



hSITE

Healthcare Support through Information
Technology Enhancements

The potential, promises and pilots of ICT in healthcare (and maybe some perils)

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McGill

Disclosure

I have no conflicts to declare

The thoughts in this presentation represent my analysis and personal experiences with ICT in healthcare, along with some wild thinking thrown in. Information gathered for this presentation has in part come from publically-accessible Websites.

hSITE Themes

- 1. Clinical Workflows and Clinical Grade Requirements**
- 2. Context Aware Smart Sensors Systems, Software and Applications**
- 3. Enabling Networks and Technologies**

Healthcare & ICT: Mission impossible?

- Attributes of healthcare
 - Complex & uncertain
 - Questionable reliability
 - Uneven quality
 - Non-standardized
 - Regulated
- Attributes of ICT
 - Precise
 - Reliable
 - High quality
 - Standardized
 - Regulated

Healthcare as a 'final frontier' of ICT development needs to
Co-existence → Collaboration → Convergence

Star trek- emia (**-emia**: Suffix meaning blood or referring to the presence of a substance in the blood)



G1 medical tricorder
wireless probe

NG medical tricorder



Why is 'trek'-care so successful?

- Voice-activated, wireless
- Optimal infection control (no touch)
- Mobile, ultra-portable
- Nano-technology
- *Instantaneous results*
- Durable, reliable documentation
- Species & person specific
- Galactic knowledgebase

Drivers of earthly healthcare

- Ageing population
- Health care costs reduction
 - Some meds & technologies cheaper
 - Newer meds & technologies VERY expensive
 - Non-targeted approach (every patient is the same)
 - Inappropriate use, under-use, over-use
- Patient-centric focus (Me!), more-informed consumers, personalized medicine (proteomics)
- Ubiquitous health care, globalization
- Wellness (prevention) vs. disease (treatment)

Evolution of Computer Power/Cost

MIPS per \$1000 (1997 Dollars)

Million

1000

1

1

1000

1

Million

1

Billion

1900

1920

1940

1960

1980

2000

2020

Year

Brain Power Equivalent per \$1000 of Computer

Human

Monkey

Mouse

Lizard

Spider

Nematode

Worm

Bacterium

Manual Calculation

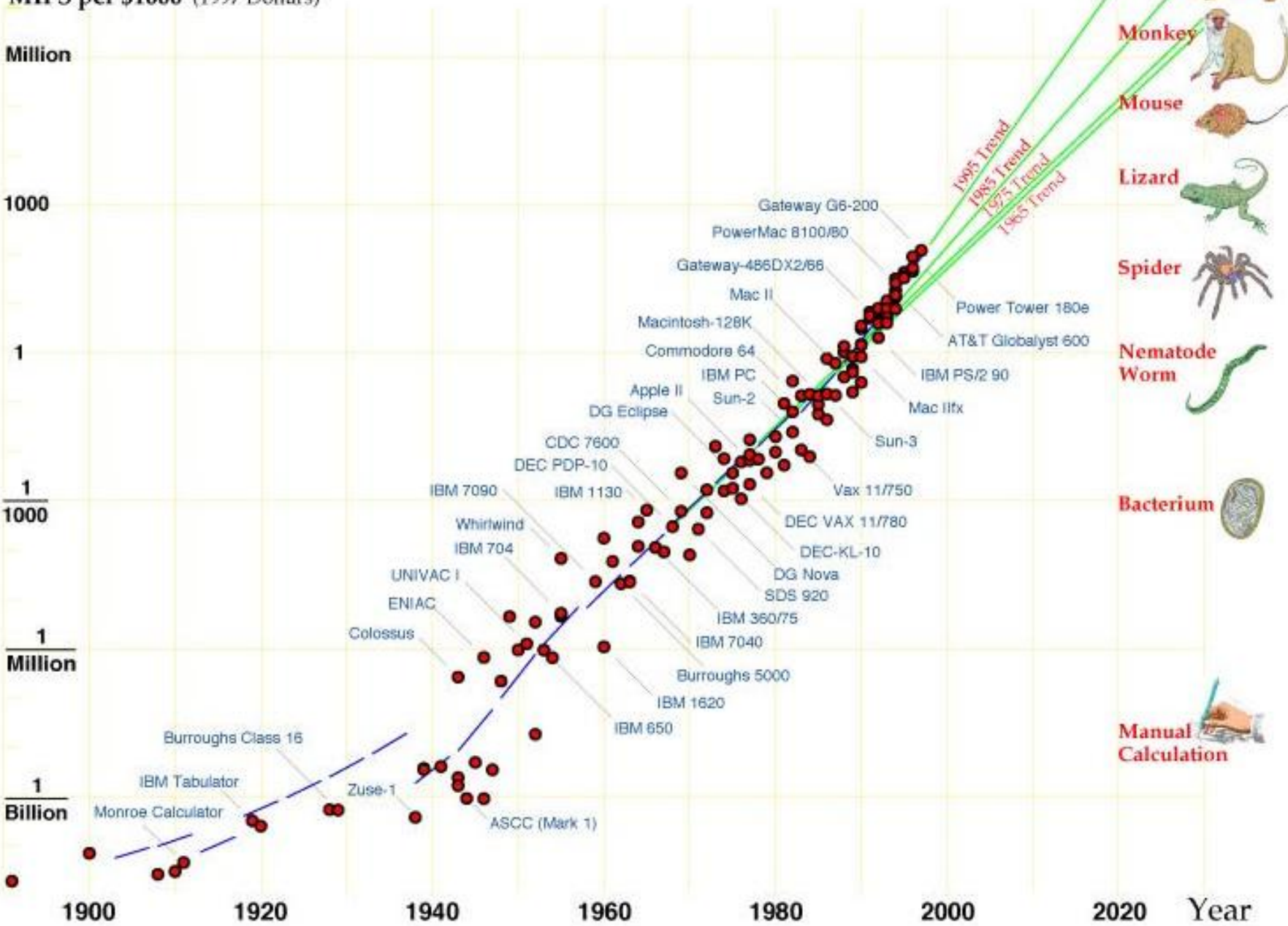


1995 Trend

1985 Trend

1975 Trend

1965 Trend

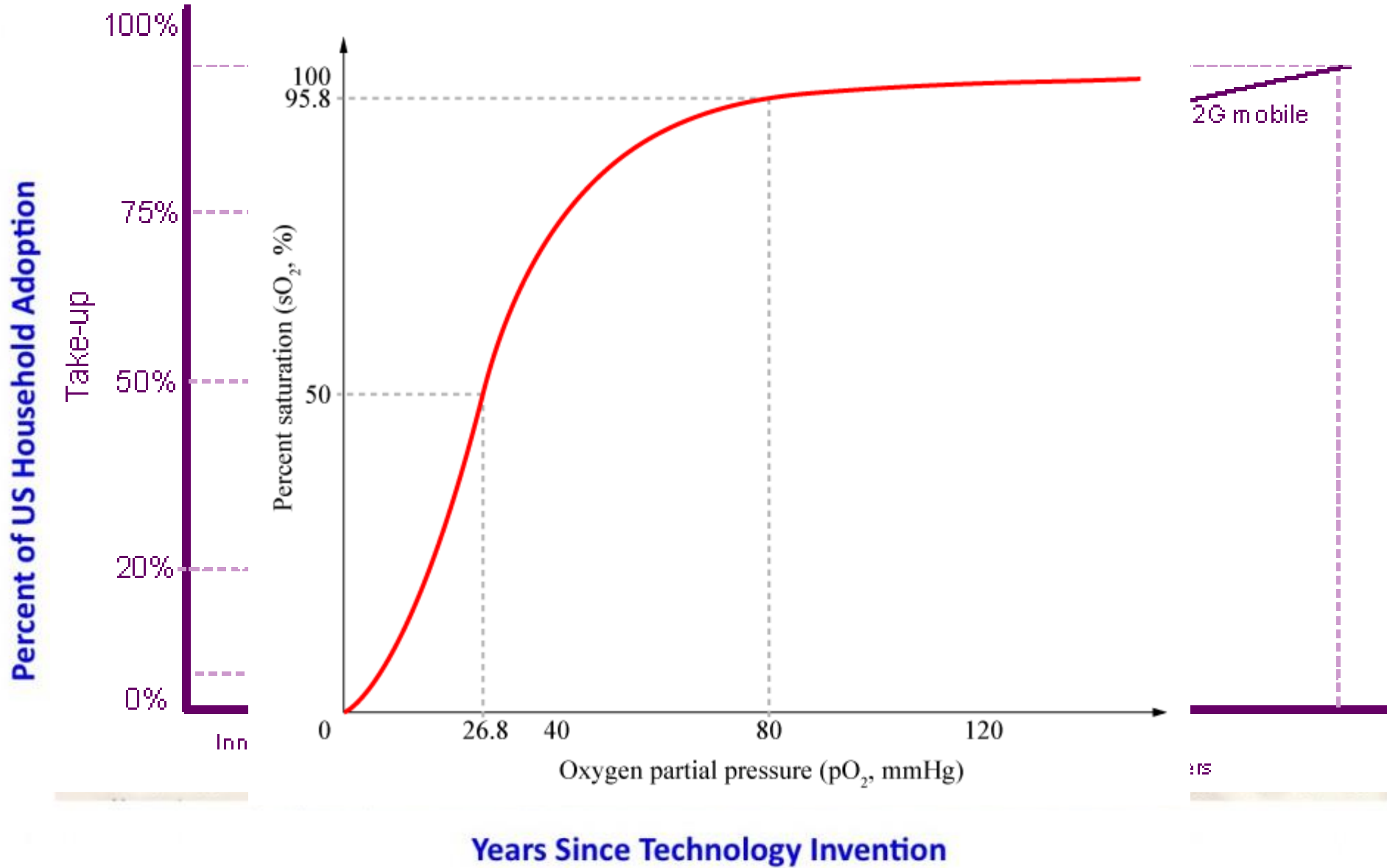




Healthcare is trying to sync with the 21st century

- Borrowing from successful industries
 - Banking industry
 - ROI (return on *information*)
 - Airline industry
 - Clinical glidepaths
 - Pre-operative checklists
 - Manufacturing
 - 6-sigma quality
 - Exploring ICT

