

# Validation of metric-based training and assessment in a (bi)national training program

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# Definitions

## Metrics:

- Measureable parameters of surgical competence and performance

## Competence:

- Knowledge, skills and attitudes expected of a surgeon

## Validation:

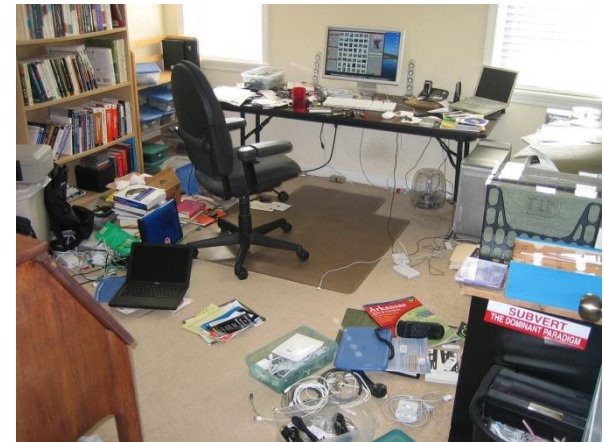
- Ensuring tools used are appropriate for and effective in achieving their stated purpose



# Assumption

Surgical training programme is supported by a sound governance structure and consistent processes around:

- Policies and procedures
- Selection
- Defining learning objectives
- Clearly defined curriculum
- Measurable indicators of trainee progression (acquisition of skills)
- Validated assessments (formative and summative) aligned to syllabus
- Accreditation and review of training positions against defined parameters
- Training of supervisors and examiners



# Principles of RACS Surgical Education and Training Programmes

Competency-based (hybrid time-based)

Entire training in hospitals

Selection straight into training scheme of chosen specialty

- Starting from as early as PGY3
- Minimal pre-requisites for selection



# Trend to competency-based programme

## Implications:

1. better recognition of prior learning
2. variable training period
3. hard to measure non-technical skills
4. need for defined standards for stages in training
5. necessitates quality in-training formative assessments and timely feedback
6. timing and content of summative assessments better suited to purpose



# Metric-based training and assessment

Topics covered:

1. Formative assessment of trainee progression
2. Summative assessment of acquisition of surgical competencies
3. Process for measuring “performance” of training scheme



# The problem: inadequate tools

## Operative (technical skills):

- Logbooks for scope, numbers and degree of supervision (graded responsibility)
- DOPS: issues with numbers, compliance and parameters chosen
- In-training assessment reviews: dependent on surgeons
  - ? know what to look for
  - ? quality of assessment



