SMART - PROFILE Version 3: Streamlined and enhanced to promote a bespoke assessment and investigation of the PDOC patient
June 17, 2022

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Key development themes for Version 3

- Changes in legal framework, RCP guidelines and research findings
- Need a spectrum for durability and reproducibility
- Length of assessment
- The need for a bespoke client centered assessment
- Using clinical judgment
- Comparison of each component to others
- Provide indicative diagnosis but also framework for intervention and management

SMART- PROFILE

PDOC Responses Observation Framework for Investigative Inquiry and Locating Evidence

Assessment of PDOC – "Detective Work at its Best" – Dr E Freeman

SMART PROFILE- Investigation NOT just an Assessment

What do you need for an investigation?

- Experienced and consistent detective to review the evidence and oversee trends and findings
- Investigative tools
- Conduct interviews
- Verify evidence

Organisation of the SMART Assessment

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Clinical questions in development of SMART

What **impacts** responses?	**SPEC**
What **behaviours** are present before we do anything?	**Behavioural Observations**
What does the patient respond to? And **how** do they respond?	**Sensory Assessment**
Where is the patient on the **PDOC spectrum** and within the diagnostic category to show clinical change?	**Analysis and Profile**
What responses are seen by **family and team?**	**Informs, Formal observation**
What **happens** after the assessment?	**Intervention and Management strategy**

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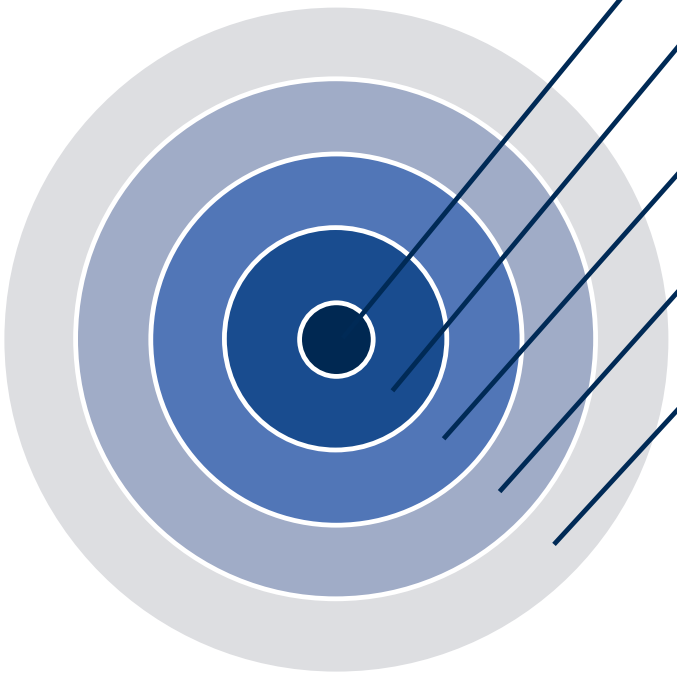
SMART - Layering the Evidence



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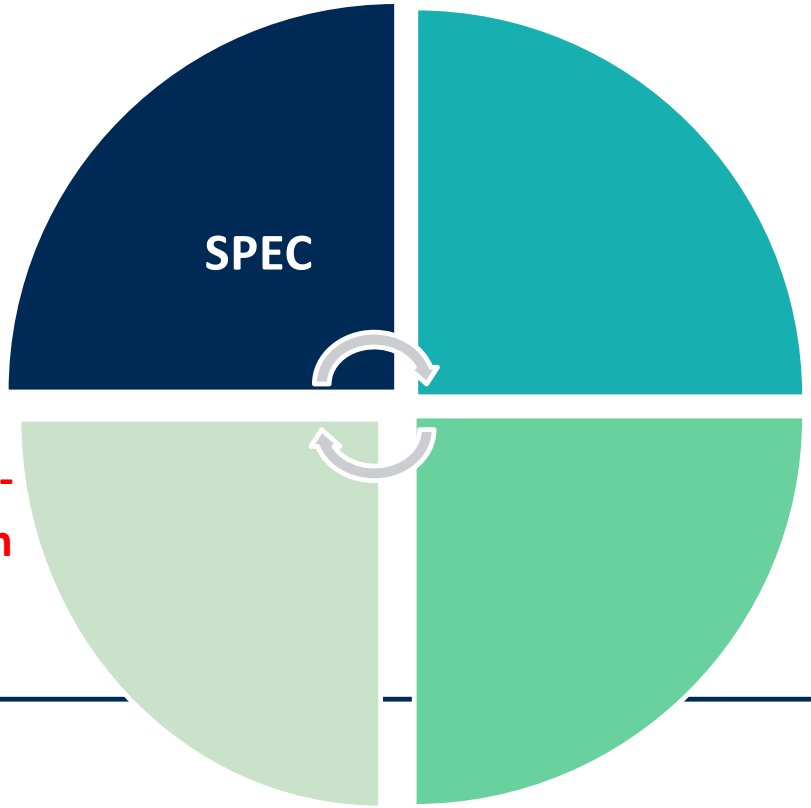
Layering the Evidence – what's new