The Spread of Products into American Households



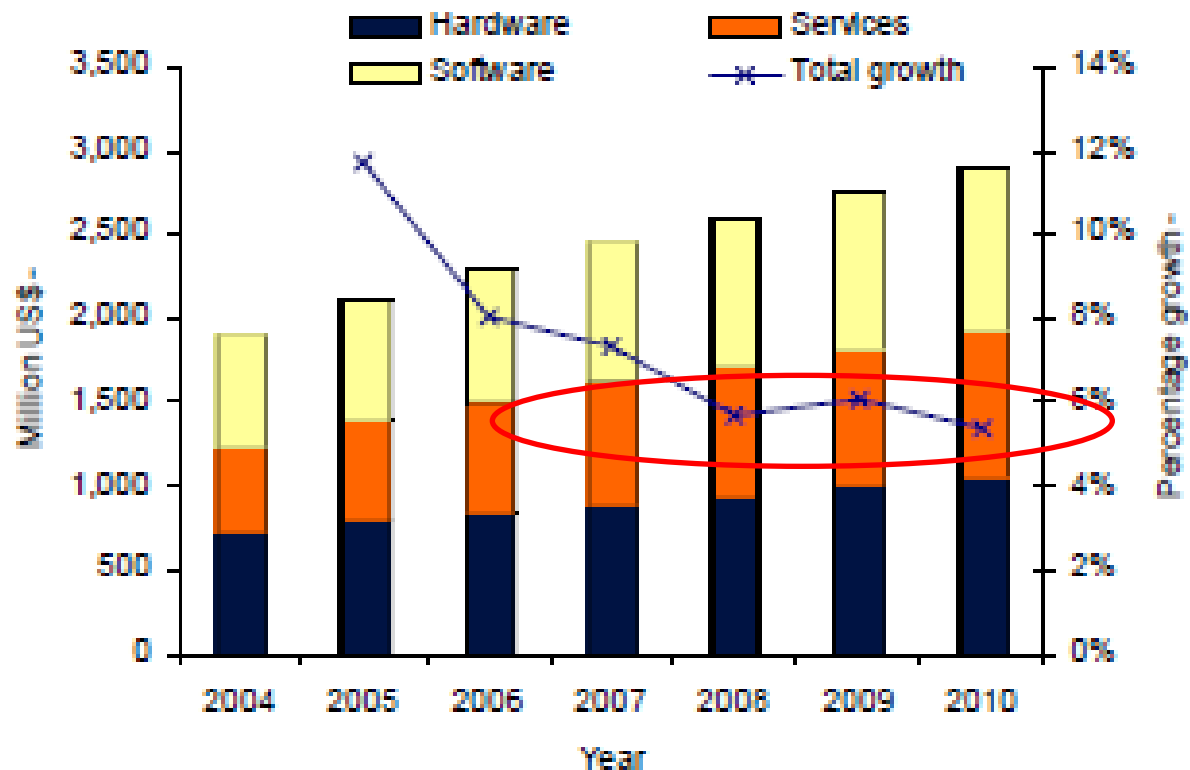
Years Since Technology Invention

Sources: U.S. Bureau of the Census (1970 and various years);
Cellular Telecommunications Industry Association (1996);
The World Almanac and Book of Facts (1997).

Brief scan of Global healthcare ICT

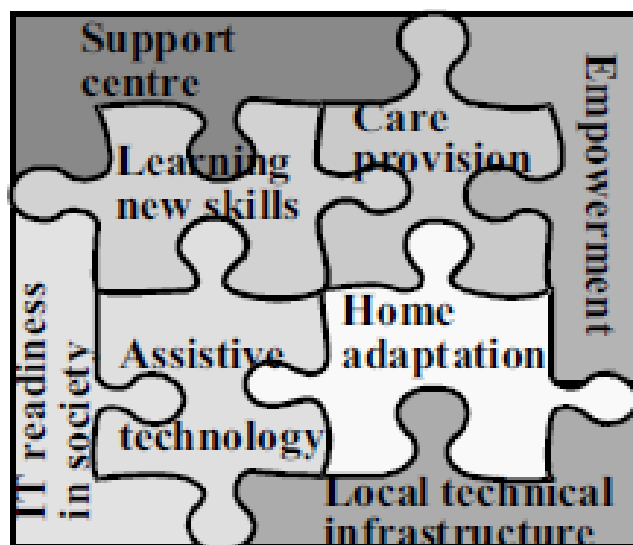


Hardware, software and services spending in German healthcare

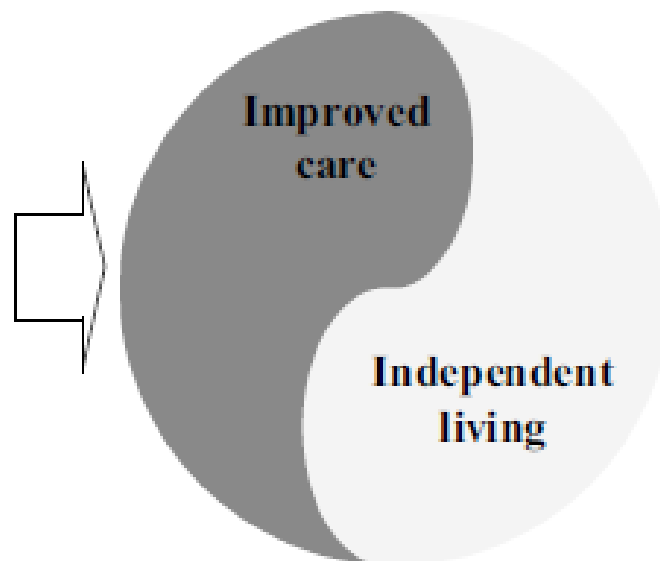


Source: ICT Opportunities in Healthcare

INTERLOCKING ENABLERS



CHANGED ACTIVITIES



ACHIEVEMENTS

- Well-being
- Personalized care
- High-quality service
- Cost efficiency
- Learning and continuous improvement

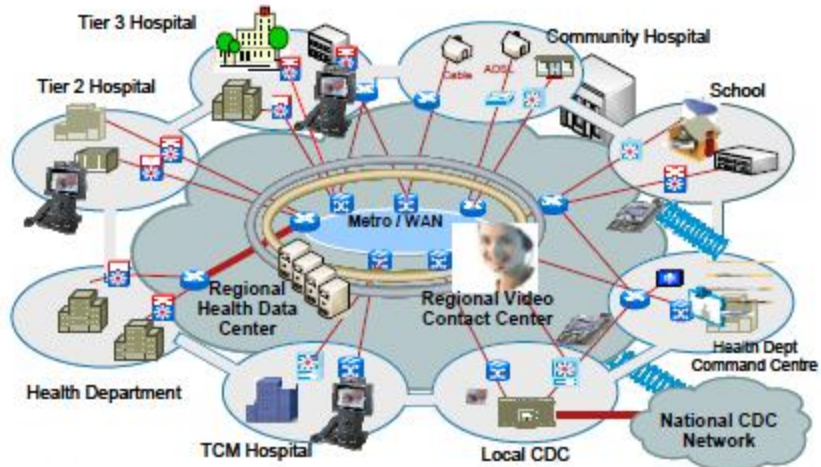
Figure 1 Effects of the introduction of ICT and expected achievements as a consequence of independent living in the area of elderly care

Economic analyses for ICT in elderly healthcare: questions and challenges

Vivian Vimarlund and Nils-Göran Olve
Health Informatics Journal 2005 11: 309
DOI: 10.1177/1460458205058758

Sweden

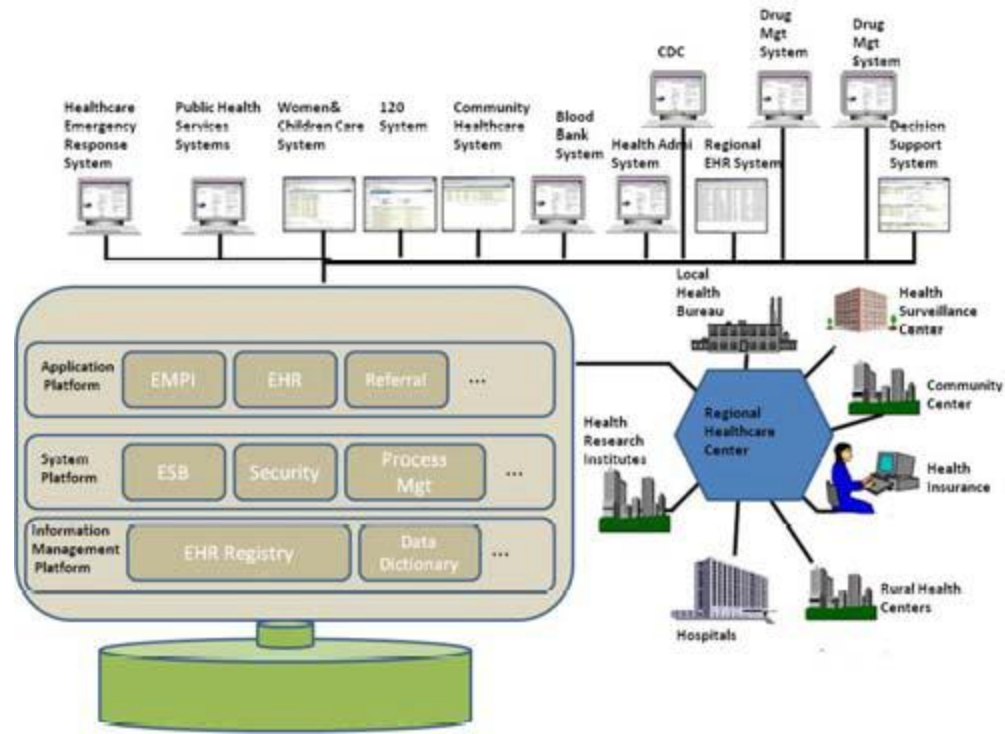
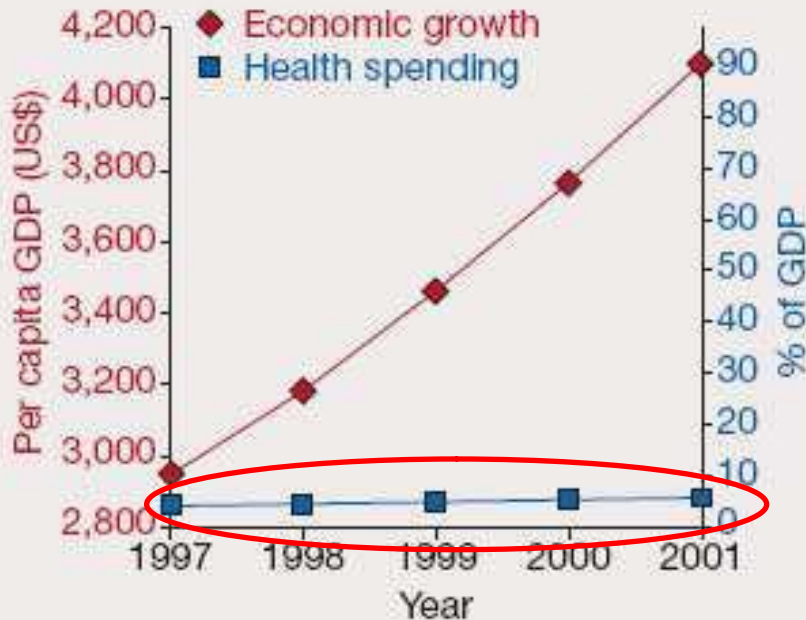
Regional Healthcare Information Network (RHIN)