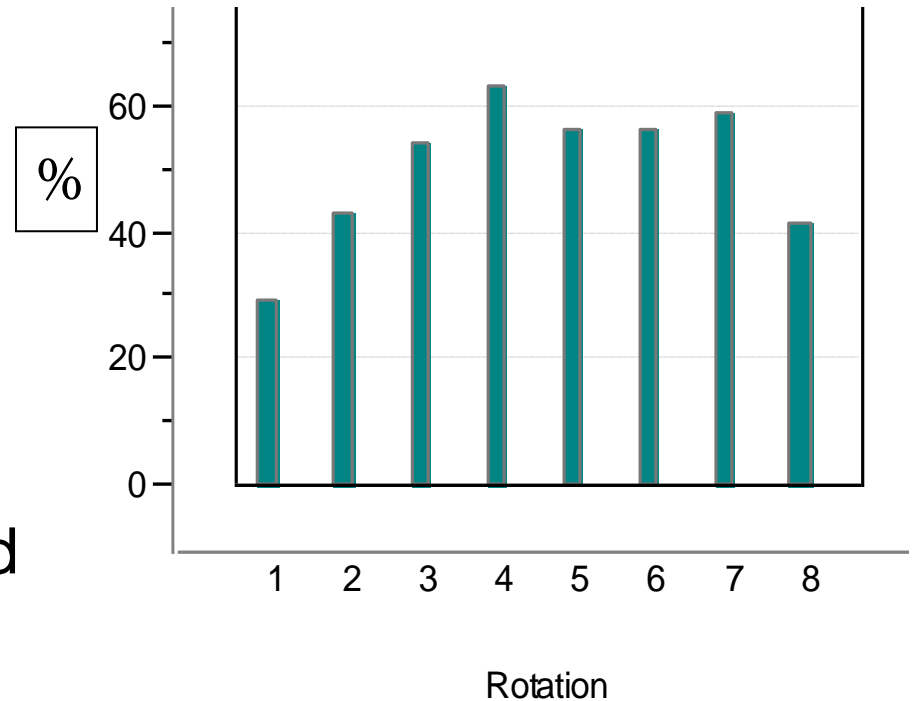
# Centre-specific supervision levels

Overall supervision ~50%

No obvious relationship to seniority

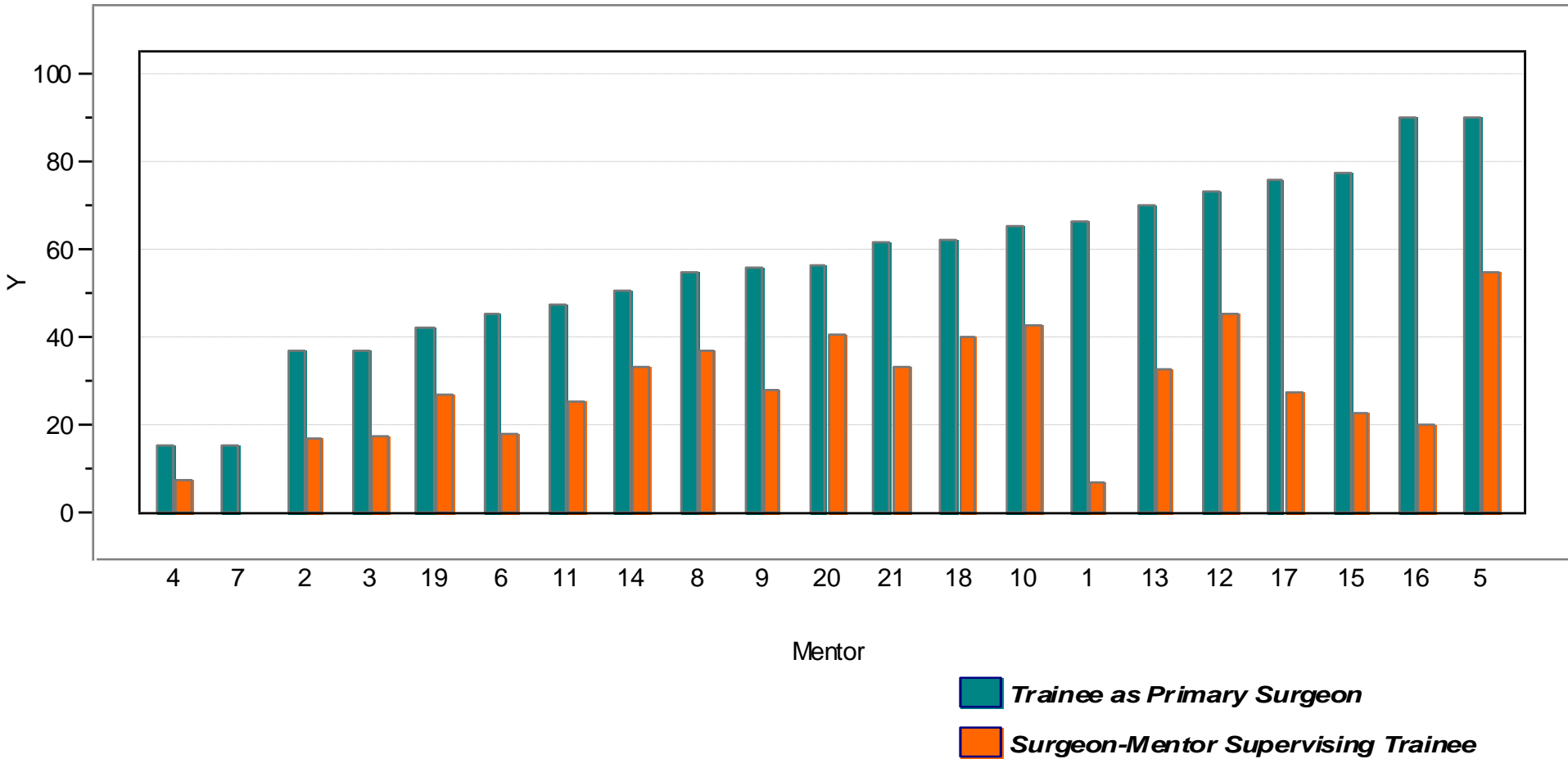
? 'inherent' level of supervision for each hospital rotation

