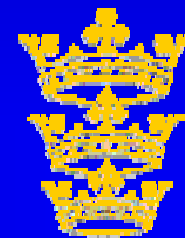


Telemonitoring of Heart Disease Patients

The Medical Perspective

**John GF Cleland
University of Hull
Kingston upon Hull**



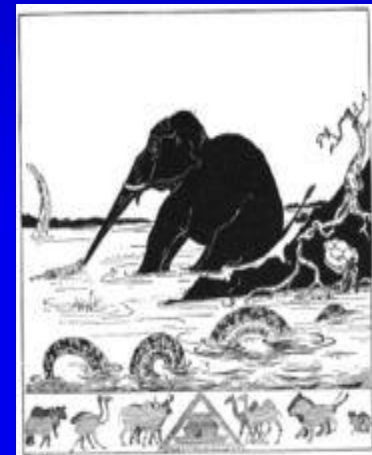
Questions I was Asked to Address

- **Despite clear evidence of benefits for patients the uptake of telemonitoring services is slow - what are the main hindrances and how can they be overcome?**
- **Why and when do health professionals support investment in eHealth and telemedicine solutions?**
- **How does this translate into investment decision-making and procurement processes of their organisations?**

Six Honest Serving-Men

- I keep six honest serving-men
(They taught me all I knew);
Their names are What and Why and When
And How and Where and Who.
I send them over land and sea,
I send them east and west;
But after they have worked for me,
I give them all a rest.

Rudyard Kipling
Anglo-Indian Poet (1865-1936)



The Elephant's Child

WHO should be Monitored

(Assumes a Modest Cost per Month - ~50 euro)

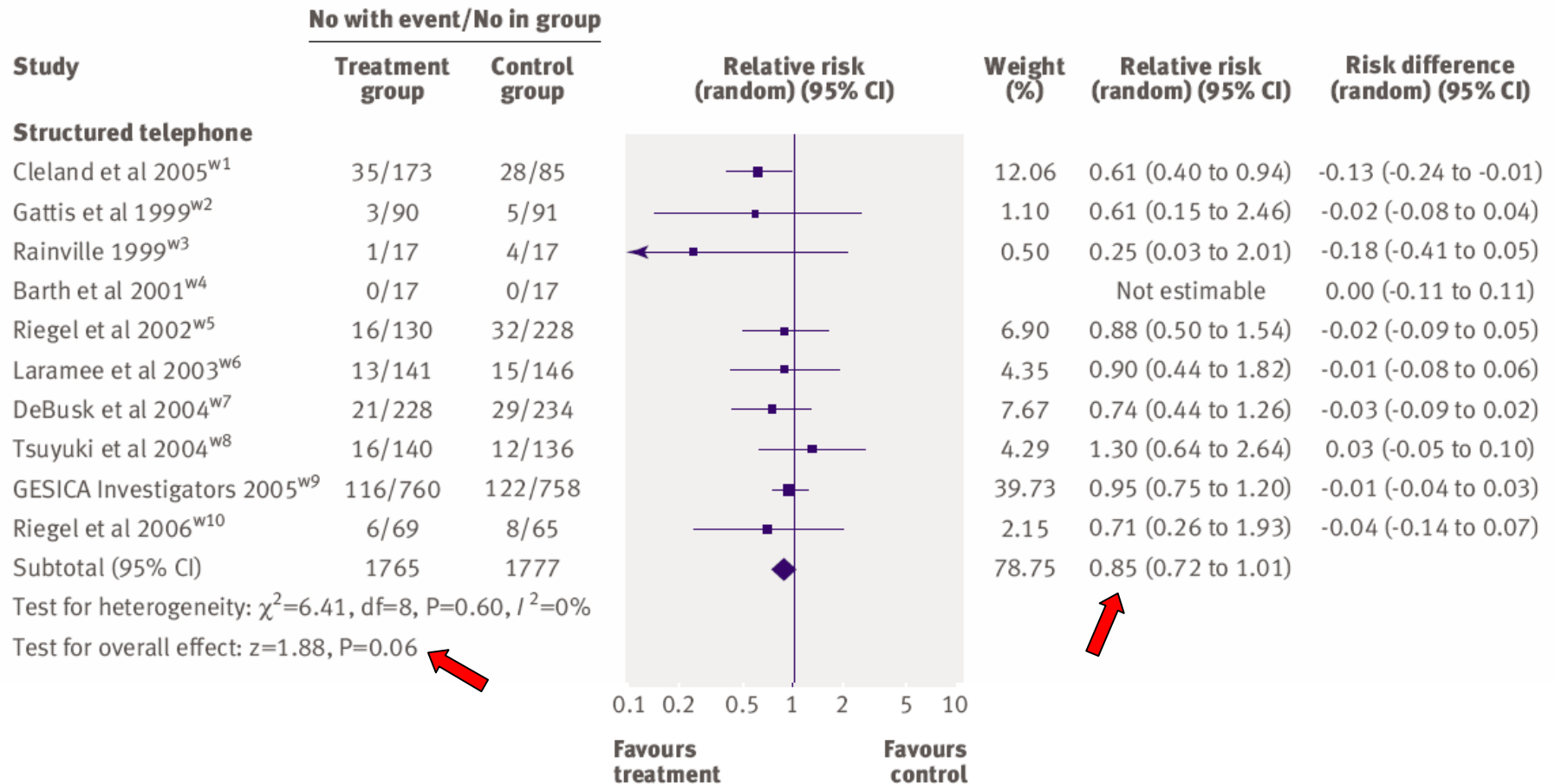
- Who should be considered for home telemonitoring
 - Patients who might benefit from frequent measurements
 - **High (but modifiable) risk of hospitalisation & death**
 - Eg:- patients with severe but stable heart failure
 - Why:- To improve outcomes and reduce (hospital) cost
 - **Rapid treatment titration**
 - Eg:- after a myocardial infarction, new hypertension
 - Why:- to ensure good rehab & secondary prevention
- Who should **not** be considered for home telemonitoring
 - Stable patients at low risk of hospital'n/death in the next year
 - Eg:- **Most patients who are well with no recent 'event'**
 - Why:- Not cost-effective unless costs are very low.
Medicalisation of patients who do not need it.