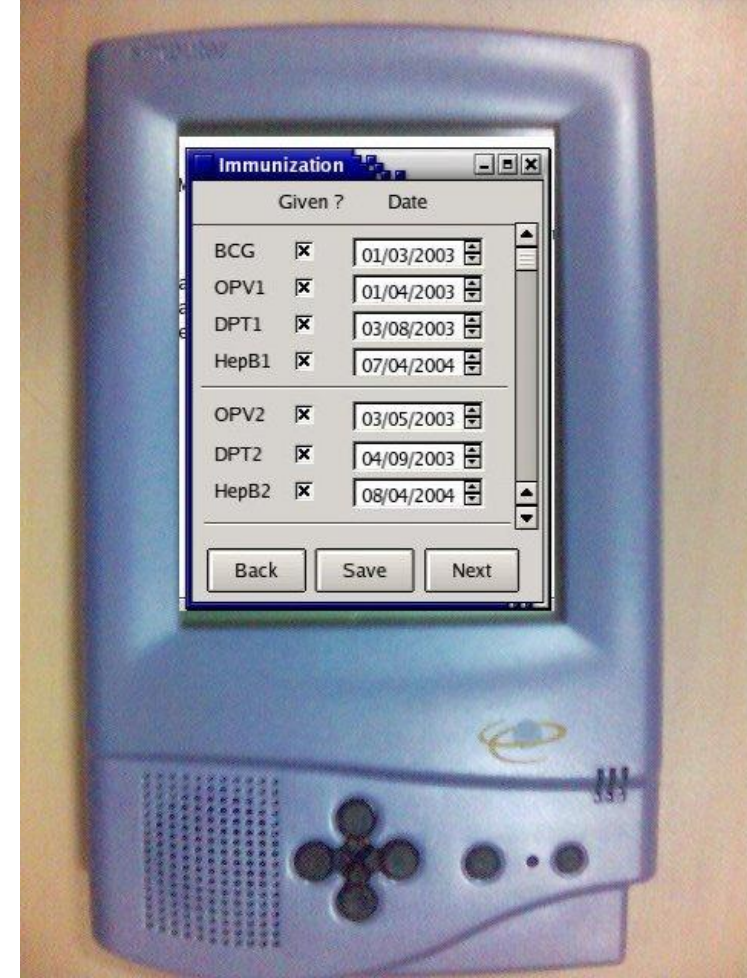


Source: Cisco



China's spending on health (% of GDP)





India

Linking remote communities

Traversing a multi-level healthcare delivery network

Ensuring access to more of the population

Areas where e-Health can assist

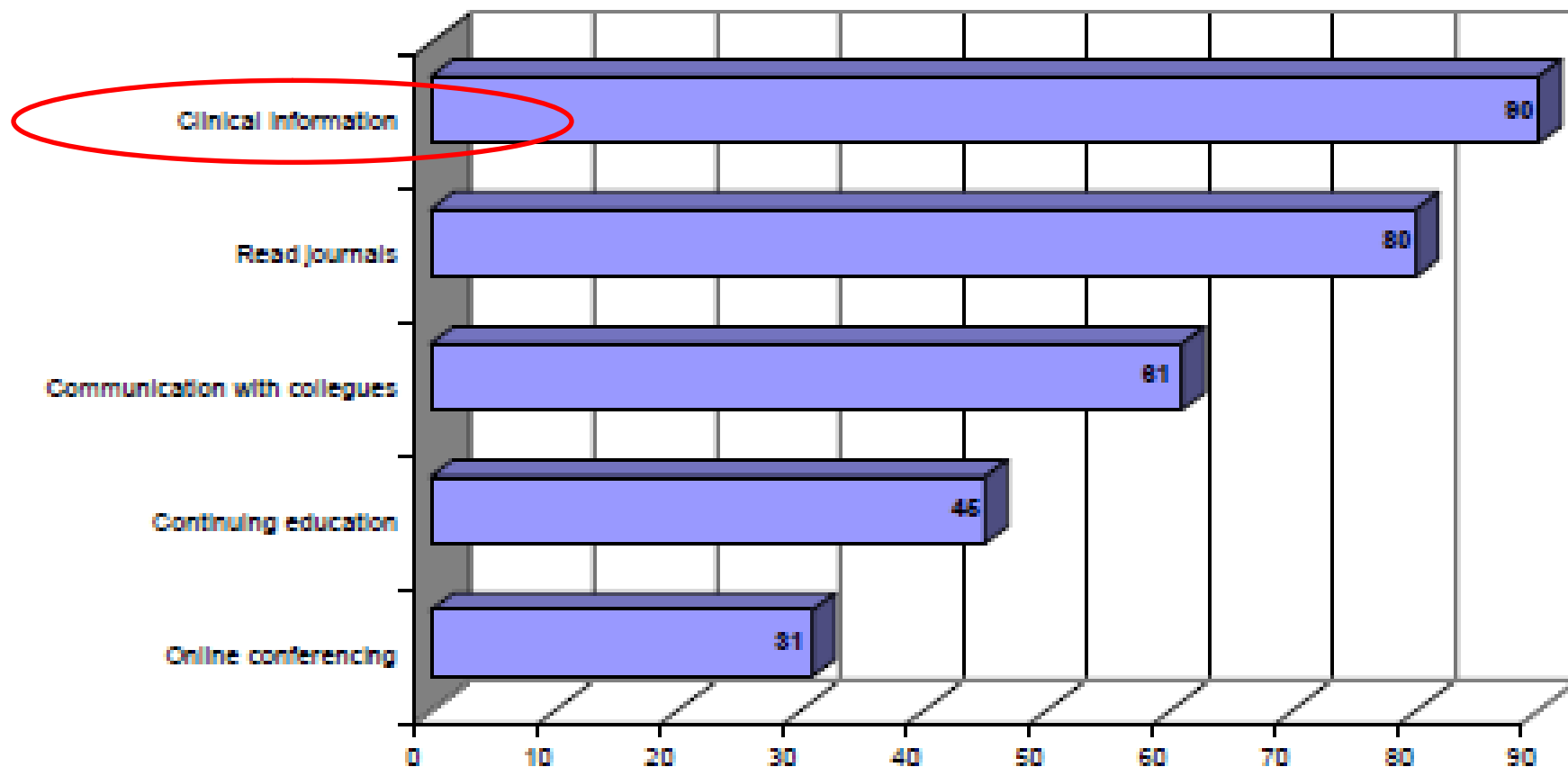
- Lack of access to specialists doctors
- Need for second opinion
- Lack and need for CME (e-learning)
- Lack of proper record keeping of clinical data and prescription
- Need for information in real time
- Lack of proper screening before referral
- Lack of sufficient equipments/ambulances