? Supervision complexity related





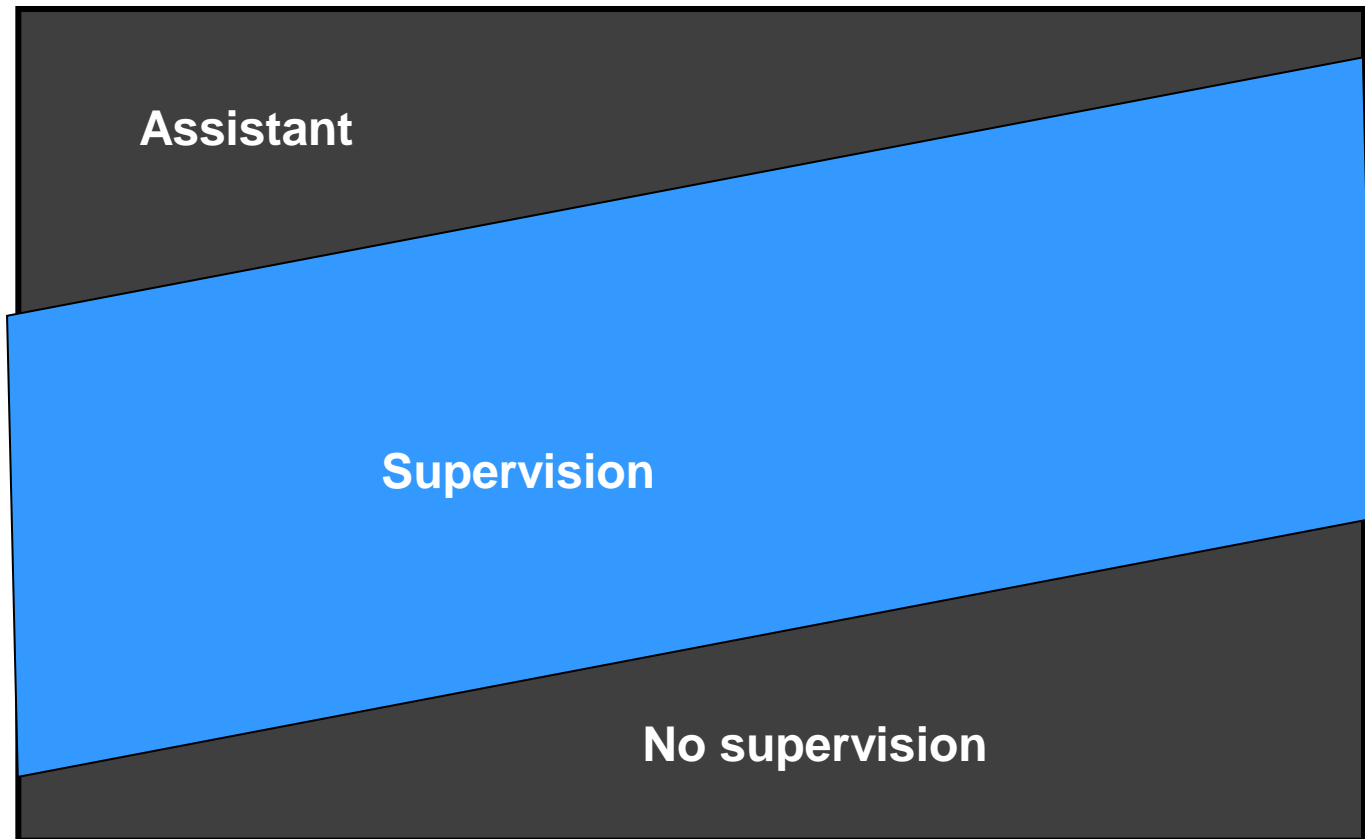
# Role as primary surgeon, and % supervised