Red – Unique to SMART, other evidence not gathered by PDOC assessment (only with specialist team)

- Medical Stability
- Medication
- Tone
- Positioning-
- Bed and Wheelchair
- Seating System
- Sitting Tolerance
- Environment
- Pain and Mood
- Impact of all of above -
  - Overall and Per Session



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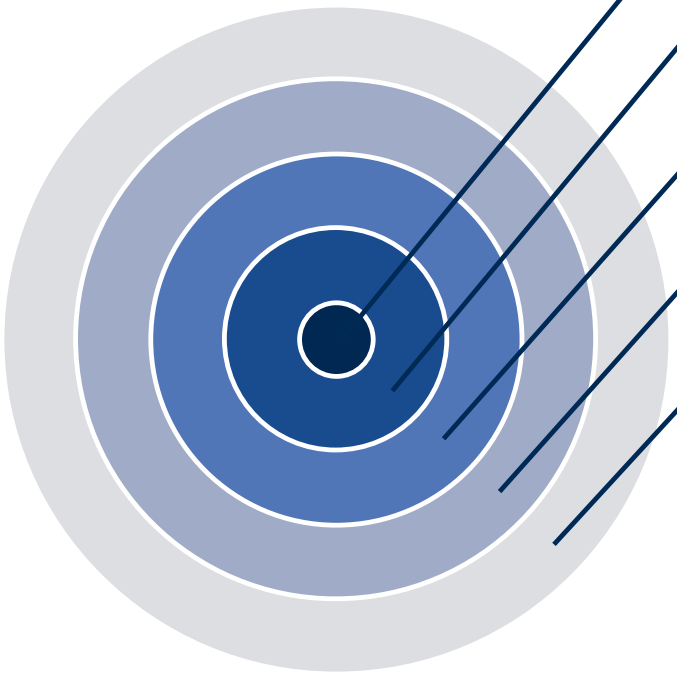
S8 SPEC AUDIT - Formal Evaluation and record of diagnosis of VS or MCS – SPEC Requirements reviewed Adapted from RCP guidelines Annex 2f			
Minimum Requirement	**Met [M] Unmet[U] Review [R]**	**Action Required**	**Action No Table 4 (report)**
MEDICAL MANAGEMENT General Medical Condition has been stabilised as far as possible			
Medically Stable Free from sepsis and other serious illness affecting consciousness			
Medications – reviewed to minimise sedations			
Clinical examination Of sensory pathways has been undertaken			
Imaging/Investigations As appropriate to eliminate			
SPECALIST MANAGEMENT PROGRAMME			
TONE Active spasticity management in place, including medication			

SMART - Layering the Evidence



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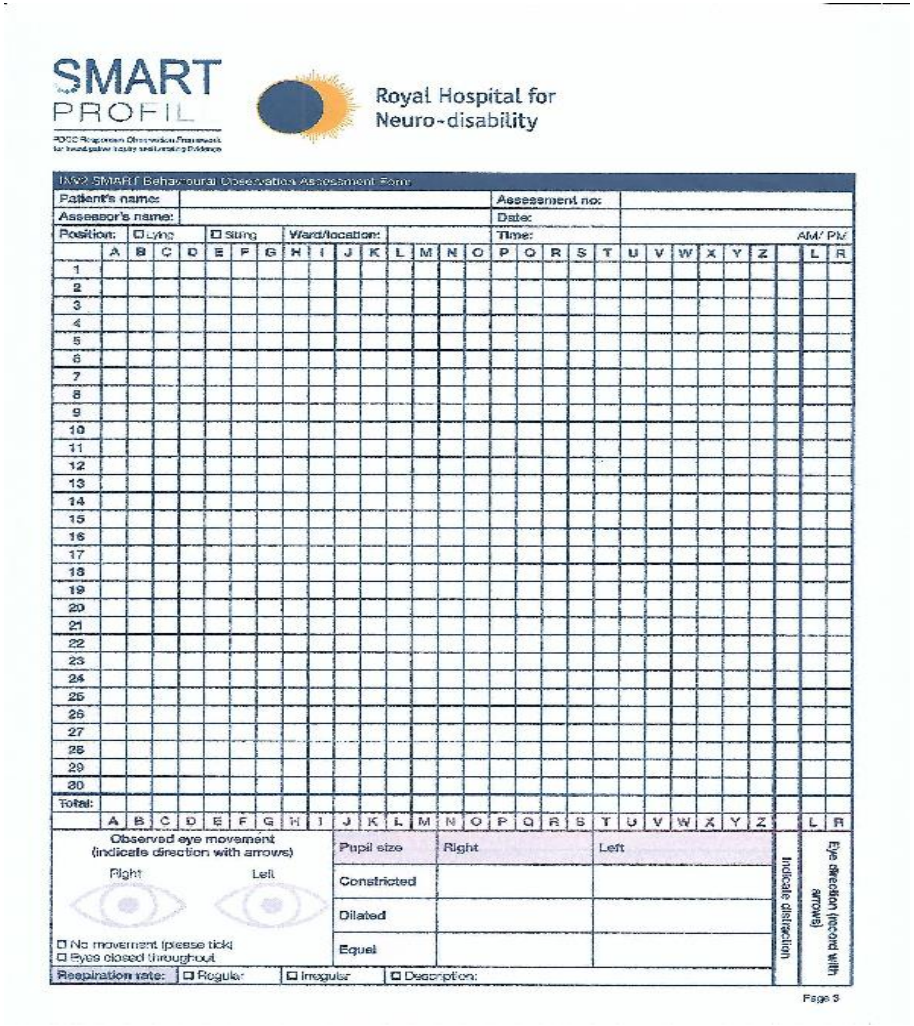
Eye movement per episode