Plasma NT-proBNP!

Breaking Down Question 1

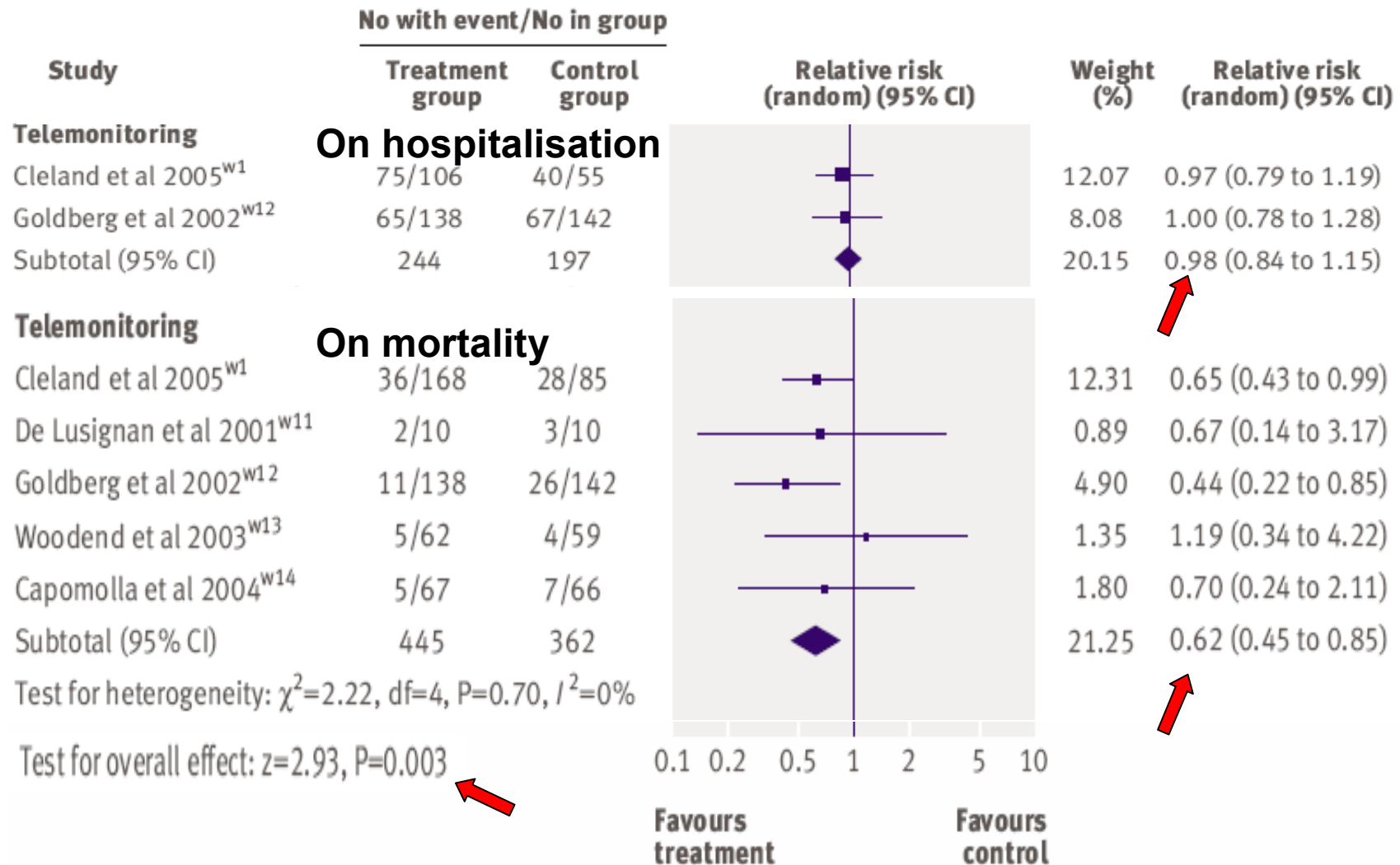
- **Despite clear evidence of benefits for patients**
- **The uptake of telemonitoring services is slow**
- **What are the main hindrances?**
- **How can these be overcome?**

