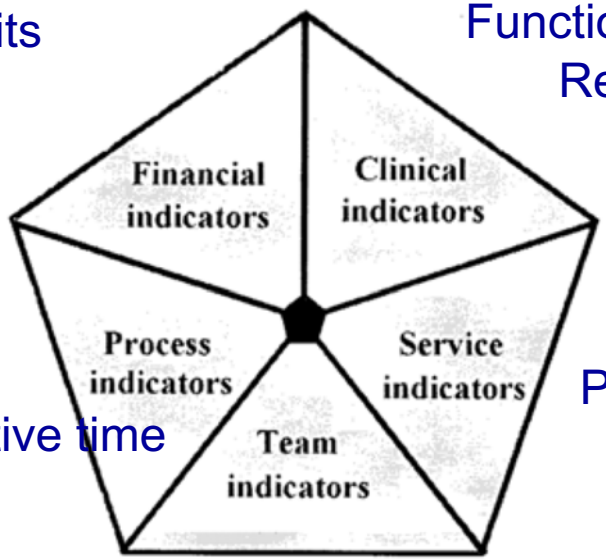
Evaluation of Care Pathways
Care Pathway Compass

Bill of Services - ABC
Costs - profits
LOS

Mortality, morbity
Functional status
Re-admissions
adverse events
QoL



Waiting times
Waste, nonproductive time

Patient satisfaction

Job satisfaction
Team effectiveness, multi-disciplinary teamwork

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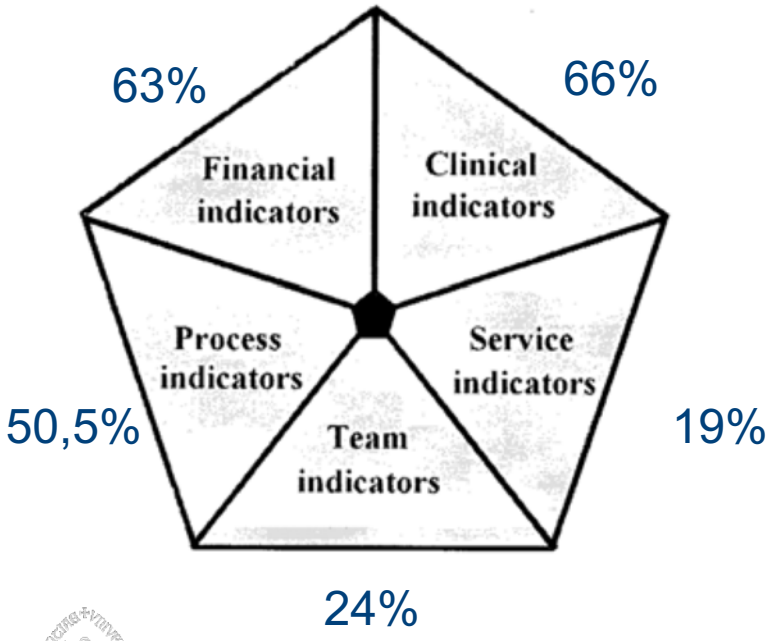
Vanhaecht & Sermeus, Journal of Integrated Care Pathways, 2003

Results literature review 2000-2002

613 publications
Evaluation in 208/613 (34%)



	Positive effect	=	Negative effect
Clinical outcomes	65,6%	32%	2,4%
Service	62,2%	29,7%	8,1%
Process	86%	6,9%	6,9%
Team	83,3%	6,3%	10,4%
Financial	82,5%	13,5%	4%

Van Herck, Vanhaecht, Sermeus, 2003

BMC Medicine

BioMed Central

Effects of clinical pathways in the joint replacement: a meta-analysis

BMC Medicine 2009, **7**:32 doi:10.1186/1741-7015-7-32

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Review: Clinical pathway and total hip and knee arthroplasty
Comparison: 02 Care Pathway vs standard care
Outcome: 01 Postoperative complications