Craig McBride



# A trainee progressing well through duration of training



# How can trainee progression be monitored?

- Needs to cover all surgical competencies, including non-technical
- Needs clarity around standards at each level, and how to measure them
- For many, acquisition of surgical competence best assessed by observing behaviour in clinical setting



# Choice of formative assessment tools

## Technical expertise:

Logbook: scope and numbers

DOPS (Direct observation of procedural skills)

pattern (level of supervision, graded responsibility) of operative experience

## Clinical judgement:

MiniCEX,

CBD (case-based discussion),

CATS (critical appraisal tasks),

DOGS (directed on-line group learning sessions),

360 degree reviews

## Non-technical skills:

360 degree review

specific courses/modules

regular in-training assessment reviews



**Direct Observation of Procedural Skills (Surgical DOPS) – Assessment Form**

Setting:  Theatre  ICU  ED  Other .....

Procedure: *Intra-operative Cholangiogram* .....  Major  Intermediate  Minor

Difficulty:  Easier than usual  Average  More than usual

Number of times this procedure has been performed by this trainee prior to this occasion ... *4-5* .....

Please assess and mark the following areas:	Below expectations for level of training	Borderline	Meets expectations	Above expectations for level of training	Not observed / not applicable
1. Explains the procedure and complications to the patient and obtains patient's informed consent			<input checked="" type="checkbox"/>		
2. Prepares for procedure according to an agreed protocol			<input checked="" type="checkbox"/>		
3. Demonstrates aseptic techniques and safe use of instruments/charges			<input checked="" type="checkbox"/>		
4. Performs technical aspects competently				<input checked="" type="checkbox"/>	
5. Demonstrates manual dexterity required to carry out procedure				<input checked="" type="checkbox"/>	
6. Adapts procedure to accommodate patient and/or unexpected events					<input checked="" type="checkbox"/>
7. Is aware of own limitations and seeks help when appropriate			<input checked="" type="checkbox"/>		
8. Completes required documentation (written or dictated)				<input checked="" type="checkbox"/>	
9. Analyses one's own clinical performance for continuous improvement			<input checked="" type="checkbox"/>		

Overall Score	Significant Improvement Required	Some Improvement Required	Competent
Overall performance during procedure			<input checked="" type="checkbox"/>

Suggestions for development: *Is competent to start learning more complex parts of laparoscopic Cholecystectomy under direct supervision. Easier on Cholecystectomy + removing GB from fossae.*

Other comments:

Agreed action: *To complete more part of the procedure.*

Assessor's signature: \_\_\_\_\_

Trainee's signature: \_\_\_\_\_

Trainee's satisfaction with DOPS process Not at all      Extremely satisfied

Assessor's satisfaction with DOPS process Not at all      Extremely satisfied

Has the Assessor had training in the use of this assessment tool?

Yes: attended a workshop  Yes: other .....  No

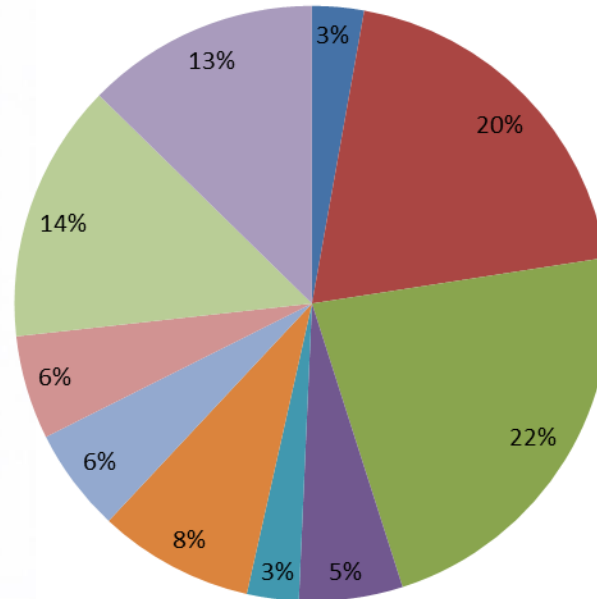
Time taken for observation (in minutes): ..... Time taken for feedback (in minutes): ..... *5* .....