Effect of Structured Telephone Support on All-Cause Mortality



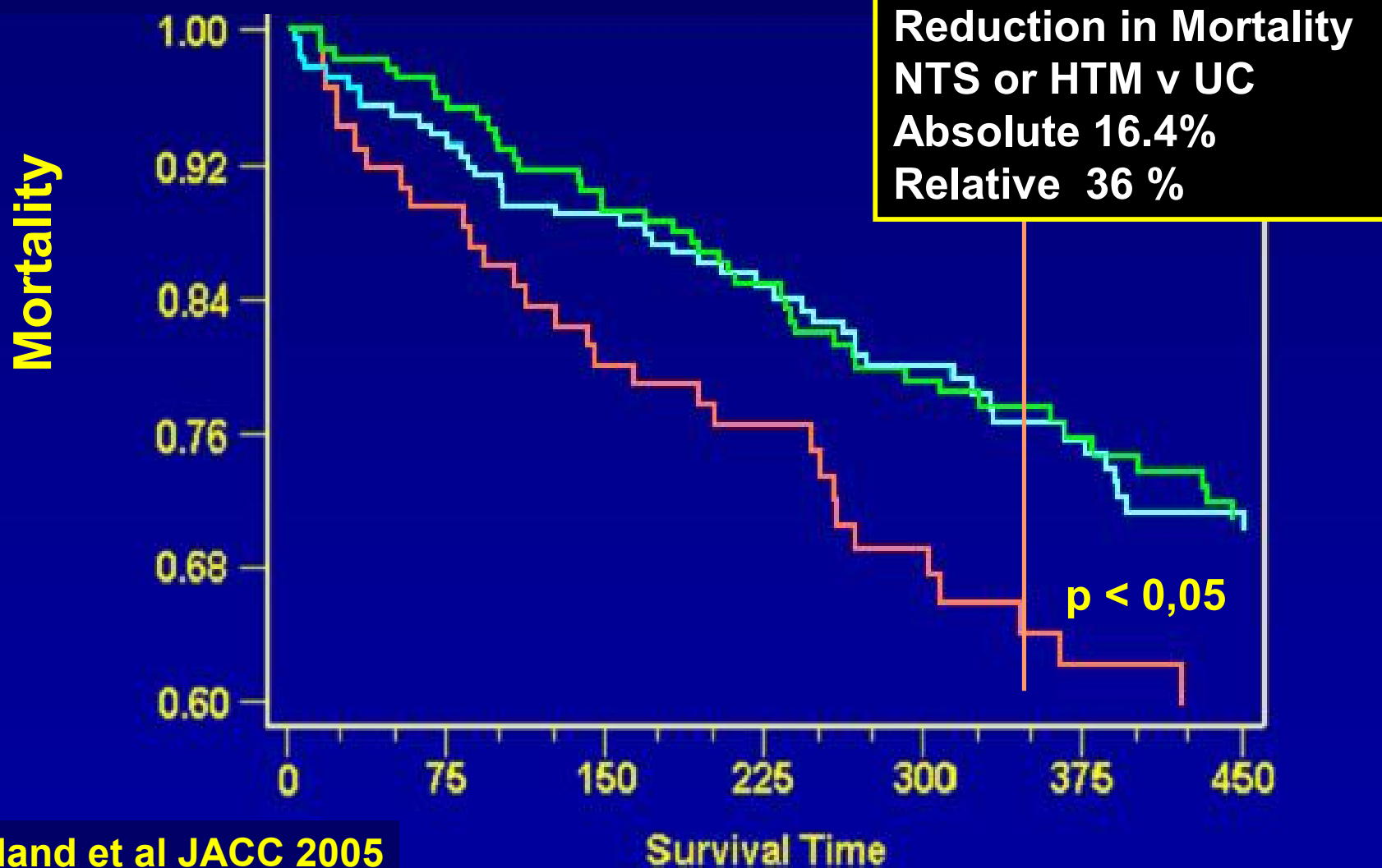
Clark RA et al. BMJ 2007

Effect of Home Telemonitoring



Clark RA, Cleland JG et al. BMJ 2007

TransEuropean Home Telemonitoring Study – TEN-HMS