SMART PROFIL

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IWA SMART Behavioural Observation Assessment Form

Patient's name:															Assessment no:														
Assessor's name:															Date:														
Position:	☐ Lying			☐ Sitting			Ward/location:								Time:													AM/ PM	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z		L	R
1																													
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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z		L	R

Observed eye movement (indicate direction with arrows)	Pupil size	Right	Left
Right / Left	Constricted		
	Dilated		
☐ No movement (please tick) ☐ Eyes closed throughout	Equal		

Indicate distraction

Eye direction (record with arrows)

Respiration rate: ☐ Regular ☐ Irregular ☐ Description:

Page 3

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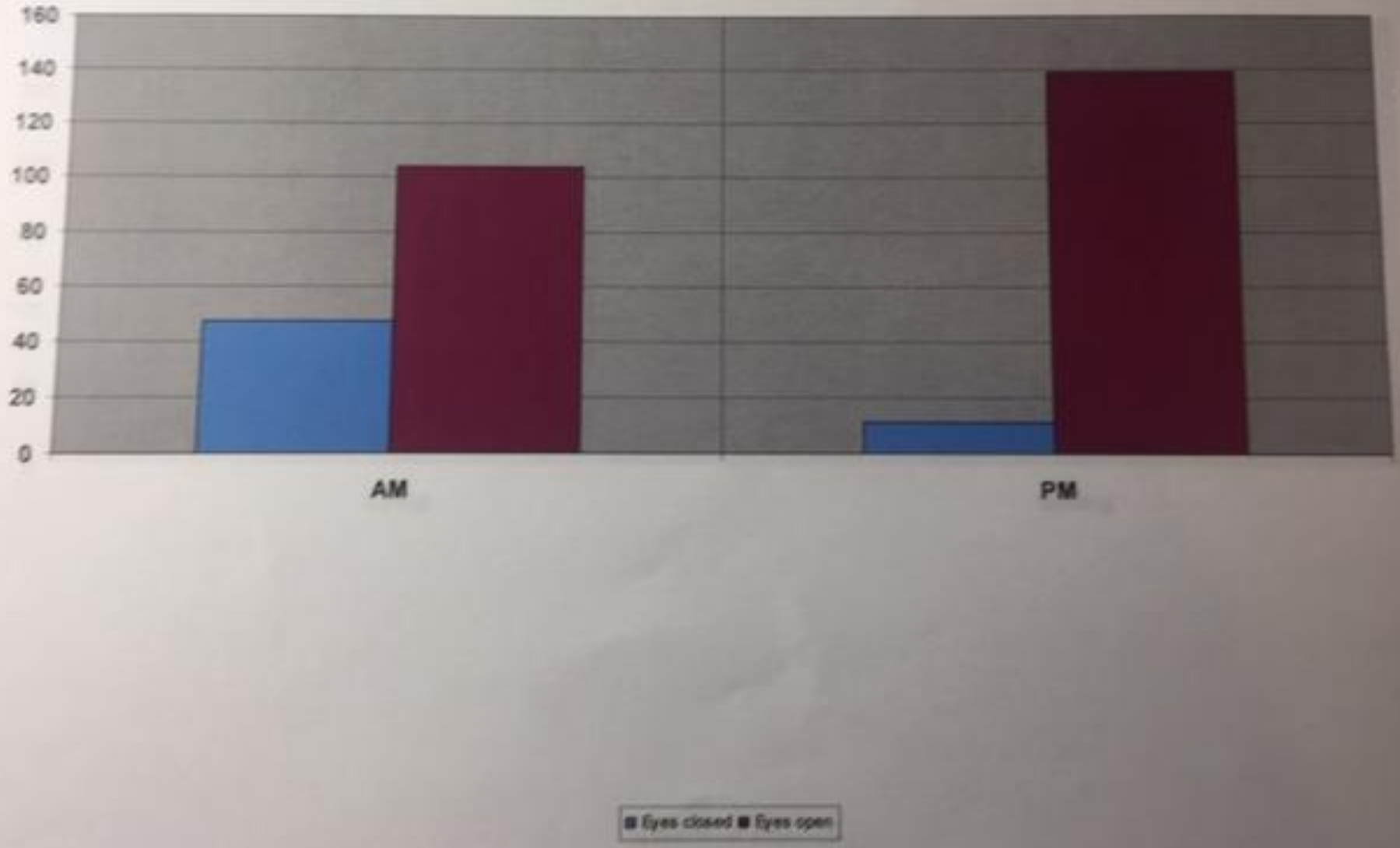
Behavioural Observation Assessment – creating a behavioural profile

