Cognitive Processes and Decision Making in Healthcare

Potential areas of interest

- Patient decision making: Risk assessment/risk translation
- Team-level cognitive processes in healthcare
- Telemedicine: Supporting distributed work
- The design of resilient systems in healthcare
- Medical error:
  Individual, team, organizational and technological factors
- Medical decision making:
  Human-centered design of tools to support diagnosis and treatment
- Healthcare information systems:
  Tracking for early detection and prevention and for continuous improvement of practices and procedures

Cognitive Processes and Decision Making in Healthcare

Presentations

Nancy Cooke: Team-level cognitive processes

Bill Marras and Phil Smith: Human-centered design of decision support systems to enhance medical decision making

Debbie Boehm-Davis: Analysis techniques for gaining insights into medical error

Tom Sheridan: Human-system integration issues in telesurgery

Cognitive Processes and Decision Making in Healthcare

Medical Decision Making:
Human-centered design of tools to support diagnosis and treatment

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- Example 1. Quantification of low back pain
- Example 2. Interactive critiquing systems
  (immunohematology)

Cognitive Processes and Decision Making in Healthcare

Interactive critiquing systems (immunohematology)

Highlight | Ruled Out | Unlikely | Likely | Confirmed

	Donor				Rh-	hr					MN	Ss		P	Lewis		Luth'r			Kell			Duffy		Kidd			Special Type		Test	Methods			
		D	C	E	c	e	f	V	C^w	M	N	S	s	P_1	Le^3	Le^b	Lu^3	Lu^b	K	k	Kp^3	Js^3	Fy^3	Fy^b	Jk^3	Jk^b	Xg^3		IS	LISS	IgG	RT	4°	
1	A478	0	0	0	+	+	0	0	0	+	+	0	+	+	0	+	0	+	+	+	0	0	0	+	0	+	+		0	0	0			1
2	B102	0	0	0	+	+	0	0	0	+	+	0	+	+	+	0	0	+	0	+	0	0	+	0	+	+	+		2+	0	2+			2
3	C559	0	0	0	+	+	0	0	0	+	0	+	0	+	0	+	0	+	+	+	0	0	+	0	+	0	+		0	0	2+			3
4	D275	0	+	0	+	+	0	0	0	+	+	+	+	0	0	0	0	+	0	+	0	0	0	+	+	+	+		0	0	0			4
5	E164	0	0	+	+	+	0	0	0	0	+	0	+	+	+	0	0	+	0	+	0	0	0	+	+	0	+		2+	0	0			5
6	F065	+	+	0	0	+	0	0	0	+	0	+	+	+	0	+	0	+	0	+	0	0	+	0	+	+	0		0	0	2+			6
7	G163	+	0	0	+	+	0	0	0	+	+	+	0	+	+	0	0	+	0	+	0	0	0	0	+	+	+		2+	0	0			7
8	H168	+	0	+	+	0	0	0	0	0	+	0	+	+	0	+	0	+	0	+	0	0	+	0	0	+	+		0	0	2+			8
9	R331	+	+	+	0	+	0	0	0	+	+	0	+	0	0	+	0	+	0	+	0	0	+	+	+	+	+		0	0	1+			9
10	A624	+	0	0	+	+	0	0	0	+	+	0	+	+	0	0	0	+	0	+	0	0	0	0	+	0	+		0	0	0			10
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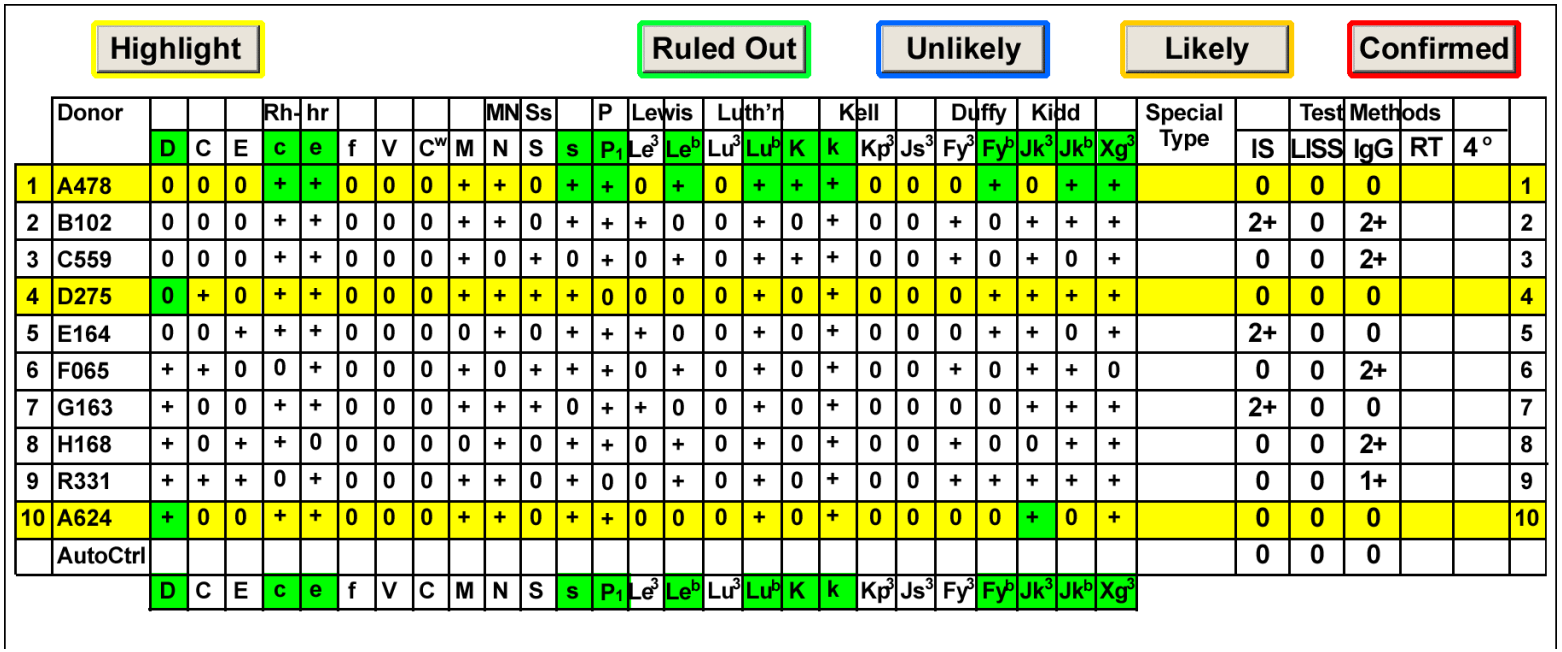
		D	C	E	c	e	f	V	C	M	N	S	s	P_1	Le^3	Le^b	Lu^3	Lu^b	K	k	Kp^3	Js^3	Fy^3	Fy^b	Jk^3	Jk^b	Xg^3							

For details see Smith, P.J., Geddes, N. and Beatty, R. (2008). Human-centered design of decision support systems. In A. Sears and J. Jacko (eds.), Handbook of Human-Computer Interaction, 2nd Edition. Mahwah, NJ: Lawrence Erlbaum Associates.