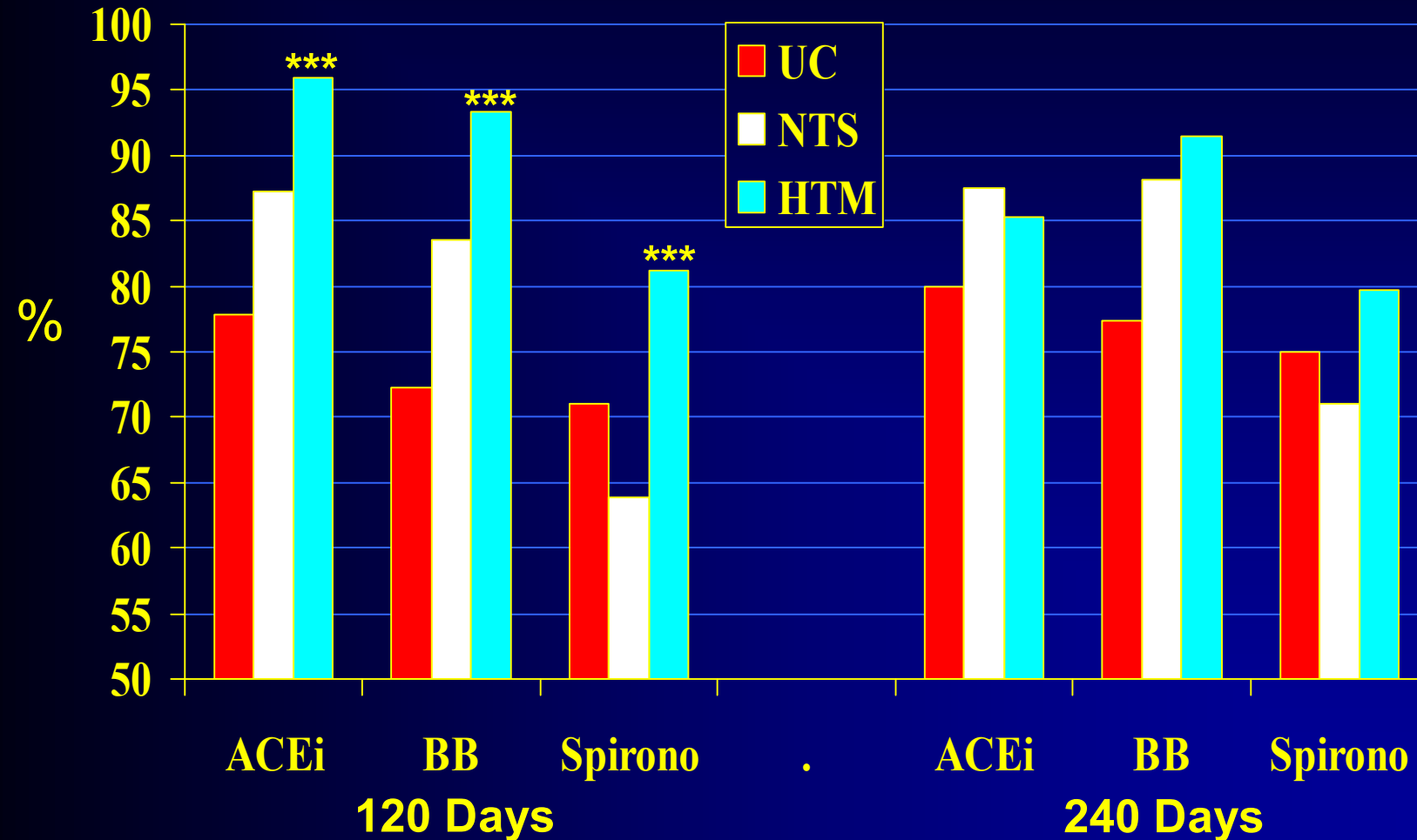
Cleland et al JACC 2005

Usual Care Nurse Support Home Telemonitoring

TEN-HMS

Implementation of Patient Management Plans

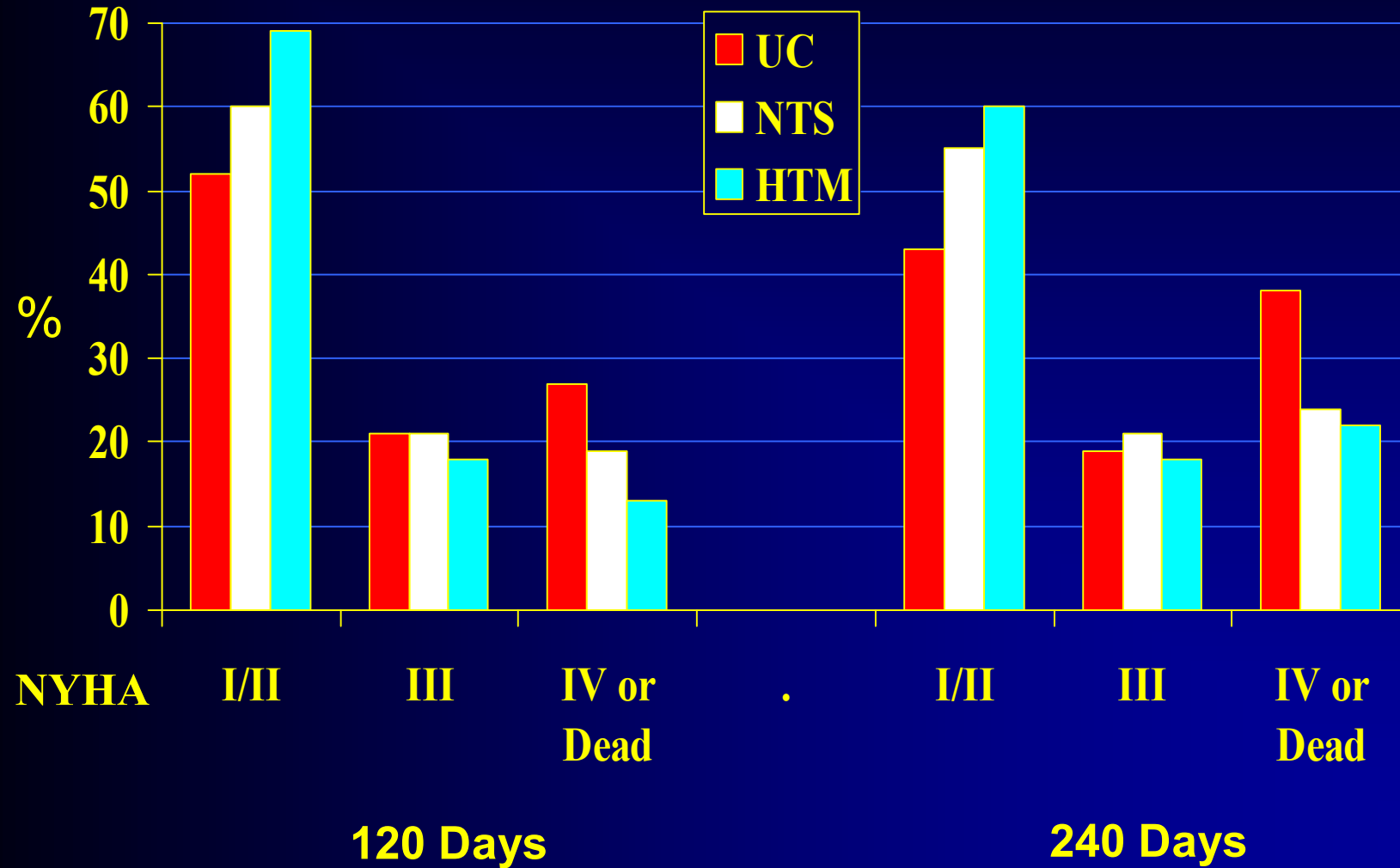
(amongst survivors at each time point)