- Ensure metrics correlate with desired expertise  
e.g. respect for tissues, identifying planes, ergonomic efficiency
- Obtain sufficient numbers of “biopsies”
- Observers qualified



# Regular in-training formative SET assessments

N - Not Competent	B - Borderline	C - Competent	E - Excellent	Assessment							
				N	B	C	E	N	B	C	E
<b>Judgement</b>				Trainees				Supervisor			
Clinical decision making, organise diagnostic testing, imaging, and consultation as needed											
- Incomplete or inaccurate - Poor basic skills	- Hesitant or inconsistent of patient - Lacks attention to detail.	- Takes a history, performs an examination, and arrives at a well-reasoned diagnosis - Efficiently and effectively examines the patient	- Precise, thorough and perceptive	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
- Incomplete/inaccurate recognition of significant symptoms - Significant errors/omissions in diagnosis - Frequent inaccuracies history, signs, or diagnosis	- Poor presentation/discussion of clinical cases - Occasional inaccuracies in diagnosis - Sometimes confuses priorities - Concise and correct on clinical details - Arrives at appropriate conclusions in case presentations	- Recognises variations, accurately diagnoses, and manages common disorders - Differentiates those conditions amenable to operative and non-operative treatment - Concise and correct on clinical details - Arrives at appropriate conclusions in case presentations	- Accurate and efficient - Considers a wide range of symptoms and factors - Insightful perspective in case discussions	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
- Inadequate or inappropriate, poor selection and/or interpretation - Disregards patient's needs or circumstances	- Unable to appropriately justify use of selected investigations - Occasional errors in interpretation that could lead to patient problems - Disregards system needs	- Selects appropriate investigative tools and monitoring techniques cost-effectively - Appraises and interprets results of investigations against patient's needs in the planning of treatment - Critically evaluates the advantages and disadvantages of different investigative modalities	- Always selects optimal investigations - Excellent interpretation - Safe, efficient, and cost effective approach to use of investigations	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
- Unable to make a decision - Unable to suggest alternative interpretations	- Some suggested alternatives are inappropriate - Ignores data that does not fit interpretation - Presentation unclear and disorganised	- Formulates a differential diagnosis based on investigative findings - Evaluates the significance of data - Indicates appropriate alternatives in the process of interpreting investigations and in decision making - Clear and concise presentation of findings	- Precise, well organised, thorough, systematic, and focused presentation of findings - Indicates relevant alternatives - Decisions based on data	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
- Poor record keeping - Incomplete, disorganised, irrelevant, illegible, not up-to date	- Records difficult for others to follow	- Contemporaneously maintains accurate and complete clinical records - Precise and focused - Complies with required organisational structure	- Perceptive of relevant information for documentation - Records very easily accessible	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
- Uninterested or indifferent approach to patients - Fails to grasp significance or respond accordingly	- Culturally incompetent - Ignores/overlooks some patient's needs	- Manages patients in ways that demonstrate sensitivity to their physical, social, cultural, and psychological needs - Considers all issues relevant to the patient	- Excellent and highly developed ability to manage & interact with patients and to anticipate and/or respond to their needs	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
- Coping poorly in situations of stress and/or complexity - Under or over reacts	- Can show signs of stress when managing trauma patients	- Effectively manages the care of patients with trauma including multiple system trauma - Maintains controlled approach & demonstrates sound judgement during times of stress/complexity	- Anticipates possible risks and/or complications - In stressful situations always maintains orderly approach and demonstrates sound judgment	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
- Inadequate planning - Inadequate involvement in pre & post-operative care - Fails to grasp significance or symptoms or respond accordingly	- Slow to anticipate/identify complications - Slow to call for assistance - Under estimates complexity and/or risk factors	- Plans, and where necessary implements a risk management plan - Concentrated and reliable follow-up - Effectively manage complications - cooperative procedures & underlying disease process - Identifies and manages risk - Manages complexity and uncertainty	- Outstanding clinician who anticipates possible risks/ complications - Identifies problems early - Follows-up meticulously - Coordinates and uses other personnel effectively	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Trainee Self Assessment Comments (Include goals and methods of improving if rating is Borderline or Not-Competent)											
Supervisors Comments (Include goals and methods of improving if rating is Borderline or Not-Competent)											