Behaviour	Total Observations	Not categorised	Purposeful	Reflexive	Spontaneous	AM	PM	Lying	Sitting	AM Lying	AM Sitting	PM Lying	PM Sitting
Eyes closed	34	34				34			34		34		
Eyes open	266	266				116	150	60	206		116	60	90
No movement	50	50				41	9	8	42		41	8	1
Head ext up and left	24				24	6	18	5	19		6	5	13
Tongue protusion	154			154		59	95	18	136		59	18	77
Mouth open close	137			137		54	83	29	108		54	29	54
Neck flexion	7				7	1	6	3	4		1	3	3
slight eyebrows raise	58				58	31	27	10	48		31	10	17
Eyes widen	11				11	4	7	1	10		4	1	6
Deep exhale	2			2			2		2				2
chin up and down	1				1		1		1				1
flicker of eyelashes	12			12		8	4	1	11		8	1	3
slight flexion right elbow	4			4		1	3		4		1		3
slight scowl	13				13	7	6	5	8		7	5	1
flexion left and right upper limbs	18			18		4	14	5	13		4	5	9
slight flex left elbow	13			13		8	5		13		8		5
slight lip pursing	1			1		1			1		1		
head right to further right	5				5	3	2	2	3		3	2	
left toes movement	15			15		7	8	3	12		7	3	5
right toes movement	16			16		8	8	3	13		8	3	5
cough	3			3		1	2	2	1		1	2	
mouth widen	7				7	2	5	1	6		2	1	4
lip pursing	3			3			3	3				3	
swallow	1			1			1	1				1	
head right to midline	11				11	1	10	1	10		1	1	9
sigh	2			2		1	1		2		1		1
AA													
AB													
AC													
AD													
AE													
AF													

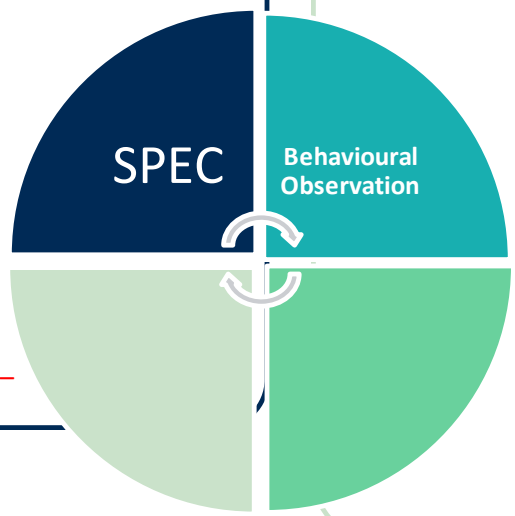
Case Study 2 - Total Eye states analysed by Time in Assessment 1



SMART - Layering the Evidence

Red – exclusive to SMART

- Impact of -
- Medical Stability, Medication,
- Tone,
- Positioning-
- Bed and Chair,
- Seating System,
- Sitting Tolerance
- Environment
- Pain and Mood
- Impact of all of above – Overall and Per Session



- **Behaviours**
- **Type of Behaviours– Reflexive, Spontaneous, Purposeful at Rest**
- **Frequency of behaviours – no/%**
- **Frequency of No movement no/%,**
- **Behavioural Groups**
- **Eye Opening**
- **Frequency of eye opening**
- **Eye movement patterns over time**
- **Eye opening versus am/pm, positioning**
- **Type and Frequency of Behaviours versus**
- **Am/pm positioning**
- **Total behaviours over 10 sessions and per session to identify patterns and influencing factors**

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Case Study 1
SMART Behavioural Observation