*** differences between HTM and other groups. No difference between UC and NTS

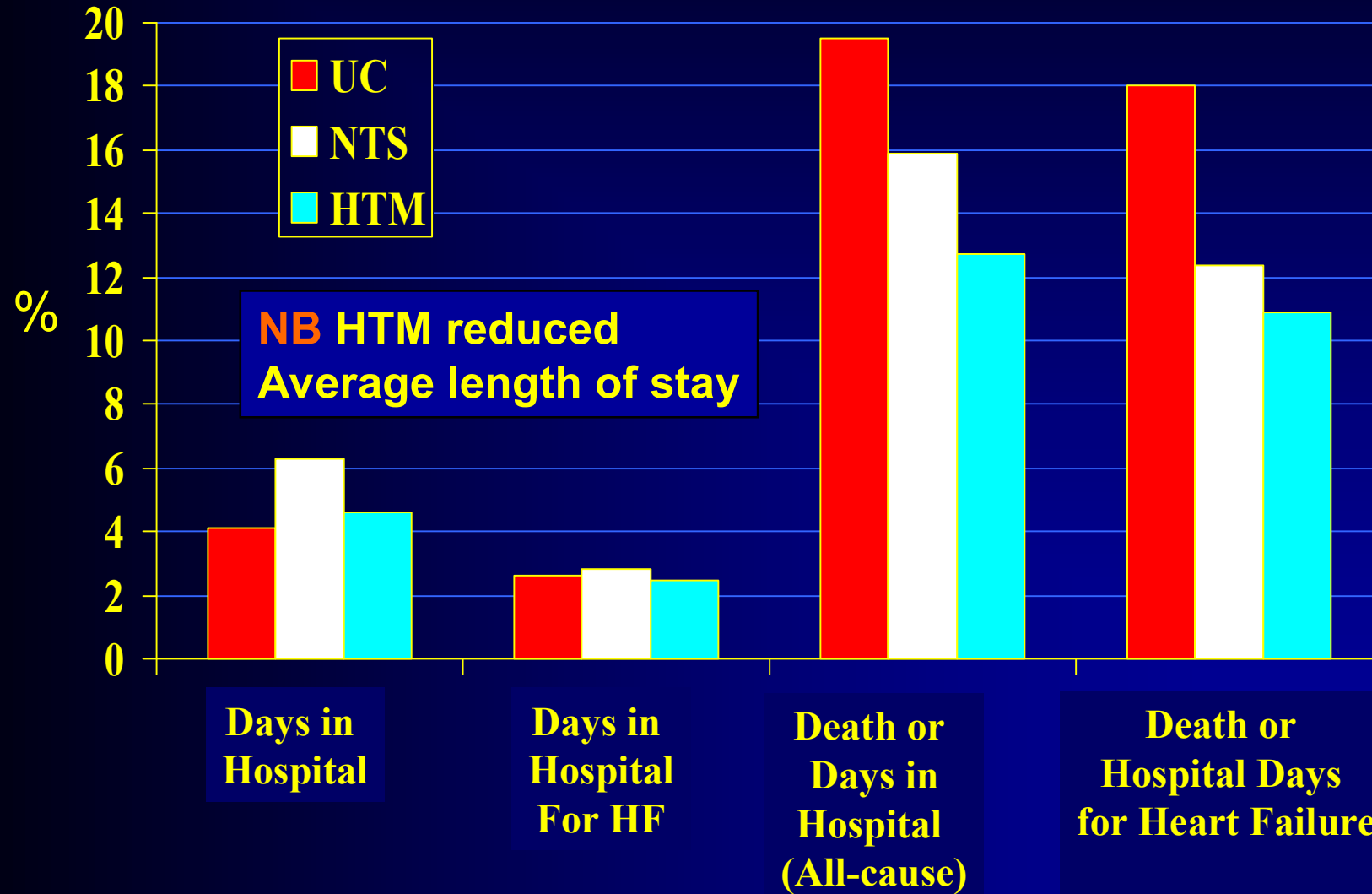
TEN-HMS

Patient Self-Reported Clinical Status



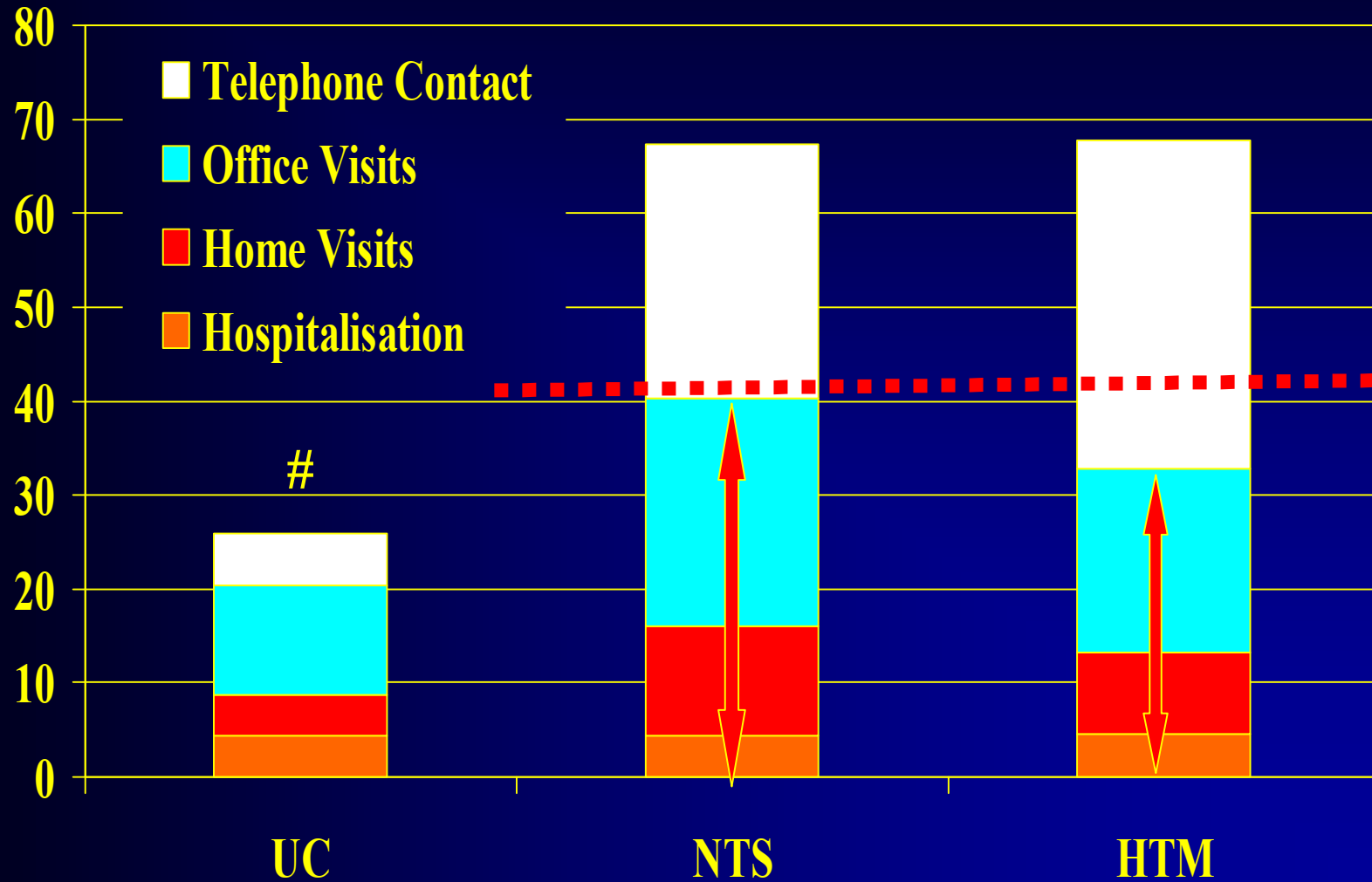
TEN-HMS

Days Dead or Hospitalised over 240 days



TEN-HMS: Total Patient Contacts

Contacts Per 1,000 Days Alive and Out of Hospital



under-reporting of events likely in this group

← P < 0.01 HTM v NTS

Breaking Down Question 1

- **Despite clear evidence of benefits for patients**
- **The uptake of telemonitoring services is slow**
 - NHS Direct
- **What are the main hindrances?**
- **How can these be overcome?**

What are the main hindrances?

- **Sub-optimal sensor technology**
- Sub-optimal communication technology
- **Lack of independent cost-effectiveness analyses**
- **Lack of appropriate service models**
- **Lack of appropriate business models**
- Lack of clinician familiarity / confidence
- Lack of robust decision-support software
- Turf wars!

Sub-optimal Sensor Technology

- **Even for apparently simple things**
 - Weight (clothes)
 - Heart Rate (Atrial Fibrillation)
 - Blood Pressure (Atrial Fibrillation, cuffs)
- **Exciting new technologies but no proof of utility**
 - Bio-impedance (there are several types)
 - Acoustic Cardiography
 - Ballisto-Cardiography
- **Wasted efforts on (intrusive?) visual link?**
- **Important gaps in telesensor capability**
 - We measure what we can rather than what we should

Sub-optimal Communication Technology

- **POTS**
 - Limited data transmission speed and quality
- **Broad-Band**
 - Much faster but delays in installation
- **GPRS (or other mobile phone technology)**
 - Probably the ideal solution
- **Data-Security**
 - Not a problem in practice (yet)