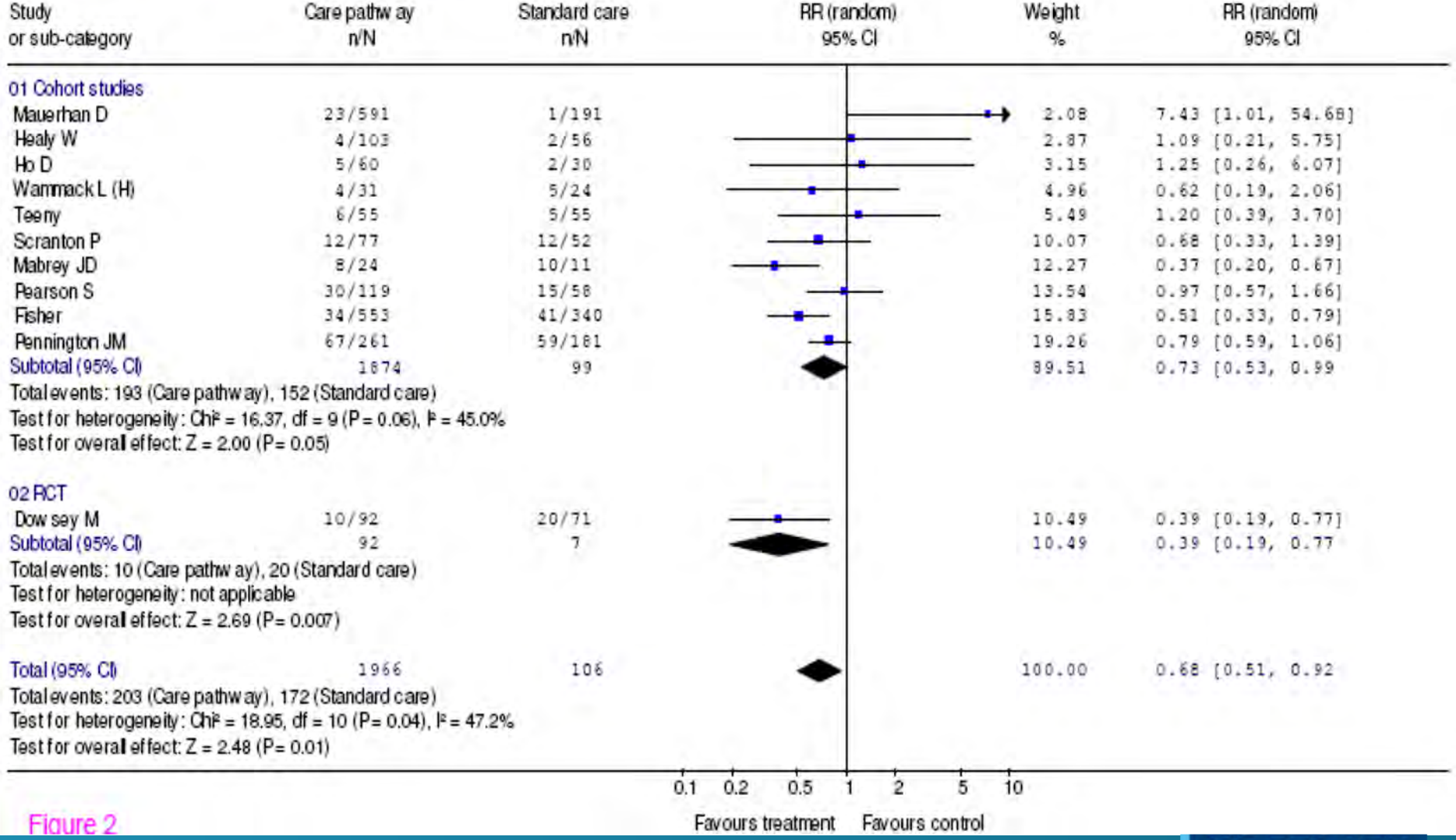

Figure 2

Review: Clinical pathway and total hip and knee arthroplasty
Comparison: 01 Care Pathway vs standard care
Outcome: 03 Lenght of hospital stay