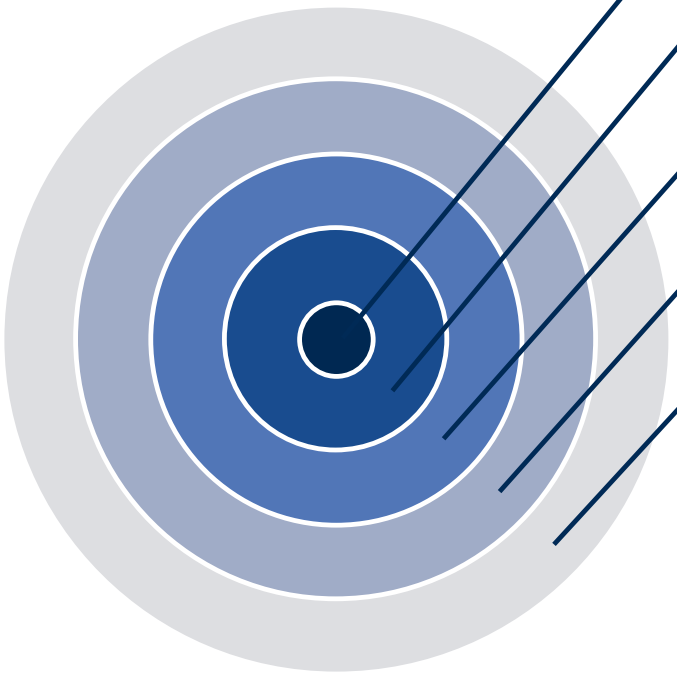
- Family strongly opposing CANH – cared for many years at home
- Now on ITU Unit – Intensivist applied for withdrawal CANH
- SMART conducted and videos taken of all behavioural observations and the family observations sessions were carefully explored.
- Family reported visual localisation to interaction on left then right
- Behavioural Observations videos and time with family revealed:

  - **Eye movement pattern at rest noted eye movement pattern sustained to left for 2 minutes, then up and over to right for 2 minutes then repeated.**

- On day of court the family withdrew their opposition

Brother spoke positively in court about SMART process and its careful exploration of family beliefs and views

SMART - Layering the Evidence



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Sensory Modality Assessment Rehabilitation Technique

Formal Sensory Assessment
Changes to Format

Reasons

- SALT involvement in constructing instructions and communicative cues
- To provide a variety of prompts to optimise patient responses
- Avoiding unnecessary assessment- formalising practice
- Keep assessment shorter where indicated
- Client centred – including familiar stimuli
- Enabling assessor to use clinical skills to explore higher level responses
- Core and Advanced Techniques
- Framework for emergence requested

PROGRESSION

Core techniques			Advanced Techniques	
Visual Modality				
6	Visual Fixation	visual fixation visual localisation which has clearly been reproduced on two occasions.	A1	Following written instruction Differentiation of Visual stimuli (verbal/written)
7	Visual tracking with verbal instruction		A2	
8	Visual tracking of a person		A3	Use of A/F switch (written)
Auditory Modality				
12	A/F switch with verbal instructions	Individual presses AF switch minimum of 4/5 > 1 session.	A4	Use of A/F switch for yes/no
Tactile Modality				
14 15	Light touch OR Shoulder tap	An ability to indicate yes/no and a reproducible response to tactile core technique, at a localising level	A5	Differentiation of tactile stimuli
Gustatory Modality				
		All requirements for this modality are achieved see Gustatory section	A5	Gustatory stimuli technique

Formal Sensory Assessment Changes to Profile

Reasons for changes to profile

- All MCS no change to indicative diagnosis or standardised validated assessment BUT

- Allows for clinical subdivision to:
  - locate on a spectrum - current thinking re diagnosis
  - Look at durability and reproducibility
  - Guide targeted intervention
  - Measuring changes and more sensitive changes in trajectory

SMART Levels and Indicative Diagnosis

SMART Level	Indicative Diagnosis
1	VS
2	
3	
4	MCS-
5 Lower	MCS+ Lower
5 Mid	MCS+ Mid
5Upper	MCS+ Upper
6	Emergent MCS