e-Health Uganda

ICT & Healthcare transformation Ireland

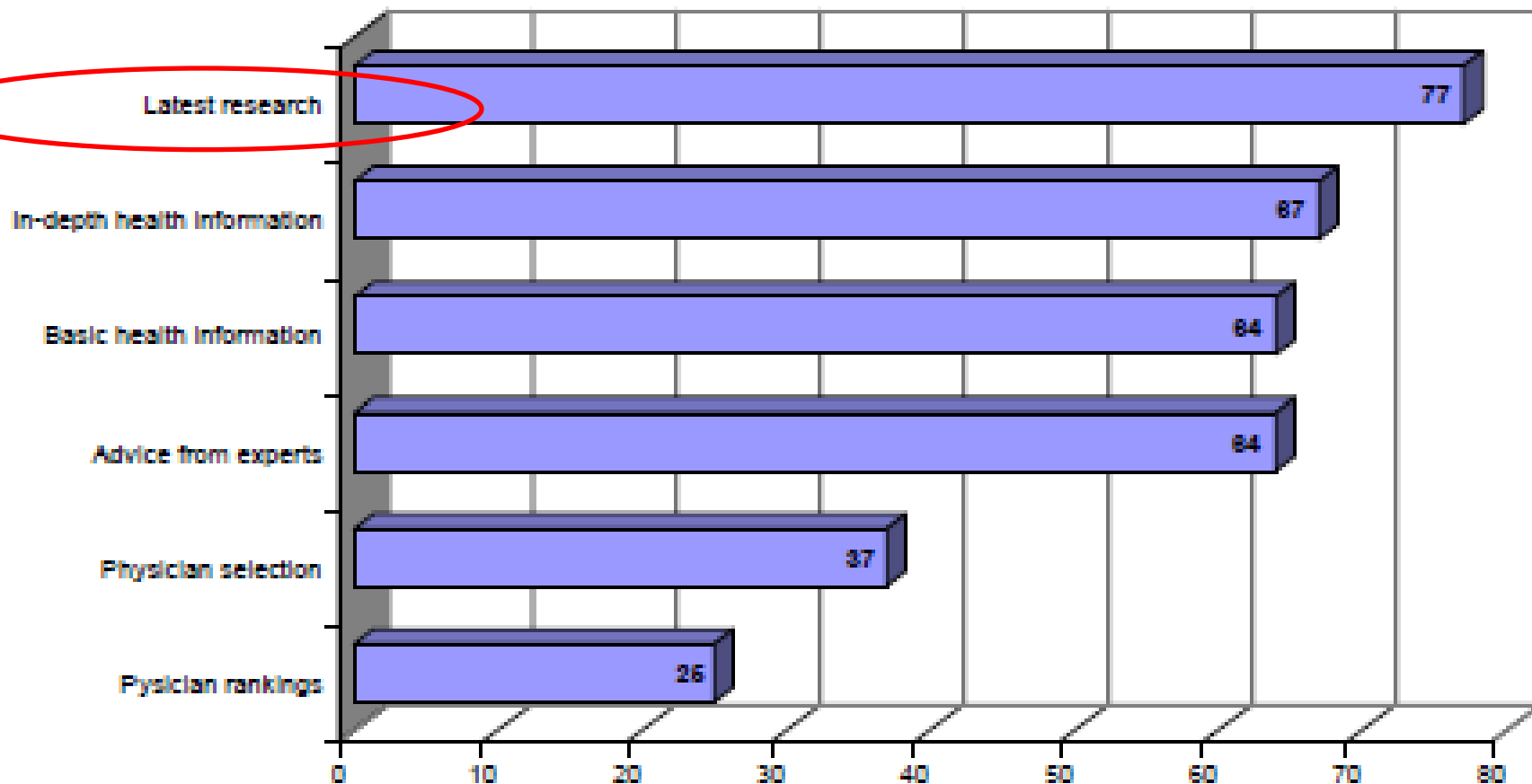
- Availability (access, waiting times and better utilisation of resources).
- Continuity of care (coordination and information sharing among care providers).
- Empowerment (patient involvement in their own care activities).
- Patient safety (reduced risk of patient harm).
- Quality of care (effectiveness and efficiency of care service provision)

Figure 5.1 What American doctors are looking for online (percentage of US-based doctors using internet)



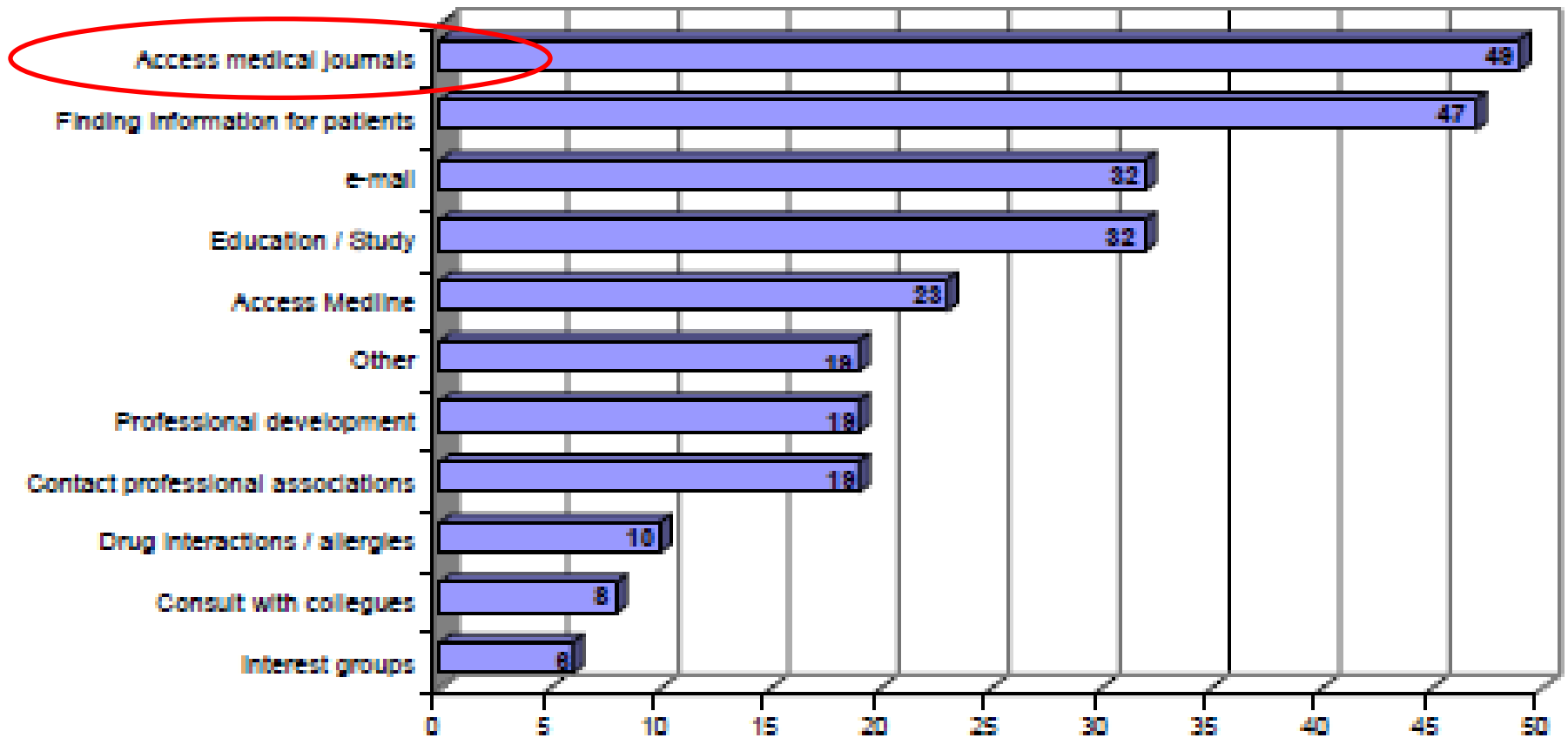
Source: von Knoop, C., Lovich, D. and Silverstein, M.B. (2001) *Vital Signs Update: Doctors Say E-Health Delivers*, Boston Consulting Group, September 2001. Available <http://www.bcg.com>

Figure 5.2 What European doctors are looking for online (percentage of interviewees)



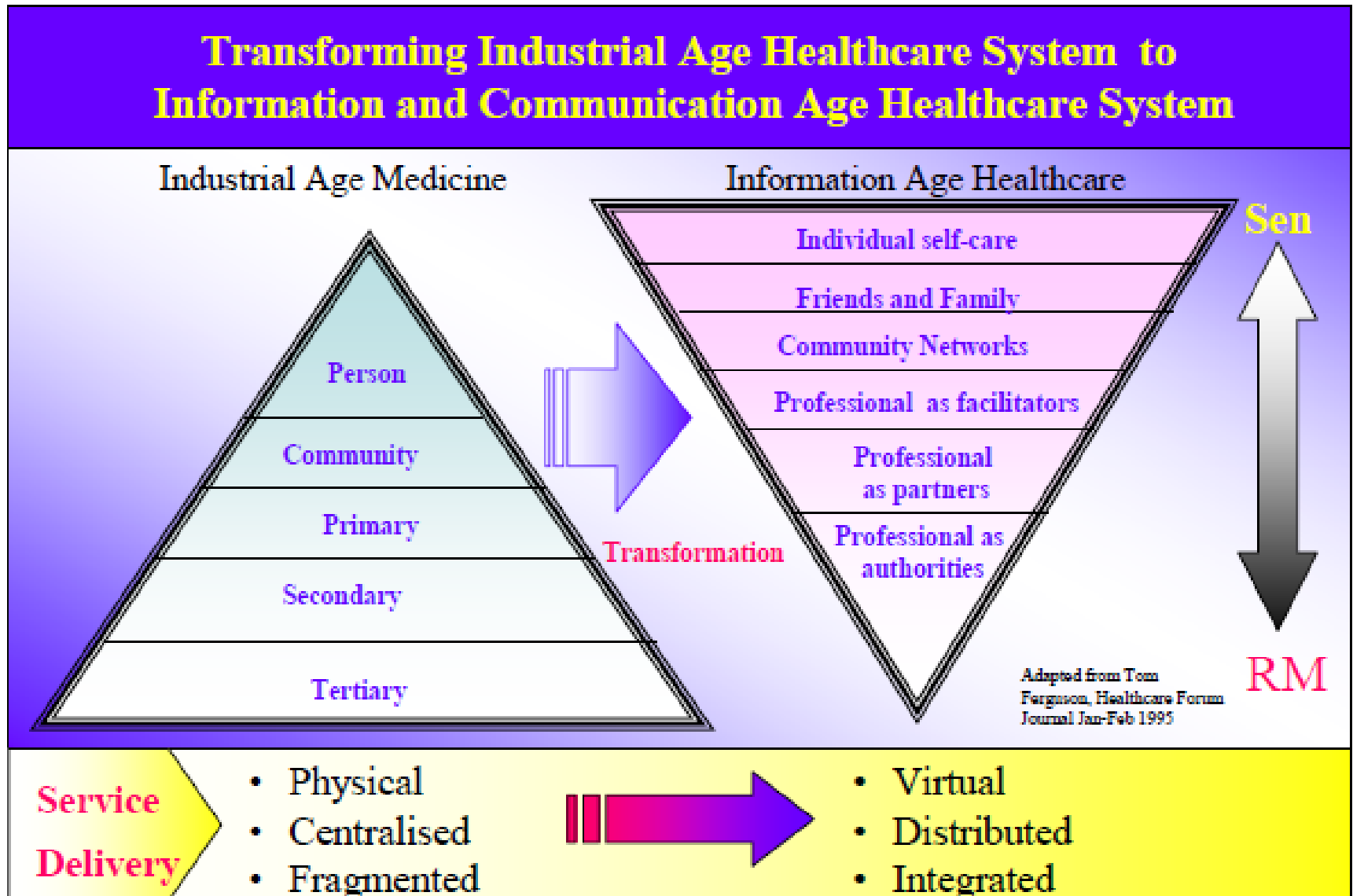
Source: Poensgen, A. and Larsson, S. (2001) *Patients, Physicians and the Internet: Myth, Reality and Implications*, Boston Consulting Group, January 2001. Available <http://www.bcg.com>

Figure 5.3 What Australian doctors are looking for online (percentage of those using internet)



Source: AC Nielsen (1998) *A study into levels of, and attitudes towards, information technology in general practice*, Research consultancy report prepared for General Practice Branch, Department of Health and Aged Care, AC Nielsen Research, Sydney, p56.