- Medical expertise
- Technical expertise
- Judgement
- Communication
- Management and leadership
- Collaboration
- Health advocacy
- Scholar and teacher
- Professionalism
- Essential criteria



# In-training assessments

N - Not Competent		B - Borderline		C - Competent		E - Excellent		Assessment	
Judgement								N B C E	
Clinical decision making, organise diagnostic testing, imaging, and consultation as needed								Trainees	
								Supervisor	
Incomplete or inaccurate poor basic skills	Hesitant or inconsiderate of patient Lacks attention to detail.	Takes a history, performs an examination, and arrives at a well-reasoned diagnosis Efficiently and effectively examines the patient	Precise, thorough and judicious	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Incomplete/inaccurate recognition of significant symptoms Significant errors/omissions in diagnosis Frequent inaccuracies history, signs, or diagnosis	Poor presentatory/discussion of clinical cases Occasional inaccuracies in diagnosis Sometimes confuses priorities	Recognises symptoms, accurately diagnoses, and manages common disorders Differentiates those conditions amenable to operative and non-operative treatment Concise and correct on clinical details Arrives at appropriate conclusions in case presentations	Accurate and efficient Considers a wide range of symptoms and factors Insightful perspective in case discussions	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Inadequate or inappropriate, poor selection and/or interpretation Disregards patient's needs or circumstances	Unable to appropriately justify use of selected investigations Occasional errors in interpretation that could lead to patient problems Disregards system needs	Selects appropriate investigative tools and monitoring techniques cost-effectively Appraises and interprets results of investigations against patient's needs in the planning of treatment Critically evaluates the advantages and disadvantages of different investigative modalities	Always selects optimal investigations Excellent interpretation Safe, efficient, and cost-effective approach to use of investigations	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Unable to make a decision Unable to suggest alternative interpretations	Some suggested alternatives are inappropriate Ignores data that does not fit interpretation Presentation unclear and disorganised	Formulates a differential diagnosis based on investigative findings Evaluates the significance of data Indicates appropriate alternatives in the process of interpreting investigations and in decision making Clear and concise presentation of findings	Precise, well organized, thorough, systematic, and focused presentation of findings Indicates relevant alternatives Decisions based on data	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Poor record keeping Incomplete, disorganised, irrelevant, illegible, not up-to-date	Records difficult for others to follow	Contemporaneously maintains accurate and complete clinical records Precise and focused Complies with required organisational structure	Informative of relevant information/data for documentation Records very easily accessible	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Uninterested or indifferent approach to patients Culturally incompetent	Culturally incompetent Ignores/overlooks some patient's needs	Manages patients in ways that demonstrate sensitivity to their physical, social, cultural, and psychological needs Considers all issues relevant to the patient	Excellent and highly developed ability to manage & interact with patients and to anticipate and/or respond to their needs	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Copes poorly in situations of stress and/or complexity Under or over reacts	Can show signs of stress when managing trauma patients	Effectively manages the care of patients with trauma including multiple system trauma Maintains controlled approach & demonstrates sound judgement during times of stress/complexity	Anticipates possible risks/complications In stressful situations always maintains orderly approach and demonstrates sound judgement	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Inadequate planning Inadequate involvement in pre & post-operative care Fails to grasp significance of symptoms or respond accordingly	Does not anticipate/ manage complications Does not call for assistance Under estimates complexity and/or risk factors	Plans and where necessary implements a risk management plan Conscientious and reliable follow-up Effectively manage complications, operative procedures & underlying disease process, identifies and manages risk Manages complexity and uncertainty	Outstanding clinician who anticipates possible risks/complications Identifies problems early Follow-up meticulously Coordinates and uses other personnel effectively	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