Cognitive Processes and Decision Making in Healthcare

Challenges

- Abduction
- Multiple solution problems
- Masking
- Noisy Data
- Time Stress (sometimes)
- Limited practice and feedback



	Donor				Rh-	hr					MN	Ss		P	Lewis		Luth'n			Kell		Duffy		Kidd			Special Type		Test	Methods			
		D	C	E	c	e	f	V	C^w	M	N	S	s	P_1	Le^3	Le^b	Lu^3	Lu^b	K	k	Kp^3	Js^3	Fy^3	Fy^b	Jk^3	Jk^b	Xg^3		IS	LISS	IgG	RT	4°	
1	A478	0	0	0	+	+	0	0	0	+	+	0	+	+	0	+	0	+	+	+	0	0	0	+	0	+	+		0	0	0			1
2	B102	0	0	0	+	+	0	0	0	+	+	0	+	+	+	0	0	+	0	+	0	0	+	0	+	+	+		2+	0	2+			2
3	C559	0	0	0	+	+	0	0	0	+	0	+	0	+	0	+	0	+	+	+	0	0	+	0	+	0	+		0	0	2+			3
4	D275	0	+	0	+	+	0	0	0	+	+	+	+	0	0	0	0	+	0	+	0	0	0	+	+	+	+		0	0	0			4
5	E164	0	0	+	+	+	0	0	0	0	+	0	+	+	+	0	0	+	0	+	0	0	0	+	+	0	+		2+	0	0			5
6	F065	+	+	0	0	+	0	0	0	+	0	+	+	+	0	+	0	+	0	+	0	0	+	0	+	+	0		0	0	2+			6
7	G163	+	0	0	+	+	0	0	0	+	+	+	0	+	+	0	0	+	0	+	0	0	0	0	+	+	+		2+	0	0			7
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10	A624	+	0	0	+	+	0	0	0	+	+	0	+	+	0	0	0	+	0	+	0	0	0	0	+	0	+		0	0	0			10
	AutoCtrl																												0	0	0			
		D	C	E	c	e	f	V	C	M	N	S	s	P_1	Le^3	Le^b	Lu^3	Lu^b	K	k	Kp^3	Js^3	Fy^3	Fy^b	Jk^3	Jk^b	Xg^3							

Cognitive Processes and Decision Making in Healthcare

Process Errors

- Slips
- Incorrect knowledge/poor strategies
- Cognitive biases
  - biased assimilation
  - ignoring base rates
- Perceptual distortions

Highlight | Ruled Out | Unlikely | Likely | Confirmed

	Donor				Rh-	hr					MN	Ss		P	Lewis		Luth'n			Kell			Duffy		Kidd			Special Type		Test Methods			
		D	C	E	c	e	f	V	C^w	M	N	S	s	P_1	Le^3	Le^b	Lu^3	Lu^b	K	k	Kp^3	Js^3	Fy^3	Fy^b	Jk^3	Jk^b	Xg^3		IS	LISS	IgG	RT	4°	
1	A478	0	0	0	+	+	0	0	0	+	+	0	+	+	0	+	0	+	+	+	0	0	0	+	0	+	+		0	0	0			1
2	B102	0	0	0	+	+	0	0	0	+	+	0	+	+	+	0	0	+	0	+	0	0	+	0	+	+	+		2+	0	2+			2
3	C559	0	0	0	+	+	0	0	0	+	0	+	0	+	0	+	0	+	+	+	0	0	+	0	+	0	+		0	0	2+			3
4	D275	0	+	0	+	+	0	0	0	+	+	+	+	0	0	0	0	+	0	+	0	0	0	+	+	+	+		0	0	0			4
5	E164	0	0	+	+	+	0	0	0	0	+	0	+	+	+	0	0	+	0	+	0	0	0	+	+	0	+		2+	0	0			5
6	F065	+	+	0	0	+	0	0	0	+	0	+	+	+	0	+	0	+	0	+	0	0	+	0	+	+	0		0	0	2+			6
7	G163	+	0	0	+	+	0	0	0	+	+	+	0	+	+	0	0	+	0	+	0	0	0	0	+	+	+		2+	0	0			7
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10	A624	+	0	0	+	+	0	0	0	+	+	0	+	+	0	0	0	+	0	+	0	0	0	0	+	0	+		0	0	0			10
	AutoCtrl																												0	0	0			
		D	C	E	c	e	f	V	C	M	N	S	s	P_1	Le^3	Le^b	Lu^3	Lu^b	K	k	Kp^3	Js^3	Fy^3	Fy^b	Jk^3	Jk^b	Xg^3							