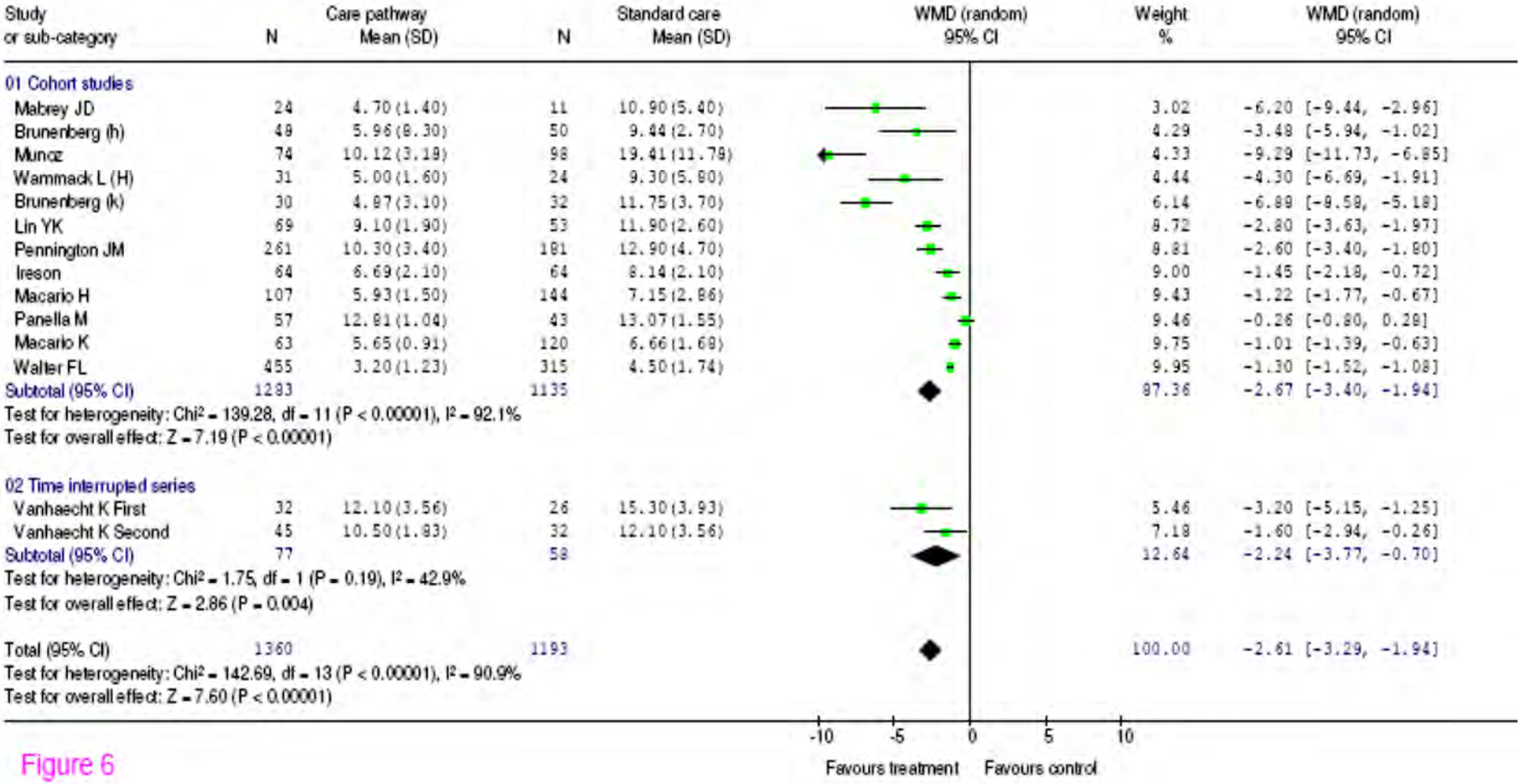

Figure 6

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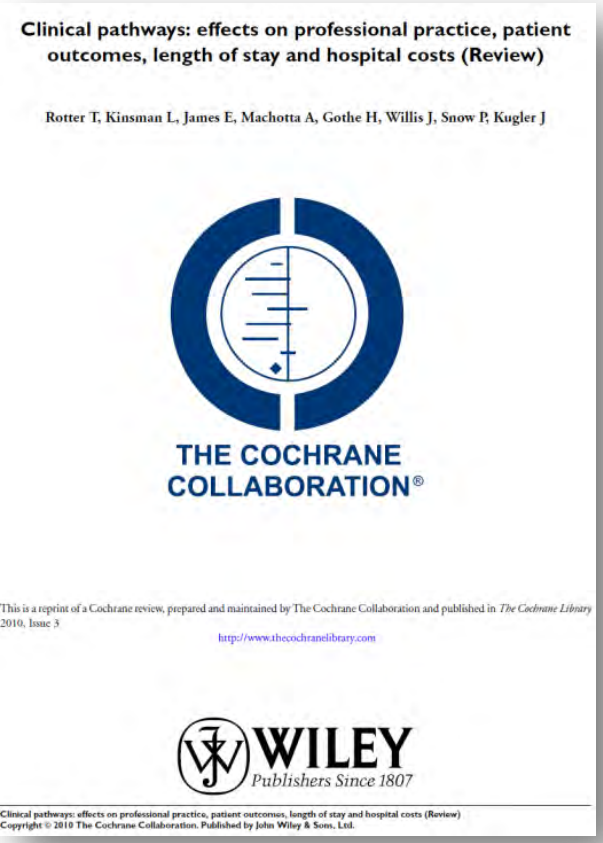
Results Cochrane Systematic Review 2010