Lack of Independent Cost-Effectiveness Analyses

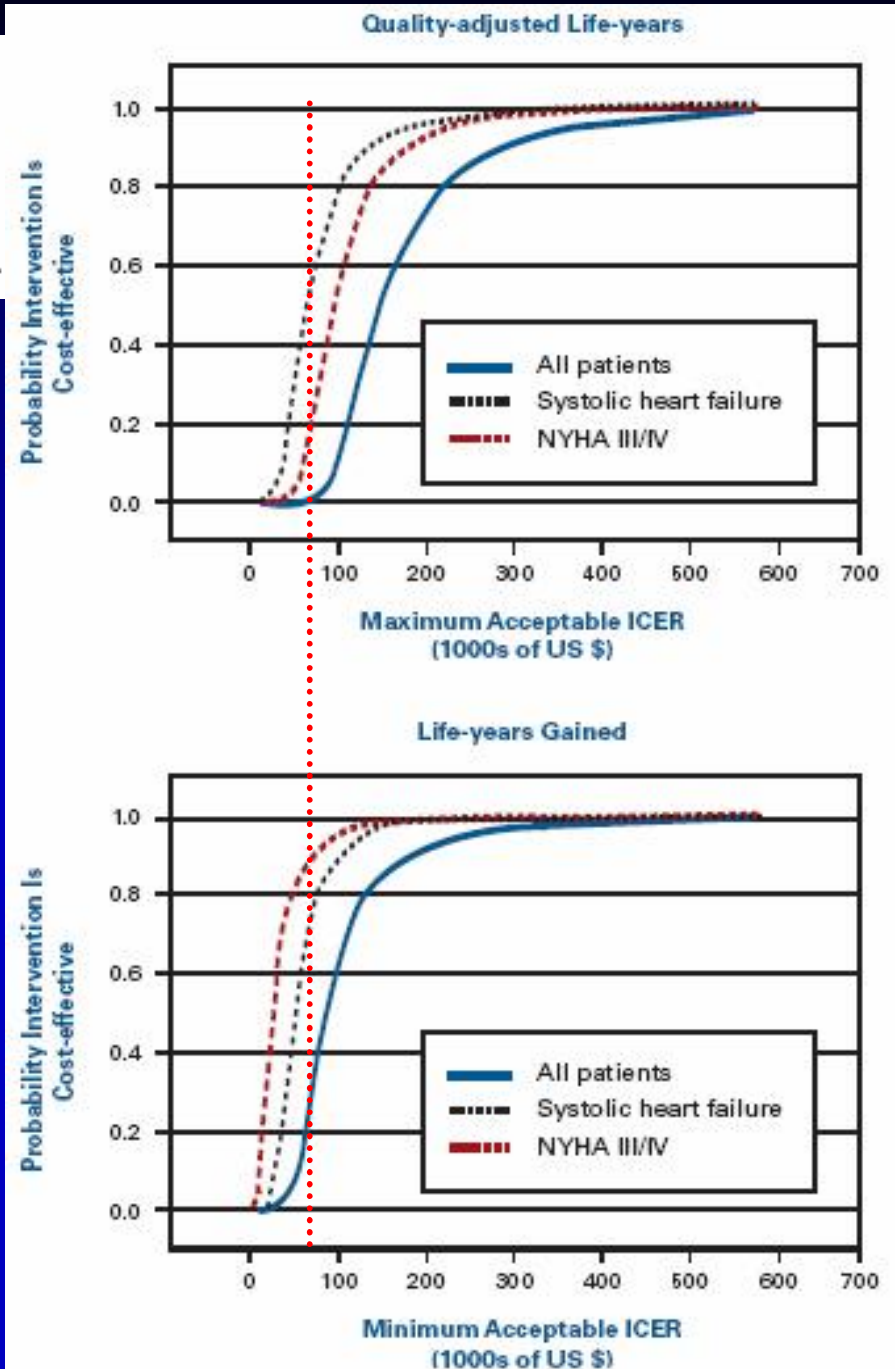
- **Trial Data**
 - TEN-HMS
 - US Managed Care Data
- **Service Data**
 - Lack of adequate controls
 - Cluster randomisation
 - Trials of service duration
 - Hybrids

Cost-effectiveness of Telephonic Disease Management in Heart Failure

Brad Smith, PhD; Paul E. Hughes-Cromwick, MA; Emma Forkner, MS; and Autumn Dawn Galbreath,

N = 1,069
18 months FU
HTM \$246/mth
Weekly Phone Calls
&
Bathroom Scales

Subgroup	Survival		Wilcoxon P
	Entire Sample Usual Care	Disease Management	
All patients	509.5 (6.2)	526.9 (3.1)	.04
NYHA			
I/II	523.9 (5.6)	531.6 (3.2)	.47
III/IV	464.2 (18.2)	511.9 (8.4)	.02
Diastolic heart failure	526.0 (9.3)	528.5 (5.7)	.89
Systolic heart failure	502.1 (8.1)	526.3 (3.8)	.01
NYHA III/IV with systolic heart failure	435.7 (24.9)	515.1 (9.6)	.04



Cost-effectiveness of Telephonic Disease Management in Heart Failure

Brad Smith, PhD; Paul F. Hughes-Cromwick, MA; Emma Forkner, MS; and Autumn Dawn Galbreath, MD

Scope	Cost	Arm	Mean Cost (Bootstrap 95% Confidence Interval),*	
All Patients				
All causes	Total costs	Disease management	19 631 (18 693-20 620)	
		Usual care	14 953 (13 845-16 091)	
	Emergency department visits	Disease management	295 (253-324)	
		Usual care	248 (210-295)	
	Inpatient admissions	Disease management	5513 (4908-6240)	
		Usual care	5159 (4467-5922)	
	Outpatient visits	Disease management	1140 (1064-1217)	
		Usual care	1090 (986-1186)	
	Laboratory	Disease management	150 (140-161)	
		Usual care	141 (127-156)	
	Procedures	Disease management	3267 (2976-3605)	
		Usual care	3499 (3119-3927)	
	Nonchronic drugs	Disease management	47 (39-57)	
		Usual care	41 (31-54)	
	Noncardiovascular drugs	Disease management	2714 (2511-2933)	
		Usual care	2605 (2330-2883)	
	Heart failure	Total costs	Disease management	8165 (7807-8618)
			Usual care	3762 (3344-4201)
Emergency department visits		Disease management	77 (58-108)	
		Usual care	63 (44-88)	
Inpatient admissions		Disease management	1557 (1238-1961)	
		Usual care	1517 (1172-1936)	
Urgent outpatient visits		Disease management	16 (12-21)	
		Usual care	13 (9-19)	
Cardiovascular drugs		Disease management	2458 (2342-2573)	
		Usual care	2403 (2221-2559)	