Transforming the Healthcare System



Malaysia Healthcare

Potential intersection zones

Developing successful ICT solutions for healthcare

- Time-neutral or savings (time=\$\$\$)
- Improve workflow, working faster, smarter
- Improve information management
 - Right type (data, knowledge, decision support)
 - Deliver at time, in the right context
- Improve signal to noise
- Human-machine interface & usability

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A few pilots I am aware of

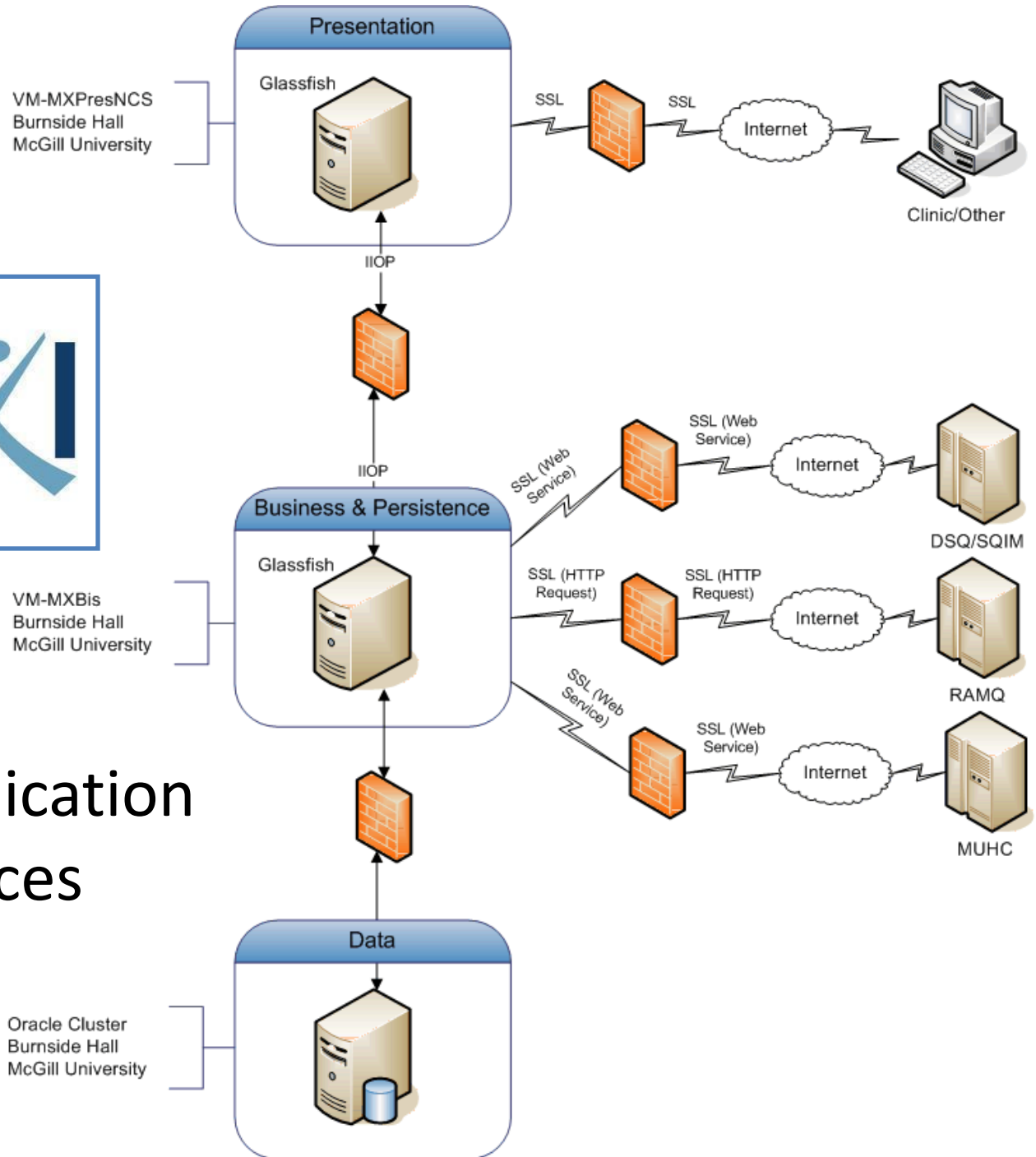
- hSITE research programs
- The Ottawa Hospital iPad Clinical Mobile App
- iPhone clin doc tool Mt Sinai Hospital, Toronto
- Telus Remote Patient Monitoring
- MUHC telehealth program

Some local real-life pilots

- Medical Office of the XXIst century (MOXXI)
 - On-going trials
 - RightRx & medication reconciliation at hospital discharge
- Real-Time Location Services (RTLS)
 - ED asset & staff tracking
 - Geriatric wandering patient alert & containment
- Is there an app for that?
 - vSigns iPhone app, RIM playbook project
 - O-Word pilots



Web application and services





L'innovation par l'intégration
Innovation through integration

Version: 1.2b.60

Bienvenue à MOXXI-NG


Nom d'utilisateur

Mot de passe




Enregistrer mon nom d'utilisateur

[Mot de passe oublié?](#)

 [English](#)

 [Ouvrir une session](#)



 **L'asthme chez ce patient semble NON CONTRÔLÉ** [Éducation](#) [Directives](#)
 Dernière visite : Non disponible  [Visualiser l'historique de l'asthme](#)  [Voir le plan d'action MAP](#)

Profil de l'asthme

1. Veuillez valider les médicaments et les posologies

Médicament(s)	Posologie
<input checked="" type="checkbox"/> FLOVENT HFA 125MCG	1 INH BID
<input checked="" type="checkbox"/> VENTOLIN HFA 100MCG	1-2 INH

2. Visites à l'urgence pour problèmes respiratoires, utilisation des BACA

*Pas de visites à l'urgence pour problèmes respiratoires (3 derniers mois)
BACA délivré(s) dans les 3 derniers mois : doses < 250*

3. Au cours de la dernière semaine, le patient a :

- Difficulté respiratoire au cours de 4 jours ou plus
- A utilisé sa pompe d'urgence 4 fois ou plus
- Été réveillé à cause de l'asthme
- A été limité dans ses activités habituelles
- A manqué l'école ou le travail du à l'asthme
- A eu une visite médicale urgente pour asthme

4. Mettre à jour

 [Obtenir la recommandation](#)

Recommandation

5. Choisir une recommandation

- Recommandation
- AJOUTER LE BALA SEREVENT DISKUS 50 1 INH BID.
 - AJOUTER L'ARLT SINGULAIR 10MG PO DIE.
 - ARRÊTER LE FLOVENT & AJOUTER L'ADVAIR 125 1 INH BID.
 - AUGMENTER LE FLOVENT À 125 2 INH BID.
 - Médicament déterminant : (FLOVENT HFA 125MCG 1 INH BID)**

6. Prescrire un β agoniste à courte action [BACA] si nécessaire

- SALBUTAMOL AER 100 1-2 INH AU BESOIN
- TERBUTALINE 500 1 INH AU BESOIN

7. Enregistrer les modifications

 [Enregistrer les modifications](#)

 [Enregistrer les modifications et imprimer](#)

Plan d'action MAP

Ceci est le plan d'action contre l'asthme du patient issu du portail de l'asthme MAP (Dernière mise à jour: Lundi, 31 janvier 2011)

Contrôle

Pompe de contrôle/prévention:

FLOVENT (FLUTICASONE) METERED INH.
125MCG [D]

Pompe de secours/dépannage:

VENTOLIN INH. (SALBUTAMOL) METERED INH.
100MCG [D]

Perte de contrôle

PREDNISONNE (PREDNISONNE) TABLET 1MG

Crise d'asthme

set

 Fermer


2. Visites à l'urgence pour problèmes respiratoires, utilisation des BACA

*Pas de visites à l'urgence pour problèmes respiratoires (3 derniers mois)
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 [Obtenir la recommandation](#)

- ARRÊTER LE FLOVENT & AJOUTER L'ADVAIR 125 1 INH BID.
- AUGMENTER LE FLOVENT À 125 2 INH BID.