c

SMART Level		Criteria	Motor function/functional motor	Functional communication
1	VS	No response	No response	No response
2		Reflexive	Reflexive	Reflexive non-meaningful facial expression
3		Reflexive withdrawal responses to stimuli **OR** Non-meaningful spontaneous responses	Withdrawal **OR** Non-meaningful spontaneous responses	Reflexive non-meaningful facial expression, non-meaningful vocalisation to stimuli, and so on
4	MCS-	Localises to stimuli or meaningful spontaneous responses **OR** Communicative responses to specific stimuli but not to instruction/cue/prompt	**Motor function** ➢Localises, visual fixation, pursuit; ➢Body part towards stimulus; ➢For example, meaningful, spontaneous brushes hair out of eyes (often repetitive). **Functional motor** ➢Active movement within guided activity felt with facilitation; ➢Unable to complete any aspect of task; ➢Unable to initiate task; ➢Manipulates form.	Communicative facial expression or meaningful vocalisation in context or to specific technique or stimuli Intelligible verbalisation. Lacks meaning or not in context
5 Lower	MCS+ Lower	Responds appropriately directly to the type of stimulus ,interacting with stimuli, not to verbal, written instruction or cues	**Motor function** Cause-and-effect, copying Presses the auditory feedback switch/iPad but does not follow direct instruction **Functional motor** Completes simple functional task without instruction, for example, removes sock, adjusts hat, removes glasses, but not to instruction	Copies facial expression, gestures, words **OR** uses automatic speech to finish phrase, **OR** verbally responds appropriately to stimuli, for example, "go away" in response to having an injection
5 Mid	MCS+ Mid	Following visual, verbal instruction, tactile cues or discriminates *(Telling the client to …)*	Follows instruction/cue or discriminates	Demonstrates "Yes" and/or "No" but cannot functionally answer questions when asked
5 Upper	MCS+ Upper	Demonstrates one of the following: choice-making/matched pairs/functional use of an object Demonstrates "Yes/No" but **does not** meet the RCP criteria. *(Asking the client to …)*	**Motor function** Choice-making/matches, but **does not** meet RCP criteria for emergence **Functional Motor** ➢Use of object, that is, pen But **does not** meet the RCP criteria	Uses gesture or other methods of output (see output options) to make needs known. Makes choices or indicates "Yes/No" (see output options). Answers questions to situational and/or autobiographical questions But **does not** meet the RCP criteria.
6	MCS emerged	**Meets the RCP guidelines** for emergence from MCS by demonstrating the required number of correct responses with one or more of the following:	**Motor function** Choice-making/matches, but **does** meet the RCP criteria for emergence	Uses gesture or other methods of output (see output options) to make needs known. Makes choices or indicates "Yes/No" (see output options). Answers questions to situational and/or

SMART Categories of Frequency and Durability of Response

HI

- **Highest Inconsistent Responses**
- Relevant responses observed in the modality that occurs on 1-4 sessions over assessment stage. (1 is unverified)

FI

- **Frequent Inconsistent response**
- A response that occurs 5 times or more but not consecutively

C

- **Consistent response**
- A consistent response occurring in at least 5 consecutive assessment sessions

SMART Profile - new

Can be applied to all sensory modalities for both Motor and Functional Communication Level 6 not validated

Table 7: SMART Level and Frequency and associated indicative diagnosis

Indicative diagnosis	VS							MCS									Emergent MCS
								MCS–			MCS+ lower			MCS+ mid			MCS+ upper			
SMART Level	1	2HI	2FI	2C	3HI	3FI	3C	4HI	4FI	4C	5HI	5FI	5C	5HI	5FI	5C	5HI	5FI	5C	6

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COMPARISONS

Review highest motor and functional communitive responses over 10 sessions

AN7 Sensory Framework SMART Trajectory Profile (STP) per Session and Final Indicative Diagnosis																								
	Session	1		2		3		4		5		6		7		8		9		10		Indicative diagnosis		
Indicative Diagnosis	SMART Profile	M	FC	M	FC	M	FC	M	FC	M	FC	M	FC	M	FC	M	FC	M	FC	M	FC	M	FC	STPS
MCS Emergent	6																							20
MCS+ Upper	5 Upper C																							19
	5 Upper FI																							18
	5 Upper HI																							17
MCS+ Mid	5 Mid C																							16
	5 Mid FI																			x		x		15
	5Mid HI									x				x		x								14
MCS+ Lower	5 Lower C																							13
	5 Lower FI																							12
	5 Lower HI																							11
MCS-	4C											x						x						10
	4FI																				x		x	9
	4HI	x		x		x		x					X		x		x		x					8
VS	3C																							7
	3FI																							6
	3HI										x													5
	2C																							4
	2FI																							3
	2HI		x		x		x		x															2
	1																							1

PDOC: A response to a “critical review of the new RCP guidelines”

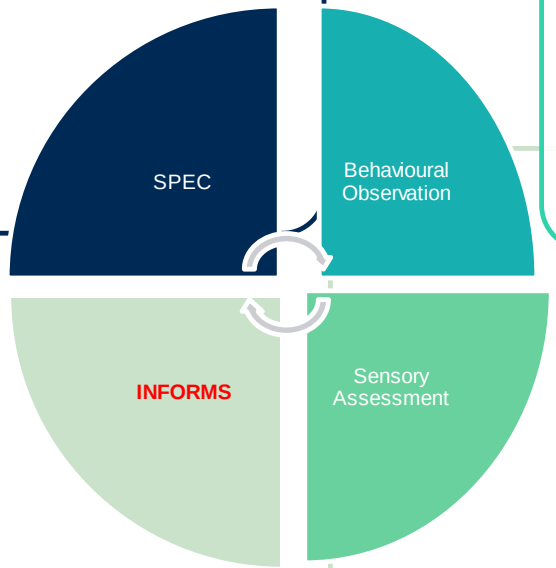
The UK marked contrast to USA

- Recognise that PDOC may “demonstrate a trajectory towards improved awareness”
- “One reason for using the term PDOC is that clinicians who work in this field understand that levels of consciousness form a spectrum”.