Clinical pathways: effects on professional practice, patient outcomes, length of stay and hospital costs (Review)

Rotter T, Kinsman L, James E, Machotta A, Gothe H, Willis J, Snow P, Kugler J

THE COCHRANE COLLABORATION®

This is a reprint of a Cochrane review, prepared and maintained by The Cochrane Collaboration and published in *The Cochrane Library* 2010, Issue 3

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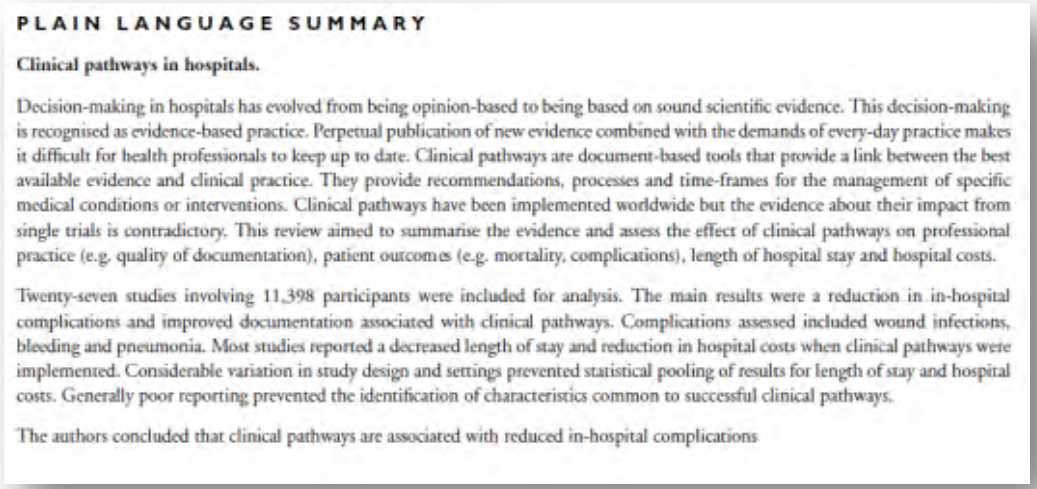

PLAIN LANGUAGE SUMMARY

Clinical pathways in hospitals.

Decision-making in hospitals has evolved from being opinion-based to being based on sound scientific evidence. This decision-making is recognised as evidence-based practice. Perpetual publication of new evidence combined with the demands of every-day practice makes it difficult for health professionals to keep up to date. Clinical pathways are document-based tools that provide a link between the best available evidence and clinical practice. They provide recommendations, processes and time-frames for the management of specific medical conditions or interventions. Clinical pathways have been implemented worldwide but the evidence about their impact from single trials is contradictory. This review aimed to summarise the evidence and assess the effect of clinical pathways on professional practice (e.g. quality of documentation), patient outcomes (e.g. mortality, complications), length of hospital stay and hospital costs.

Twenty-seven studies involving 11,398 participants were included for analysis. The main results were a reduction in in-hospital complications and improved documentation associated with clinical pathways. Complications assessed included wound infections, bleeding and pneumonia. Most studies reported a decreased length of stay and reduction in hospital costs when clinical pathways were implemented. Considerable variation in study design and settings prevented statistical pooling of results for length of stay and hospital costs. Generally poor reporting prevented the identification of characteristics common to successful clinical pathways.