 Médicament déterminant : (FLOVENT HFA 125MCG 1 INH BID)

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7. Enregistrer les modifications

 [Enregistrer les modifications](#)

 [Enregistrer les modifications et imprimer](#)

[Imprimer](#) [Imprimer tout le dossier](#) [Formulaires imprimables](#)

Information générale

NAM: RICE47511617 No. de dossier:
Prénom: ÈVE Nom de famille: RICHER
Âge: 64
Date de naissance: 1947-01-16 Date de décès:
AAAA-MM-JJ
Poids: Taille:
Sexe: Femme Langue: Anglais
Courriel:
Téléphone(s): *Aucun numéro*

[Modifier](#) [Retirer le consentement](#)

Recommandation pour les dépenses personnelles du patient



Il est possible de réduire les dépenses personnelles du patient pour son traitement de l'hypertension :

Dépenses personnelles annuelles non-remboursées : 220,84 \$
Dépenses minimales avec un diurétique : 53,68 \$

Économies annuelles potentielles: 167,16 \$

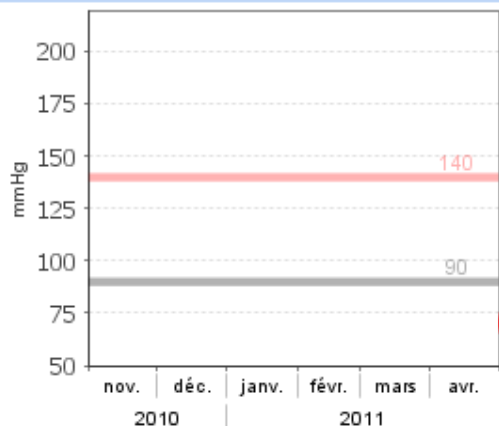
[Réduire les dépenses du patient](#) [Fermer](#)

0 Nouveau(x) problème(s)

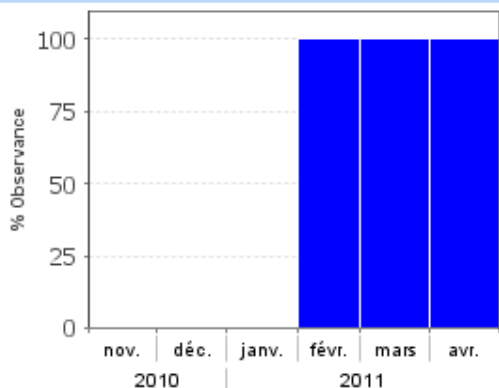
Réduire les dépenses du patient

Tension artérielle

Tableau

Syst. : Diast. :  Enregistrer

Observance avec antihypertenseurs



■ APO DILTIAZ CD

Changements de traitement suggérés

Les dépenses personnelles élevées sont associées à une **moindre observance**.
 Les diurétiques offrent une **efficacité équivalente** et peuvent réduire significativement les dépenses de ce patient.

	Médicament	Dépenses personnelles annuelles	Économies potentielles du patient	Coûts annuels
<input type="radio"/>	<input checked="" type="checkbox"/> TM APO DILTIAZ CD CAPSULE-24H 120MG	220,84 \$	0,00 \$	330,45 \$
<input checked="" type="radio"/>	<input checked="" type="checkbox"/> HYDROCHLOROTHIAZIDE COMPRIME 12.5MG	53,68 \$	167,16 \$	53,68 \$
<input type="radio"/>	<input type="checkbox"/> HYDROCHLOROTHIAZIDE COMPRIME 25MG	107,36 \$	113,49 \$	107,36 \$

Veillez revoir ou modifier les changements de traitement suggérés puis cliquer sur Enregistrer les modifications pour continuer. Pour maintenir le traitement existant et fermer cette alerte, choisir une raison dans la liste ci-bas.

 [Enregistrer les modifications](#) [Aucun changement](#) 

Profil pharmacologique - 10 médicament(s)

Re-prescrire Arrêter Historique des prescriptions Légende Imprimer actifs Imprimer tous Aller à : 2011-04

Sélectionner : Tous sauf arrêté(s) Actif(s) Tous Aucun Affichage : Réduit Tous

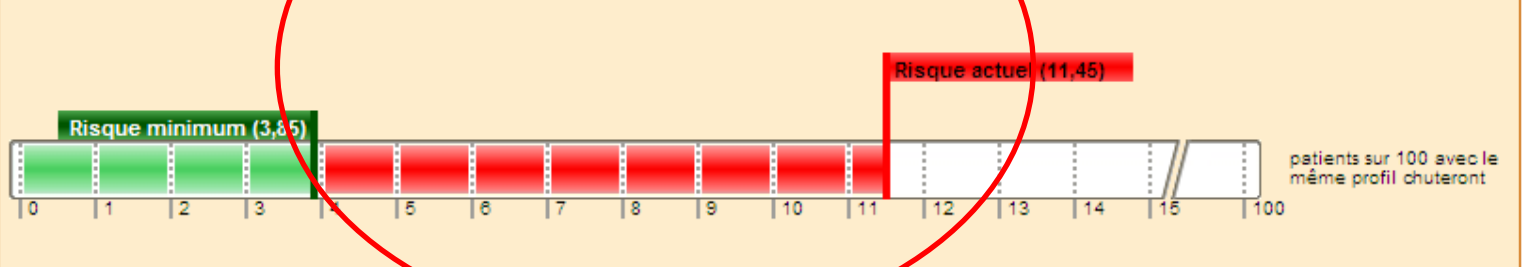
	Médicament(s)	2010-11	2010-12	2011-01	2011-02	2011-03	2011-04	2011-05	2011-06
<input type="checkbox"/>	TM ACTONEL 35MG					█	█		
<input type="checkbox"/>	TM APO CYCLOBENZAPRINE 10MG					█			
<input checked="" type="checkbox"/>	TM APO FLURAZEPAM 30MG					█	█		
<input type="checkbox"/>	TM APO OXAZEPAM 15MG, 30MG					█	█		
<input type="checkbox"/>	TM CAL D 500MG+400UI					█	█		
<input type="checkbox"/>	TM CODEINE 15MG						█	█	
<input type="checkbox"/>	TM METFORMIN 500MG					█	█		
<input type="checkbox"/>	TM MODURET 50+5MG					█	█		
<input type="checkbox"/>	TM PMS PAROXETINE 20MG					█	█		
<input type="checkbox"/>	TM SYNTHROID 0.050MG					█	█		

Patient \$ / RAMQ \$: 0/0 0/0 0/0 0/0 65/210 3/7 0/0 0/0

Facteurs de risque Alerte: Augmentation du risque de chute

- Âge: 80
- Sexe (F)
- Troubles cognitifs
- Troubles de l'équilibre
- Blessures liées aux chutes
- Médicaments psychotropes

Risque de blessure liée aux chutes pour THÉRÈSE LACHUTE dans l'année à venir





Centre universitaire de santé McGill
McGill University Health Centre

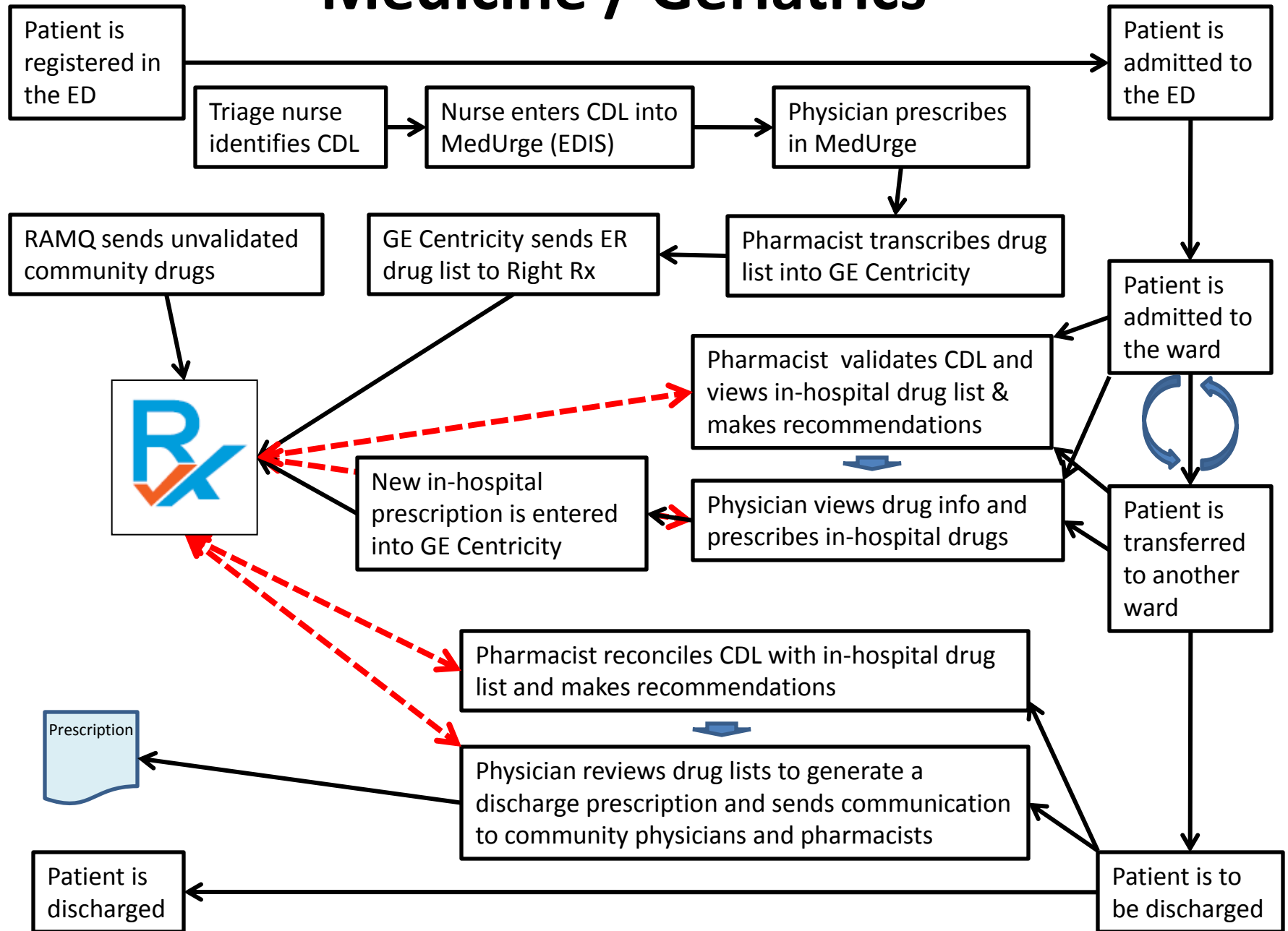


McGill



Canada Foundation for Innovation
Fondation canadienne pour l'innovation

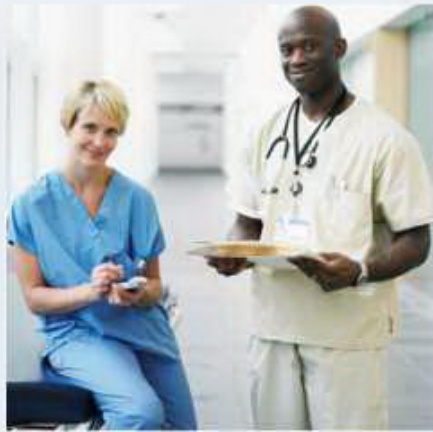
Medicine / Geriatrics





User Name

Password



McGill University Health Centre's
OACIS Clinical Information System

- **MESSAGE IMPORTANT**
 Pour des raisons de maintenance, le système SIC OACIS ne sera pas disponible aux utilisateurs Mercredi le 25 Mai de 5h30 - 6h00. Merci de votre collaboration.
- **IMPORTANT MESSAGE**
 Due to maintenance reasons CIS OACIS will not be available to users on Wednesday May 25, from 05:30 - 06:00 AM. Thank you for your cooperation.

