

## Using standards in decision support

Glenn Edwards  
MBBS MD FRCPA  
g.edwards@pks.com.au

3rd Australian HL-7 Conference  
August 13th -14th, 2003

## The clinical pathologist's role

Decision support tools for  
automated testing factories

## Pathologist as consultant

- Dr M. Laposata, MGH
  - Interpretative reporting rounds
    - Pathologist
    - Residents, medical students
    - Technologists
  - Coagulation disorders, protein electrophoresis, molecular diagnostics

Clinical outcome:  
Interpretation helped avoid a misdiagnosis ?



M. Laposata, 2001

Cost outcome:  
Reduced number of tests needed for diagnosis ?



M. Laposata, 2001

## Guidelines in practice: diabetes

- Recommended HbA1c testing
  - Type 1 (IDDM): 4/yr
  - Type 2 (NIDDM): 2/yr
- HbA1c testing (eligible Medicare recipients): 21%
  - GAO report
- Urine microalbumin
  - 10-15% of pts are tested



## RippleDown Rules

- Simple intuitive process
- Used, controlled and driven by clinical experts
- Evolves over time
- Sustained local relevance
- Broad coverage
- Suits clinical workflow

## Lab Wizard

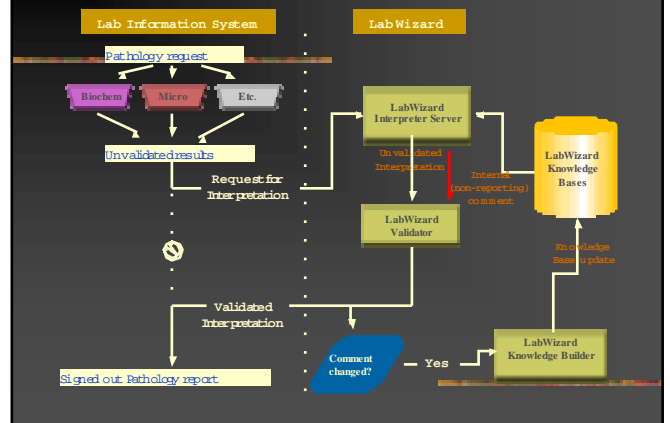
Decision support tool for enhanced lab reporting

- Better utilisation of clinical pathology data
  - SPECIALIST OPINION on every report
    - Interpretation of tests results
    - Diagnosis
    - Guidelines compliance
    - Patient management advice
- Automated reporting
  - PRODUCTIVITY
    - Automated entry of coded results/comments
    - Quality control
    - Lab process management

## Report + specialist opinion

Better Diagnostics Inc.		Pathology Report	
Dr. Glenn Edwards Pacific Knowledge Systems Suite 111, Bay 16 Australian Technology Park Eveleigh, NSW, 1430, Australia		Thank you for referring.... Mr. John Patient Pt: 1 Smith St, Smithtown 2000 Age: 67 years DOB: 16/1/33 Sex: M Date: 28/9/01 Lab No: 123456	
Cholesterol	7.6 mmol/L	Triglycerides	1.2 mmol/L
<b>Specialist comment</b> Hypercholesterolaemia. No previous lipid levels noted. Secondary causes should be excluded at this stage. If confirmed, this cholesterol level may warrant lipid lowering therapy.			
<b>Recommendation</b> Suggest fasting glucose to exclude diabetes. Also consider TSH level, as thyroid dysfunction can raise cholesterol and is treatable. Repeat full lipid profile, including HDL and LDL, to confirm CHD risk before instituting therapy.			
Pathologist: Dr. Sam Specialist			

## Lab Wizard workflow



## Validation

File	Action	Items	Sex/F	Age	FB	Order
512223		111 gmm	F	67	0	1345
ref.L Cholesterol	Days	21.887	panel	0-42		
		27 Apr 00	28 Apr 00	21 Aug 00	13 Nov 00	14 Apr 01
		18.0	19.46	11.15	22.06	18.15
clinical notes						
glucose	4.65	7.1*	6.7*	5.2*	6.1*	6.2*
glucose_type				F		
glucose				5.1*		
Microbiology		1				
Uddi protocol		24				
Interpretation:						
No significant change in FBGLIC. Diabetic control appears poor. Consider checking fasting MICROBIOLOGY IPNL.						
Skip    Fail    Accept    Close						

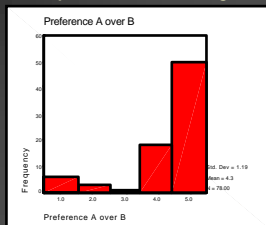
## Performance statistics

Interpretation Manager		
<b>Interpretation</b> Together with previous results, the glucose level is consistent with a diagnosis of DIABETES MELLITUS. Suggest urine albumin estimator, which is recommended at least annually in diabetes management. A full lipid profile including cholesterol, triglycerides and HDL is recommended for cardiac risk assessment.		
Given	8	% (3 out of 678)
Autosubmitted	0	% (0 out of 3)
Manual validated	100	% (3 out of 3)
Rejected	0	% (0 out of 3)
Cumulative      Autosubmission Level: 3 %		

## Physicians' preference for LabWizard reports

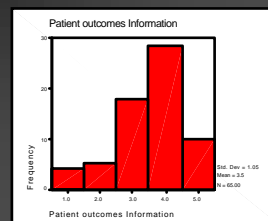
"Unambiguous evidence that doctors prefer the output style produced through LabWizard to the uncommented output produced by unembellished LIS".