The authors concluded that clinical pathways are associated with reduced in-hospital complications

- **Lower LOS**
- **Less costs**
- **Better documentation**
- **Less complications**

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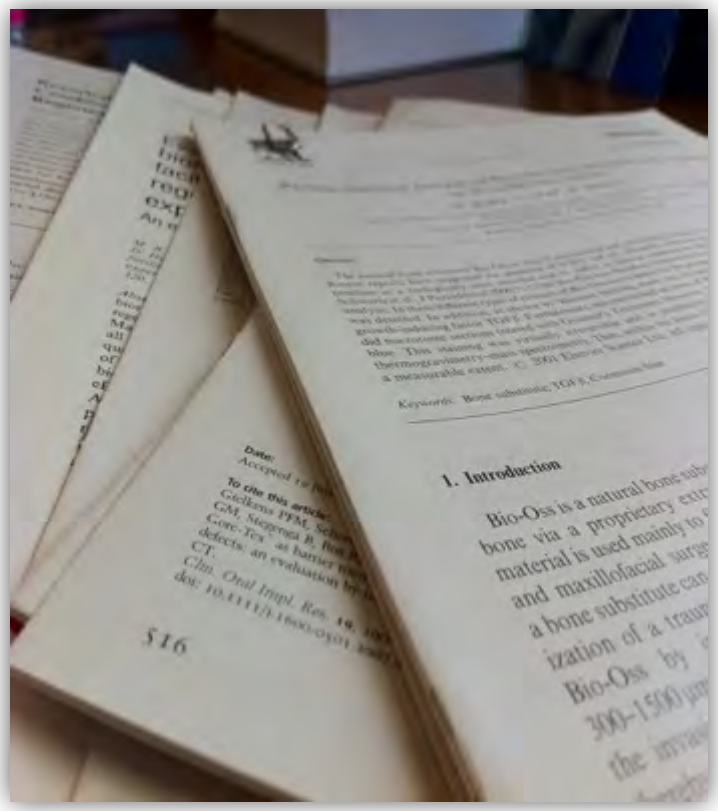
General results

- Improved coördination (*Gittel, 2000*)
- Less variation (Cannon, 2002; *Panella, 2003*)
- Improved teamwork (Deneckere, 2013)
- Lower risk on burnout (Seys 2017)
- Decreased mortality *Panella, 2009;*)
- Lower Length of Stay (Barbieri, 2009)
- Lower complications (Rotter, 2010)
- Lower cost (*Panella, 2003;* Barbieri, 2009)
- Higher patient satisfaction (Renholm, 2002)
- Lower readmission rate (Vanhaecht, 2017)



- Methods unclear
- Design
- Descriptive
- Content of the pathway
- Change mechanisms
- Sample size
- Indicators
- Sustainability
- …

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Evaluation of the evaluation

- Often no evaluation (2/3 of projects)
- Poor designs (mainly pre-post designs, case studies)
- Care pathway is not always fully described (nor control) – (what are you evaluating?)
- Small sample sizes – low power
- Systematic reviews: often negative because of large variability in interventions (- what are you combining)
- Context seems to highly important (support by management, ownership by teams, health system)

Conclusions

On care pathways

We hear a lot about guidelines, which are supposed to ensure that the right patients gets the right treatment. This is a rather glib statement, but is underpinned by some interesting ideas, including:

- **Diagnosis**: Treating the right patient
- **Treatment:** Treating the right patient right
- **Organisation**: Treating the right patient right at the right time
- **Pathway**: Treating the right patient right at the right time and in the right way

Guidelines are supposed to cover this, but they mostly cover just the first two steps. There is more to delivering good care than that. It requires good organisation - what one might call management, except that many of us now see that word as meaning anything but organisation. And it requires that we perform actions in ways that are known to deliver good quality care.

Pulling it all together

Care pathways do not start from nowhere and nothing. It is not as if what we do usually is badly awry, and our experience in modern healthcare systems is the opposite. These large, complex, organisations looking at millions of individual people do a simply marvellous job for most people most of the time.

While recognising that, none of us could or would claim that everything is perfect. There is always room for improvement as our technology, experience, and support services improve. The issue is often not one of no change, but often one of too much change, but of the wrong sort.

In industry, care pathways would be called something else. A mix, perhaps, of good practice and quality control, plus a large helping of ongoing quality improvement. After all, care pathways involve not one action, but many, often in a complex package of care. In these complex packages, it is the combining of individual interventions in a management framework suited to local needs and abilities that is the critical factor.

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