[New in OACIS May 16](#)



© 2008 Emergis





User Patient List: Special (Base: W

Rm-Bed	Icon	Icon	
S09E-00-04	~		
S09E-00-05	~		
S09E-00-06	~		
S09E-03-01	~		
S09E-03-02	~		
S09E-03-03	~		
S09E-03-04	~		
S09E-04-01	2	THAUVE	
S09E-04-02	2	FLEURY	
S09E-04-03	2	R GAUTHIER, JACQUES	
S09E-04-04	2	R OZARANSKY, ALEC	
S09E-05-01	2	R WIDGERY, KATHLEEN J	
S09E-05-02	2	MORRIS, SIDNEY	
S09E-05-03	2	BELIVEAU, THERESE	
S09E-05-04	2	LAVOIE, JACQUELINE	
S09E-06-01	2	DALBEC, YVETTE	
S09E-06-02	2	TSOUPELIS, KETTY	
S09E-06-03	2	KLUCHA, KAROLINA	
S09E-06-04	1	R ASLANIDOU, SOFIA	
S09E-07-01		~	
S09E-12-01		~	
S09E-14-01	2	GAGNE, GERARD	
S09E-22-01	2	CARTWRIGHT, MICHAEL	
S09E-22-02	1	GROUMOUTIS, GEORGIOS	
S09E-22-03	2	LEWIS, MARJORIE	
S09E-22-04	1	JARDIN, PIERRETTE	
S09E-24-01	2	SALTER, MOREL	
S09E-24-02	2	COSTANTINI, MARIO	
S09E-24-03	1	MATTHEWS, ROBERT	
S09E-24-04	2	ANUZIS, ROSALIE	
S09E-25-01	2	GOUSKOS, ATHANASIA	
S09E-25-02	2	R VALLIANI, SHIREEN	
S09E-25-03	2	PERRY, ALICE	
S09E-25-04	2	BROWN, JEAN M	
S09E-27-01		~	

- Allergies and Intolerances
- Assessment Scales
- Chart Completion
- Clinical Measures Ctrl-F7
- Document Viewer
- Evacuation Code
- Infection Control Management
- MCH Resus
- Problem List
- Clinical notes editor (O-Word)
- Medication Reconciliation (RightRx)

MD	Service	LOS	Problem	Visit	Lab	Micro	Rx
~	~	~	~	~	~	~	~
~	~	~	~	~	~	~	~
~	~	~	~	~	~	~	~
~	~	~	~	~	~	~	~
~	~	~	~	~	~	~	~
~	~	~	~	~	~	~	~
~	~	~	~	~	~	~	~
MORAIS, J.	GER	4	URINARY TRACT..	4 d	6 d	1 h	1 h
HUANG, A.	LTA	329	DYSPHAGIA	3 mo	2 mo	6 w	3 w
MORAIS, J.	GER	35	URINARY TRACT..	5 w	29 h	3 w	2 d
MORAIS, J.	GER	14	DEMENTIA	2 w	7 h	9 d	5 h
MORAIS, J.	GER	31	DYSPNEA	4 w	7 d	3 w	3 d
MORAIS, J.	GER	30	MULTIPLE MILOMA	4 w	31 h	5 mo	2 d
MORAIS, J.	GER	3	SYNCOPE	3 d	3 d		1 m
MORAIS, J.	GER	15	URINARY TRACT..	2 w	7 h	3 d	7 d
HUANG, A.	LTA	51	LEFT HEMI ART..	2 mo	5 w	5 w	22 h
MORAIS, J.	GER	9	FAILED REHAB	9 d	7 d	32 h	3 d
MORAIS, J.	GER	121	SEPTICEMIA	4 mo	28 h	2 d	5 h
HUANG, A.	GER	45	DEMENTIA	6 w	4 w	5 w	3 d
~	~	~	~	~	~	~	~
~	~	~	~	~	~	~	~
MORAIS, J.	GER	7	GENERAL DETER..	7 d	29 h	3 d	58 m
WEBER, M.	LTA	66	DEMENTIA	2 mo	2 w	6 w	3 w
VRAHAS, .	LTA	399	DEMENTIA	13 mo	5 w	2 mo	30 h
MORAIS, J.	GER	12	DIABETES	12 d	4 h	9 d	3 d
MORAIS, J.	GER	11	DELIRIUM	11 d	3 d	8 d	31 h
VRAHAS, .	LTA	45	OTHER NEOPLASM	6 w	11 d	9 d	25 h
VRAHAS, .	LTA	69	PNEUMONIA	2 mo	31 h	10 d	3 d
HUANG, A.	LTA	23	ALTERED LOC	3 w	3 d	9 d	3 d
MORAIS, J.	GER	7	PNEUMONIA	7 d	3 h	2 d	2 h
MORAIS, J.	GER	135	NON S-T-E-M-I	4 mo	24 h	7 d	2 d
MORAIS, J.	GER	121	PNEUMONIA	4 mo	2 h	24 h	2 h
WEBER, M.	LTA	50	LEFT ANKLE TI..	6 w	4 h	2 w	6 m
MORAIS, J.	GER	17	DELIRIUM	2 w	4 h	2 d	2 h
~	~	~	~	~	~	~	~



Secure web application

1. Community Drug List validation Tool

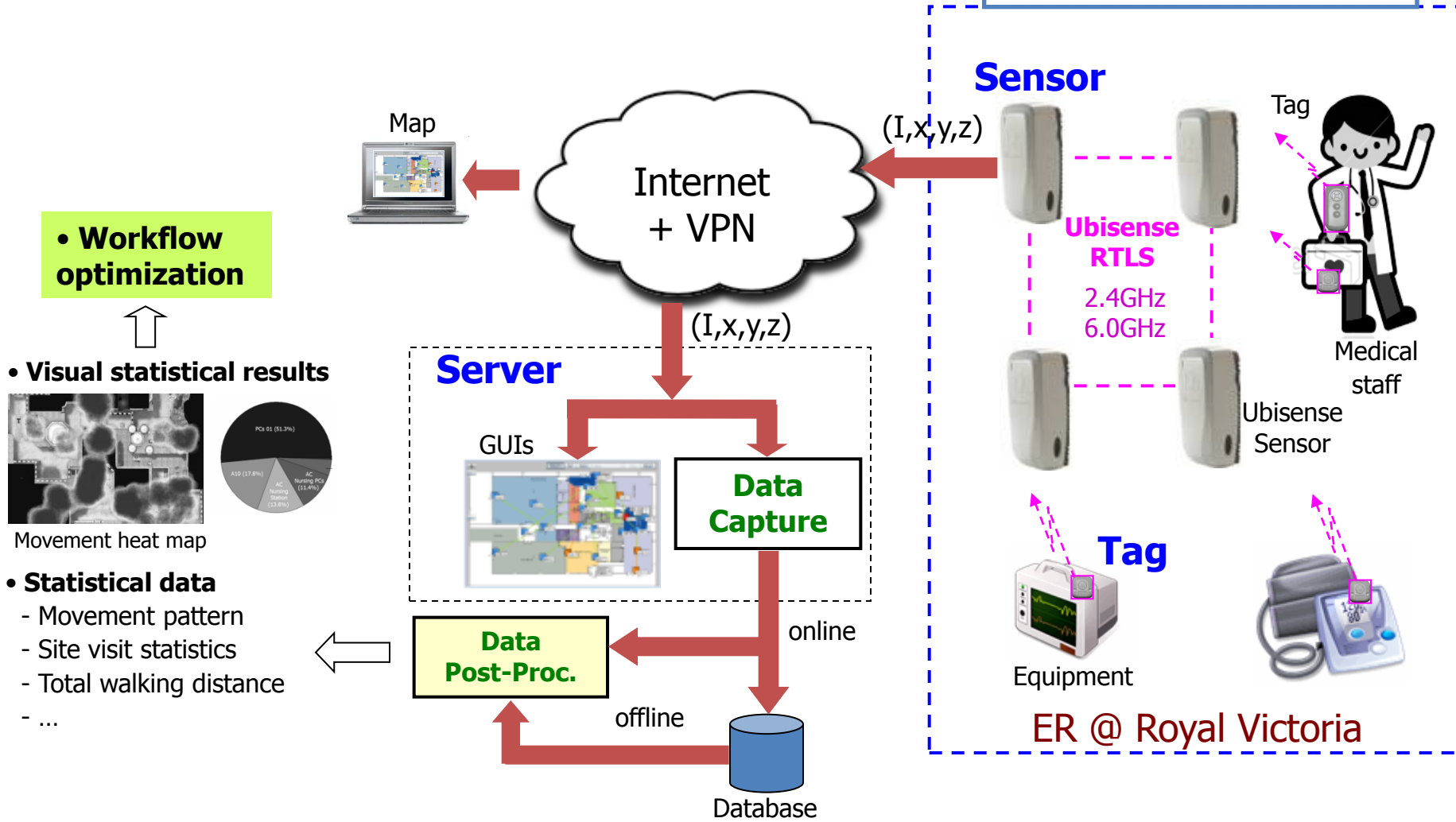
The screenshot shows the 'Right medication' Community Drug List Validation interface. At the top, it displays patient information for SIMPSON, LISA. Below this, there are two main sections: 'NON-VALIDATED Community Drug List from Electronic Sources - 9 drugs' and 'VALIDATED Community Drug List - 12 drugs'. The non-validated list includes drugs like ACETAMINOPHEN 325MG, ATORVASTATIN 10MG, and CELECOXIB 200MG. The validated list includes ACETAMINOPHEN 325MG, ATORVASTATIN 10MG, and CELECOXIB 200MG. A table below the validated list shows drug details including name, posology, and prescribing physician. At the bottom, there are fields for 'Primary Community Physician' and 'Primary Community Pharmacy'.