(where 'A' was a report of the type produced by conventional LIS-based rules, and 'B' was a report of the type produced by LabWizard).



## GP attitudes: outcomes

60% of doctors in the study believed they had improved patient outcomes since the introduction of LabWizard.



## Pathologists' views

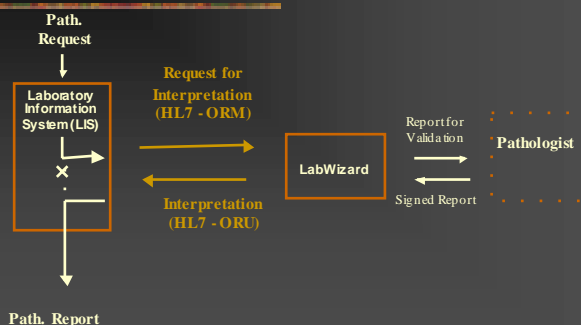
- All reported a marked increase in the number of reports incorporating pathologist comments since the introduction of LabWizard
- All believed the set-up effort would be repaid in the near to mid term with efficiency improvements
- Pathologists perceived LabWizard to be a valuable aid in their professional work.

## HL-7 interface

## LIS-LabWizard Interface

- LabWizard uses just 2 HL7 messages
  - Request For Interpretation (Order Message - ORM)
  - Interpretation (Observational Report Message - ORU)
- The use of these messages for requests to and from a Knowledge Base is specified in AS4700.2

## Interface Overview



## Information in the Order Message

- Patient demographics (PID)
- Patient visit data (PV1)
- Knowledge Base (OBR)
- Current Episode (OBR/OBX)
  - Referring practitioner and clinical notes
  - Tests ordered, Test results
- Previous Episodes (OBR/OBX)

## Information in the Results Message

- Knowledge Base (OBR)
- Interpretation (OBX)
- Pathologist reviewer (OBX)
- (optional) Review recommendation (OBX)
  - Needed if external validation used
- (optional) Textual view (OBX)
  - Needed if external validation used

### Example Order Message

```
MSH|^~\&SuprLIS2000|PaLMS03|PathKB|NSWH|G|19990215091301|ORM04001|P23.1<cr>
PID||KNEEN123|Knees^Nobby^J^Mr||19331213|M||23Shady Lane^Unit 2^LIGH TNING
RIDGE^NSW^2392|||||219171803<cr>
PV1|D<cr>
ORC|NW|LW-99021518<cr>
OBR|1|LW-99021518|RFLP^Request for Interpretation - Lipid^Lab-1|||||^^^
199902150910^^S<cr>
ORC|RE|PMS2299-0021518<cr>
OBR|1|PMS2299-0021518|LP^Lipid^Lab-1||||199902150805||||Patient is on
Zocor||D4321|Dak^Hugh^D^Dr|(02)9876 5432
|||||^A^199902141534^S^Jones^William^Dr<cr>
OBX|1|NMCH^Cholesterol^Lab-1^14646-2^CHOLESTEROL^LN|73|mmolL|<
5.5|H|F||199902150907<cr>
OBX|2|NMTG^Triglyceride^Lab-1^12951-0^TRIGLY CERIDE^LN|18|mmolL|<
2.0|F||199902150907<cr>
OBX|3|STCCM^Codal Clinical Notes^Lab-1|Zocor||||F||199902150907<cr>
ORC|RE|PMS2299-0021518<cr>
OBR|1|PMS2299-0021518|GL^Glucose^Lab-1||||199902150805||||Patient is on Zocor ||
D4321|Dak^Hugh^D^Dr|
(02)9876 5432|||||^A^199902141534^S^Jones^William^Dr<cr>
OBX|1|NMG|Glucose^Lab-1|6777-7^GLUCOSE^LN|8|mmolL|39 - 5.8|F||199902150907<cr>
OBX|2|STCCM^Codal Clinical Notes^Lab-1|Zocor||||F||199902150907<cr>
ORC|RE|PMS1198-0011423<cr>
OBR|1|PMS1198-0011423|LP^Lipid^Lab-1||||199812191124||||Initial
screening||D5432^Ligh^James^Dr|(02)9876 3122
|||||^A^199812191000^^S<cr>
```