- Regular, transparent, quality feedback
- Currently related to whether standard achieved, but no clarity around standard in relation to stage of training
- Need for reproducible levels of competence



# Training standards for the 9 RACS competencies



Royal Australasian College of Surgeons  
The College of Surgeons of Australia and New Zealand

**Becoming a competent and  
proficient surgeon**

**Training Standards for the Nine RACS  
Competencies**





# Surgical competencies

- Technical expertise
- Medical expertise
- Judgement – clinical decision-making
- Communication
- Collaboration
- Management and leadership
- Health advocacy
- Scholar and teacher
- Professionalism and ethics



# Surgical competencies

- Technical expertise
- Medical expertise
- Judgement – clinical decision-making
- Communication
- Collaboration
- **Management and leadership**
- Health advocacy
- Scholar and teacher
- Professionalism and ethics



# Management and Leadership

Involves leading the team and providing direction, demonstrating high standards of clinical practice and care, and being considerate about the needs of team members.

## Examples of behaviours:

- Setting and maintaining standards
- Leading and inspiring others
- Supporting others



# Behaviour: supporting others

## **Pre-vocational**

- Establishes good working relationships with team members

## **Novice**

- Recognise team members who need support and willing to help

## **Intermediate**

- Provides support and advice to team members when needed
- Listens to, and incorporates the views others
- Recognises and acknowledges the contribution of others

## **Competent**

- Provides constructive feedback to team members
- Able to intercede on behalf of others when appropriate
- Encourages participation by all members of the team

## **Proficient**

- Provides constructive critical feedback
- Assists with the development of a remedial plan where there are performance issues
- Provides cognitive and emotional help to team members as appropriate
- Determines team member's abilities and tailors the style of leadership accordingly
- Can adopt suitably forceful manner if appropriate without undermining role of other team members



# Outline of summative assessments

1. Generic Surgical Science exams:
  - Early (or prior to commencement) SET
2. Specialty-specific Surgical Science exams
  - Mid SET
3. Fellowship (final “exit”) examination
  - Late SET



# Levels of cognitive function in clinical practice

1. Acquisition of basic knowledge – early trainee
2. Clinical reasoning and application of knowledge – senior trainee
3. Professional judgement in sophisticated clinical decision-making (CDM)



# Final “exit” summative assessment

- Correct cognitive level
- Clinical and operative decision-making, clinical application of knowledge,
- Targeted to competencies not fully or better assessed elsewhere



# Surgical competencies

- Technical expertise (eg operative)
- Medical expertise
- Judgement – clinical decision-making
- Communication
- Collaboration
- Management and leadership
- Health advocacy
- Scholar and teacher
- Professionalism and ethics





# Surgical competencies

- Technical expertise (eg operative)
- **Medical expertise**
- **Judgement – clinical decision-making**
- Communication
- Collaboration
- Management and leadership
- Health advocacy
- Scholar and teacher
- Professionalism and ethics



# Demonstration of competence

High stakes: high validity and reliability

Requires:

- Standard setting
- Pre-determined marking descriptors for each
- Sufficient number of “biopsies” to cover scope of syllabus, and achieve reliability
- Expanded CMS, multiple marking points
- Ensure assessment at correct cognitive level



# Purpose of blueprinting

**Blueprinting** ensures that the examination

- Covers scope of syllabus, aligned to other assessment processes
- At correct cognitive level  
(for clinical decision-making and professional judgement)
- Targets specific surgical competencies