Wade, Turner –Stokes et al 2022

Layering the evidence Red – exclusive to SMART

- Impact of Medical Stability, Medication,
- Tone,
- Positioning-
- Bed and Chair,
- Seating System,
- Sitting Tolerance
- Environment
- Pain and Mood
- Impact of all of above
- –Overall and Per Session



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- Frequency of eye opening
- Eye movement patterns over time
- Eye opening versus am/pm, positioning
- Type and Frequency of Behaviours versus
- Am/pm positioning
- **Total behaviours over 10 sessions** and per session to identify patterns and influencing factors

- **Diagnosis of VS, MCS-, MCS+ Lower Mid, Upper**
- **Evidence of Emergence**
- **Per Modality and**
- **Per Motor and Functional Communication**
- **Identified Unverified Responses**
- **Frequency and Durability of Responses**

Optional Non- Standardised elements of SMART - Investigating for further evidence

➢ Formal Observation

Observation of meaningful responses reported from family and team

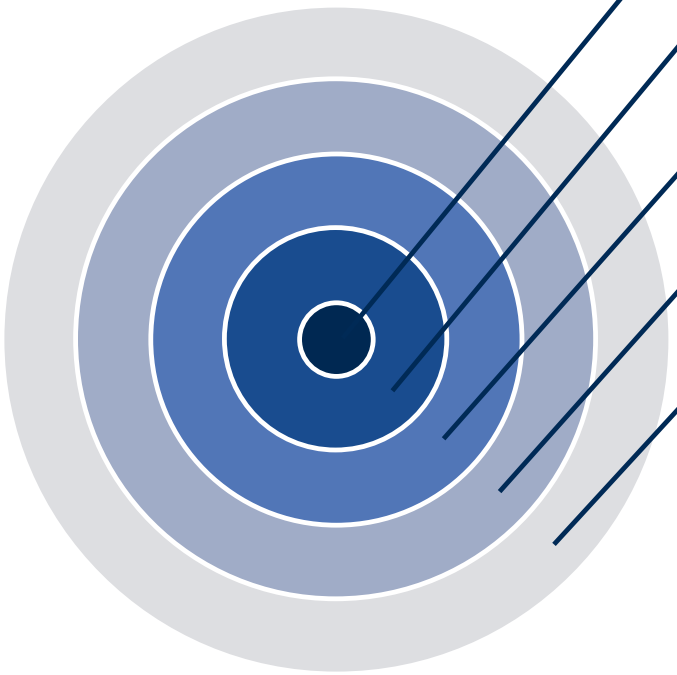
➢ SMART Functional Exploration Techniques

- F1 Copying movements
- F2 Copying functional use of an object
- F3 Differentiation between sounds
- F4 Response to Humorous stimuli
- F5 Cause and Effect

➢ Emergence Techniques

Exploring RCP parameters for Motor and Communication

SMART - Layering the Evidence



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Informs Changes

Reasons

- Elicit information from team and family before commencement of SMART not after the assessment
- Target key information about the individual that can be shared amongst team to prevent duplication for family
- Assists in shaping daily programme and familiar stimuli

Comparison of Formal SMART and INFORMAL

Table 3: SMART Profile Summary

Category	VS									MCS													Highest-level response	Modality diagnostic classification
										MCS–			MCS+ lower			MCS+ mid			MCS+ upper			MCS emergent		
SMART Level	1HI	1FI	1C	2HI	2FI	2C	3HI	3FI	3C	4HI	4FI	4C	5HI	5FI	5C	5HI	5FI	5C	5HI	5FI	5C	6		
Diagnosis equivalent on Admission	F						M																3HI	VS
SMART Formal Assessment: Verified and Unverified Response																								
Motor function																				M			5 Upper FI	MCS+ Upper
Functional communication										F													4HI	MCS-
Unverified Observations from Family/Carers/MDT																								
Motor function unverified											M												[4FI]	[MCS-]
Functional communication unverified												F											[4C]	[MCS-]

Orientation to the Report template sections

Summary, Analysis and recommendations;

1. SPEC
2. Behavioral Observations
3. Formal Sensory Assessment
4. Informs
5. Comparison to previous SMART assessment*
6. Further formal investigative inquiries
7. Indicative diagnosis & SMART Profile
8. Further investigation & intervention plan & management strategy
9. Tables

PDOC Assessment or Investigation

What is required by the stakeholder?