2. Prescription / ordering tool & Medication reconciliation

The screenshot shows the 'Right medication' Discharge Rx Builder interface. It displays patient information for SIMPSON, LISA. The main area is divided into 'In Hospital List' and 'Validated Community Drug List'. The 'In Hospital List' includes drugs like ATORVASTATIN 20MG PO qHS, BIOPROLOL 5MG PO bid, and FERINDOPIL 2MG PO qAM. The 'Validated Community Drug List' includes ATORVASTATIN 10MG PO qHS, BIOPROLOL 5MG PO bid, and LISINAPRIL 20MG PO QD. On the right side, there are sections for 'Prescribed', 'Dose Change', 'Discontinued', and 'Continue As Is'. The 'Prescribed' section lists various medications with their dosages and frequencies. The 'Dose Change' section shows changes for ATORVASTATIN 20mg PO qHS and HYDROCHLOROTHIAZIDE 12.5mg PO qD. The 'Discontinued' section lists GLIMEPIRIDE 5mg PO qD, METFORMIN 850 PO tid WITH MEALS, and ROSIGLITAZONE 8mg PO qAM. The 'Continue As Is' section lists BISOPROLOL 5mg PO bid and MONOMETASONE 50mcg Nasal spray 2 sprays qD. At the bottom, there are fields for 'Special dispensing directive' and a 'SUBMIT' button.

System and Software Setups

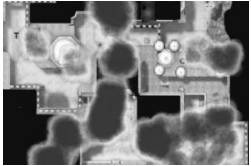
RTLS IN ER



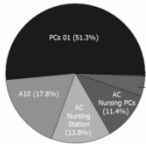
• **Workflow optimization**



• **Visual statistical results**



Movement heat map



• **Statistical data**

- Movement pattern
- Site visit statistics
- Total walking distance
- ...



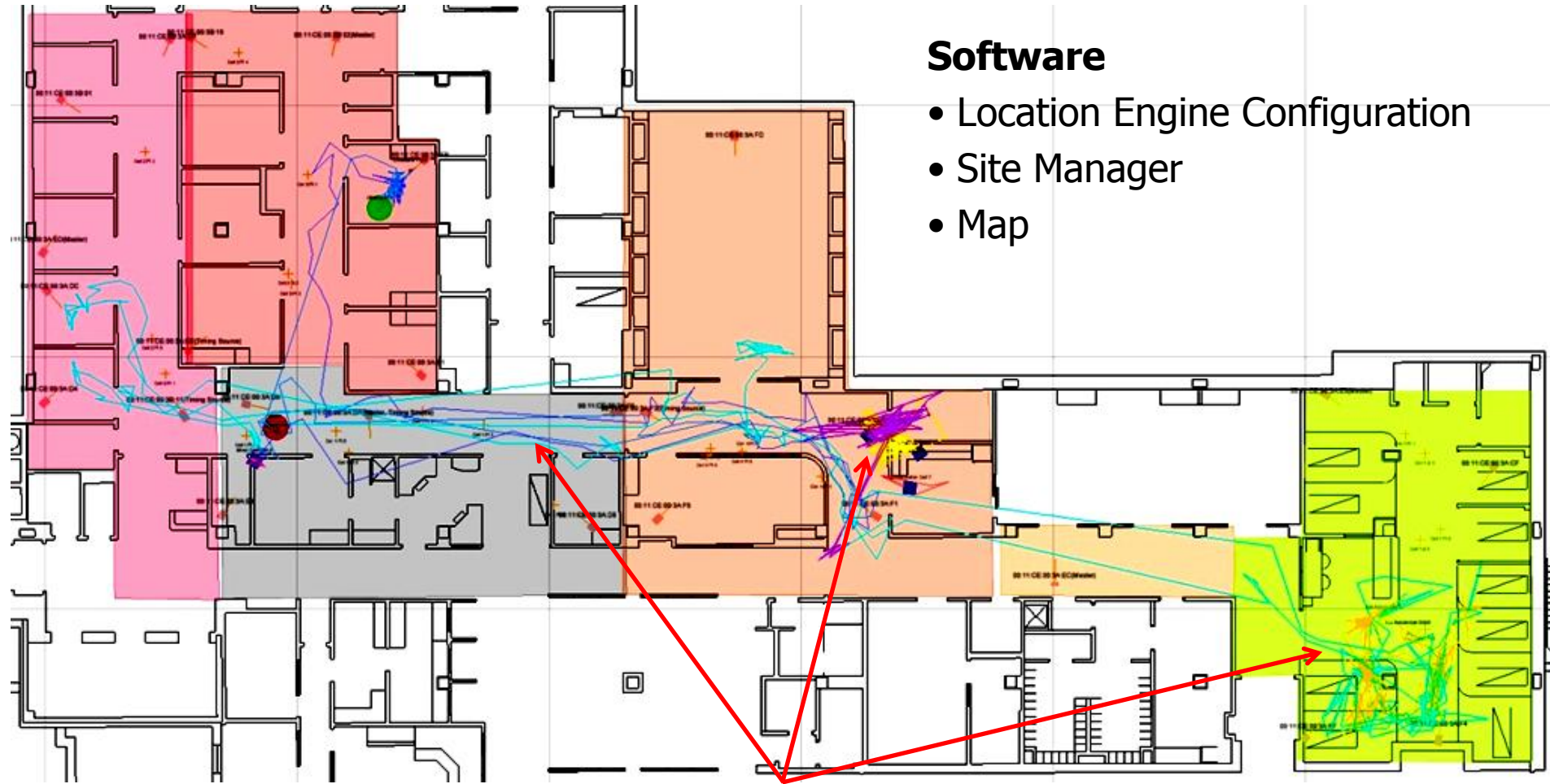
Broadband Communications Lab @ McGill

Localization System Configuration

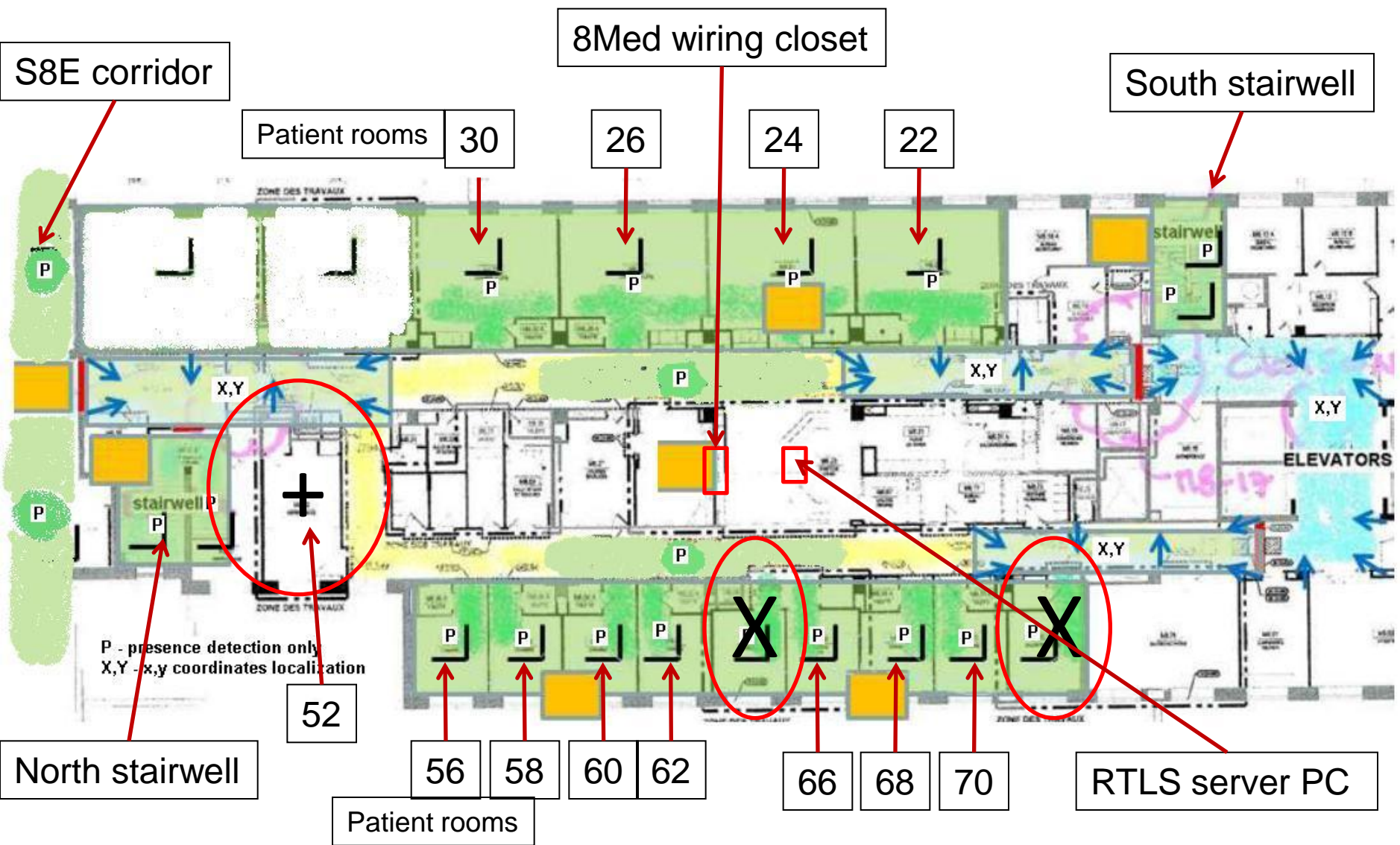
System and Software Setups

Software

- Location Engine Configuration
- Site Manager
- Map



Trails of moving tags in the ER of Royal Vic hospital



RTLS in Geriatrics

Perils

- Murphy's Law applies
- Software errors (Therac-25 radiation treatment machine story)
- IV infusion pump user design
- Failure of Cedars Sinai CPOE implementation
- Increased infant deaths in Pittsburgh PICU
- Heating of pacemaker wires in MRI machines
- ? association of wireless devices & brain cancer

Thank you