# Example of ECMS outlining performance across exit examination

WRITTEN 1			WRITTEN 2			CLINICAL 1			CLINICAL 2			OPERATIVE			PCC			ANATOMY							
	Harrison	Hansen		Banting	Eaton		Frizelle	Keogh		Harman	Blomberg		Harrison	Hansen		Banting	Eaton		Clark	Fink					
M1	8.5	8.5	M1	9	9	C1	M1	9.5	9	C1	M1	9	9	Q1	M1	9	9	M1	9	9					
M2	9	9	M2	9	9		M2	9	9		M2	9	9		M2	9	9	M2	9	9	M2	9	8.5		
M3	9	9	M3	9	9		M3	9	9		M3	9	9		M3	9	9	M3	9	9	M3	9	9		
M4	9	9	M4	9	9		C2	M4	9.5	9	C2	M2	9	9	Q2	M1	9	9	Q2	M1	9	9	M4	8	8.5
M5	9	9	M5	9	9	M1		9.5	9	M2		9	9	M2		9	9	M2		9	9	M5	9	9	
M6	9	9	M6	9	9	C2		M2	9	9	C3	M1	9	9	Q3	M1	9	9	Q3	M1	9	9	M6	9	9
M7	9	9	M7	9	9			M3	9.5	9.5		M2	9.5	9		M3	9	9		M3	9	9	M7	9	9
M8	8.5	9	M8	8.5	9	M4	9.5	9.5	C4	M1	9	9	Q5	M1	9	9	Q6	M1	9	9	M8	8.5	8.5		
M9	9	9	Average	8.97		Average	9.22			C5	M1	9.5		9.5	Average	9.00		Q5	M1	9	9	M9	9	9.5	
M10	9	9	% pass	94%		% pass	100%		C6		M2	9	9	% pass	100%		Q6		M1	9	9	M10	9	9	
M11	8	8								C6	M1	9.5	9	Average	9.00			Q6	9.00		Average	8.86			
M12	9	9							M2		9.5	9.5	% pass	100%		% pass	100%		% pass	75%					
M13	9.5	9							Average	9.13															
M14	9	9							% pass	100%															
M15	9	9																							
M16	9.5	9																							
M17	9	9																							
M18	8	8																							
M19	9	9																							
M20	9	9																							
M21	9	9																							
M22	9	9																							
M23	9	9																							
M24	8.5	9																							
M25	9	9																							
Average	8.90																								
% pass	84%																								

Cassandra Wannan



and Richard Lander, Andrew Brooks, Narelle Hardware



# Pearson's Correlations ( $r$ )\* 2008-2010

## Selection

	$n$	CV%	RR%	Int%
CV%	367	1	.013	-.206
RR%	367	.013	1	-.067
Int%	367	-.206	-.067	1

■  $P < 0.01$

## Examinations

	$n$	SSE Gen%	SSE Spec spec%	CE%
SSE Generic%	339	1	.857	.359
SSE Spec specific %	292	.857	1	.349
CE%	337	.359	.349	1

■  $P < 0.01$

\*  
 $r$  approaching 1 indicates a large positive correlation,  
 $r$  approaching -1 indicates a large negative correlation

Zaita Oldfield



# Summary of significant selection-assessment relationships

	Examinations			DOPS					MiniCEX					End of Term Assessments				
	SSE Gen-eric	SSE Spec-ialty Spec-ific	Clin-ical	DOPS 1	DOPS 2	DOPS 3	DOPS 4	DOPS Mean	Mini-CEX 1	Mini-CEX 2	Mini-CEX 3	Mini-CEX 4	Mini-CEX Mean	ETA 1	ETA 2	ETA 3	ETA 4	ETA Mean
<i>n</i>	339	292	337	252	204	88	42	253	254	199	82	33	256	277	297	148	139	312
CV					Neg											Neg		Neg
RR																		
Inter-view																		
Total Sel-ec-tion																		

■  $P < 0.05$    ■  $P < 0.01$    ■  $P < 0.05$



# Conclusion

## Competency-based training requires:

- Validated metrics to be used for assessing trainees' acquisition of skills
- For many of the non-technical competencies this may be best done by observation of behaviours against defined descriptors
- For higher cognitive clinical performance use combination of:
  - (1) observation of clinical performance; and
  - (2) focused summative assessment with marking descriptors against predetermined standards
- Constant review of all elements of program