Gathering the Evidence

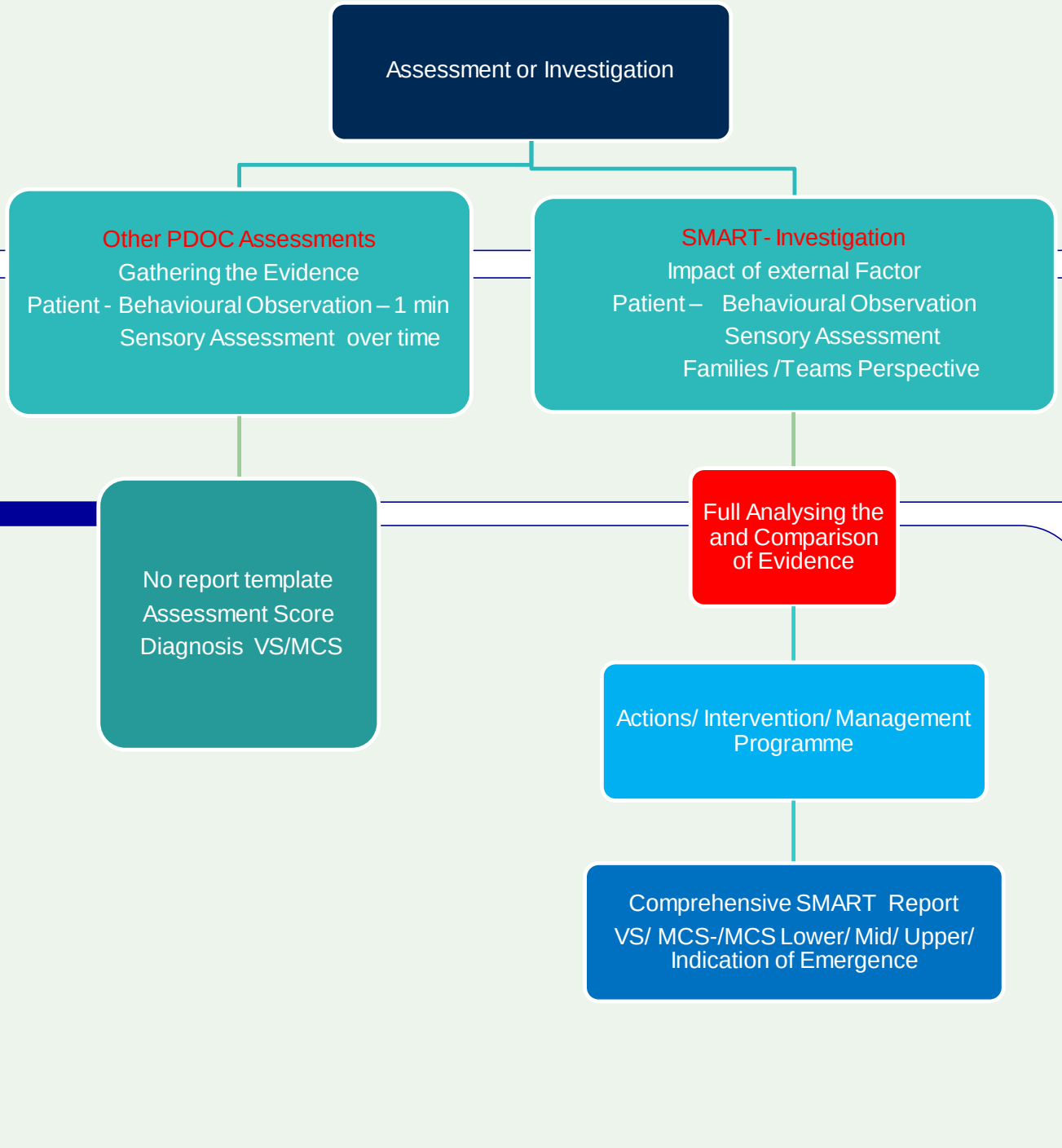
What does it find?

Outcome of Assessment/Investigation

CRS - Present what evidence is found or

SMART- Presents evidence, investigates and analyses further and provides plan?

What does the Information tell us?



PDOC: A response to a “critical review of the new RCP guidelines”

“The CRS is a wonderful simple tool but does not replace detailed clinical evaluation by experts assessing consciousness”.

Wade, Turner –Stokes et al 2022

SMART- Evidence Based Practice

1. Accuracy of Assessment, Skilled Assessor

Godbolt et al (2012)

2. Prognostic Value of SMART Behavioural Observation

Teixeira et al (2016)

3. Diagnostic Frequency

Teixeira et al (2021)

4. Use of 2 assessments – SMART/WHIM preferred

- DeLargy et al (2013)
- McAleese et al (2016)
- Morrissey A, Gill-Thwaites et al (2018)

5. Rasch Analysis -Seel paper

Tennant Gill-Thwaites (2018)

PDOC: A response to a "critical review of the new RCP guidelines"

- "The USA and European guidelines recommend clinical diagnosis on CRS. In contrast the UK support using three validated tools: the CRS, the WHIM and the more detailed SMART which complement each other."

SMART

An Innovation from RHN

SMART Course

Course run in collaboration with Gill- Thwaites & Elliott Consultants

- **SMART Assessor Course**
- **PDOC Observer and Facilitator Course**

SMART Assessments

- **SMART Assessor List or Recommended Assessors**

Gill-Thwaites & Elliott Consultants
Specialists in Disorders of Consciousness

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