Lack of appropriate service models

WHO Should do the Monitoring

- **Remote call centre**
 - A solution when low-density use?
 - Bad solution for high-density use
- **The same team that delivers usual care**
 - Best solution provided it is a major responsibility
 - Need to develop good care-pathways (who does what and when. How are you sure that one person (and not more than one) has taken care of any problem)

Lack of appropriate service models

HOW Should Monitoring be Done

- Replacing existing care-paths with HTM may be cost-effective
- Adding HTM to existing care-paths may improve outcome but probably not cost-effective #
 - # this is what most RCTs have done so far
- **Good care-pathways**
 - Who does What and When.
 - How are you sure that one person (and not more than one) has taken care of any problem)

Lack of appropriate business models

	Advantages	Disadvantages
Sell/Lease Hardware	More flexible local service Best option for long-term monitoring?	High initial cost Need for replacement Need to train staff
Service	Low initial cost Might include staff Better back-up	High recurring cost Less flexible local service Incentive to terminate
Hybrid Model	Spread of costs better aligned to clinical scenario	

Turf wars!

(Money is the Root of All Evil) & [Makes the World go Round]

- **The Doctors**

- Family doctors
- Private Specialists (in some countries)
- Hospital Specialists

- **The Organisations**

- Family doctor organisations
- Private Clinics
- Hospitals

NB

Major Effect of HTM is on

a) Death

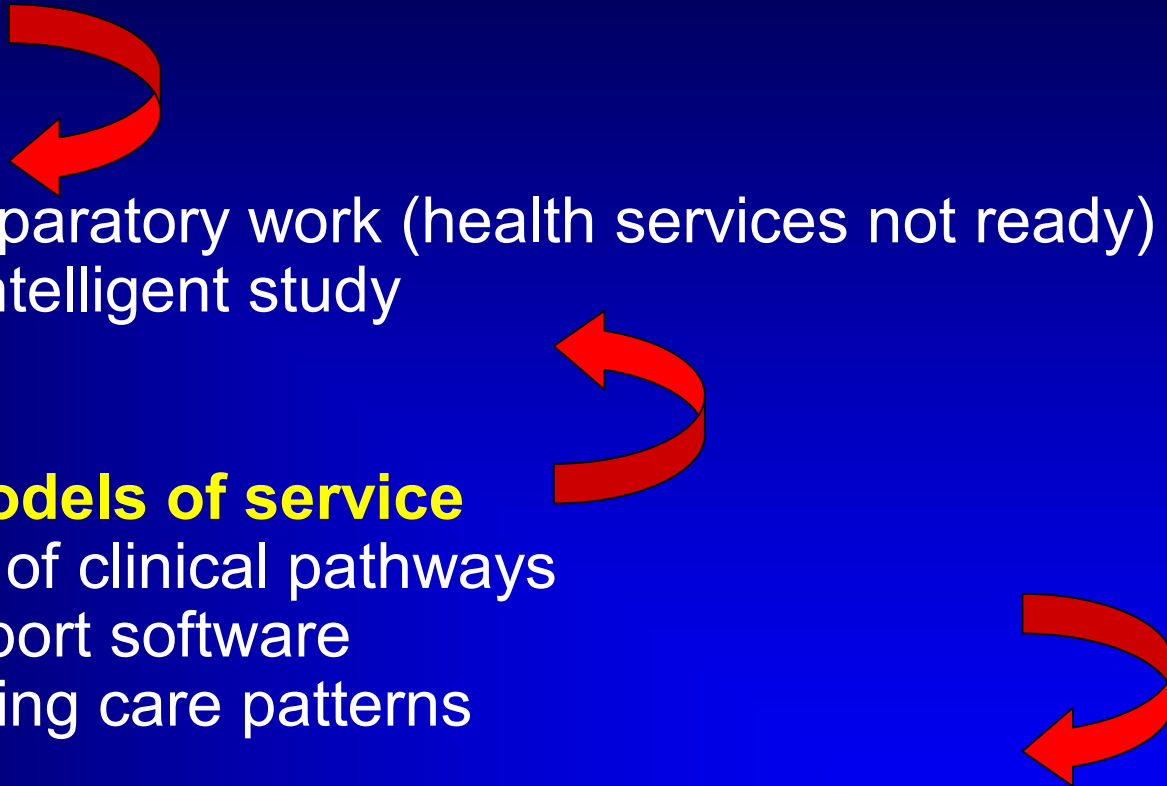
b) Duration of hospitalisation

But not (yet) on

c) Rate of Hospitalisation

Who should pay?

How Can These Problems be Overcome?

- **Improved sensor and communication technology**
 - HeartCycle
 - **Evidence!**
 - Adequate preparatory work (health services not ready)
 - A definitive, intelligent study
 - DOT-HF
 - **Clinician-led models of service**
 - Development of clinical pathways
 - Decision-support software
 - Replace existing care patterns
 - **Proper business and health-economic models**
- 

Monitoring

- **What** ✓
- **Why** ✓
- **When** ✓
- **How** - need to integrate methods
- **Where**
- **Who** ✓