*Patient and visit*

*Knowledge Base*

*Current Episode (lipids)*

*Current episode (glucose)*

*Previous episode (lipids)*

### Example Results Message

```
MSH|^~\&|PathKB V2.14|NSWH-
IG|SuprLIS2000|PaLMS03|19990215091354||ORU|23322|P|2.
3.1<cr>
PID||KNEEN123||Knees^Nobby^J^Mr||19331213|M||
23 Shady Lane^Unit 2^LIGH TNING
RIDGE^NSW^2392|||||219171803<cr>
ORC|NW|LW-99021518|PaLMS03-LW-990021518^NATA^4321^N<cr>
OBR|1|LW-99021518|PaLMS03-LW-990021518^NATA^4321^N|
RPI-LP^Request for Interpretation - Lipid^Lab-
1|||||199902150910^^S<cr>
OBX|1|FT|INT^Interpretation^Lab-1|.nf|.br| There is
little change in the
cholesterol level from baseline performed in
hospital, despite Zocor.
No evidence of diabetes. Suggest TSH to exclude
hypothyroidism|.br
|||A|0.1|F|||||^Edwards<cr>
OBX|2|FT|VIEW^Case View^Lab-1|F|||F||| (see next
slide) |||F<cr>
```

*Knowledge Base*

*Interpretation*

*Textual View*

*Review Recommendation*

*Reviewer*

*F - already approved*  
*R - requires review*

## Standards issues for Lab Wizard

- Test names
- Test results
  - Eg: HepA is "POSITIVE", "P"
- Clinical order information
- Interpretation content

## Clinical Standards

## Impact of decision support systems

### Target Observed impact

- Diagnosis 1/5 (20%)
- Drug dosing 9/15 (60%)
- Active clinical care 19/26 (73%)
- Preventative care 14/19 (74%)

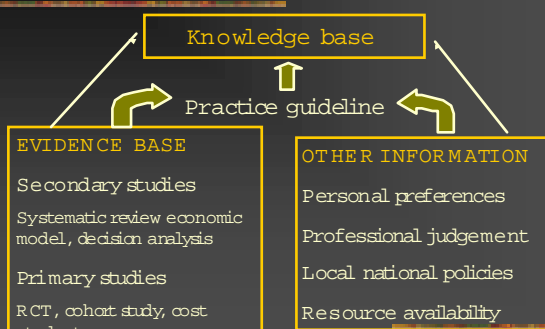
Wyatt JC J Royal Soc Med 2000;93:629-633

## Transition: global to local

- “The goal is to give advice, rather than simply present the evidence... makers of DSSs need to include information on such matters as preferences, policies and resource availability”

Wyatt JC J Royal Soc Med 2000;93:629-633

## Guidelines ... and the other stuff



Wyatt JC J Royal Soc Med 2000;93:629-633

## Evidence-adaptive DSS

- “Literature-based evidence should often be complemented by *local, practice-based evidence* for *individual and site-specific clinical decision making*”
- “The clinical knowledge base [of a DSS] *continually* reflects the most up-to-date evidence from research literature and *practice-based sources*”

Si met al J Am Med Inform Assoc 2001;8:527

### DIABETES MANAGEMENT

	14/3/02	24/8/02
	08:30	08:30
	977766	933445
	-----	-----
Fasting glucose	6.7	5.6
HbA1c	8.2	7.1
Cholesterol	6.4	5.5
Triglycerides	3.3	1.2
HDL	0.8	1.3
LDL	4.5	3.4

#### Interpretation

The glycaemic control has improved. Suggest next HbA1c in 3-4 months to monitor improvement. The dyslipidaemia has also improved with fibrate and statin therapy. Aim for cholesterol < 4.0 mmol/L, LDL < 2.5 mmol/L and triglycerides < 2.0 mmol/L. Also suggest urine albumin which is due within the next month.

Pathologist: Dr I. Jones

## Clinical judgement

- Lack of systematic evidence/RCTs
- Local factors
  - Resource constraints
  - Specialist knowledge
  - Disease/demographic patterns
- The real world of patient data
  - Dense, incomplete, complex
- The real world of professional medical practice

## Clinical judgement



## The alternative...

- Common causes of a low FT4 with a normal TSH include treated thyroid disease, non-thyroidal illness, drug effects (eg: anti-convulsants). Less common causes include pituitary disease..

....Yawn!

## Judgement-based systems

- Can we trust computers that make judgement calls?
  - Tools for experts
  - Support systems for tyros
- Is there an acceptable level of error?

## Clinical Expert System "standards"

- Clinician driven, built and maintained
- Intuitive interface and "language"
- Readily evolves over time
- Broad domain coverage
- Clinical work-flow compatible
- Localisable
- Auditable
  - Construction and development
  - Record in operation
- Explanation facility

## Challenge: are we ready?

- What do the clinical users want?
- What do consumers want?
- Who will pay?

**Quest Diagnostics**  
Personal Health Reports for Tests You Choose

Physicians already rely on our services—now you can too.

- 1. Choose and order your tests online.
- 2. Receive medical concerns and tests.
- 3. Review the ordering and testing process.
- 4. Get your confidential test results online.

**Popular Health Tests**

- Diabetes Screen
- Heart Disease
- Cholesterol, Blood Lipid
- Thyroid, Genetic, Asthma
- Women's Health/Obstetrics
- Men's Health/Prostate

Learn more about QuestDirect™



## Using standards in decision support

---

Glenn Edwards  
MBBS MD FRCPA  
[g.edwards@pks.com.au](mailto:g.edwards@pks.com.au)

3rd Australian HL-7 Conference  
August 13th -14th, 2003