Cognitive Processes and Decision Making in Healthcare

Expertise

- Hypothesis generation
  - specific antibodies
  - number of antibodies
- Test interpretation
- Hypothesis testing
- Overall protocol (collecting converging evidence)

Highlight | Ruled Out | Unlikely | Likely | Confirmed

	Donor				Rh-	hr					MN	Ss		P	Lewis		Luth'n		Kell			Duffy		Kidd			Special Type		Test	Methods			
		D	C	E	c	e	f	V	C^w	M	N	S	s	P_1	Le^3	Le^b	Lu^3	Lu^b	K	k	Kp^3	Js^3	Fy^3	Fy^b	Jk^3	Jk^b	Xg^3		IS	LISS	IgG	RT	4°	
1	A478	0	0	0	+	+	0	0	0	+	+	0	+	+	0	+	0	+	+	+	0	0	0	+	0	+	+		0	0	0			1
2	B102	0	0	0	+	+	0	0	0	+	+	0	+	+	+	0	0	+	0	+	0	0	+	0	+	+	+		2+	0	2+			2
3	C559	0	0	0	+	+	0	0	0	+	0	+	0	+	0	+	0	+	+	+	0	0	+	0	+	0	+		0	0	2+			3
4	D275	0	+	0	+	+	0	0	0	+	+	+	+	0	0	0	0	+	0	+	0	0	0	+	+	+	+		0	0	0			4
5	E164	0	0	+	+	+	0	0	0	0	+	0	+	+	+	0	0	+	0	+	0	0	0	+	+	0	+		2+	0	0			5
6	F065	+	+	0	0	+	0	0	0	+	0	+	+	+	0	+	0	+	0	+	0	0	+	0	+	+	0		0	0	2+			6
7	G163	+	0	0	+	+	0	0	0	+	+	+	0	+	+	0	0	+	0	+	0	0	0	0	+	+	+		2+	0	0			7
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9	R331	+	+	+	0	+	0	0	0	+	+	0	+	0	0	+	0	+	0	+	0	0	+	+	+	+	+		0	0	1+			9
10	A624	+	0	0	+	+	0	0	0	+	+	0	+	+	0	0	0	+	0	+	0	0	0	0	+	0	+		0	0	0			10
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		D	C	E	c	e	f	V	C	M	N	S	s	P_1	Le^3	Le^b	Lu^3	Lu^b	K	k	Kp^3	Js^3	Fy^3	Fy^b	Jk^3	Jk^b	Xg^3							

Cognitive Processes and Decision Making in Healthcare

Design (modeled after human error detector)

- Critiquing system with underlying expert model and feedback
  - Continuous context sensitive monitoring
  - Overall protocol (collecting converging evidence)
  - Metaknowledge
  - Unobtrusive data collection
  - Perceptual aids
  - Memory aids

Highlight | Ruled Out | Unlikely | Likely | Confirmed

	Donor				Rh-	hr					MN	Ss		P	Lewis			Luth'n			Kell			Duffy		Kidd			Special Type		Test Methods				
		D	C	E	c	e	f	V	C^w	M	N	S	s	P_1	Le^3	Le^b	Lu^3	Lu^b	K	k	Kp^3	Js^3	Fy^3	Fy^b	Jk^3	Jk^b	Xg^3		IS	LISS	IgG	RT	4°	
1	A478	0	0	0	+	+	0	0	0	+	+	0	+	+	0	+	0	+	+	+	0	0	0	+	0	+	+		0	0	0			1
2	B102	0	0	0	+	+	0	0	0	+	+	0	+	+	+	0	0	+	0	+	0	0	+	0	+	+	+		2+	0	2+			2
3	C559	0	0	0	+	+	0	0	0	+	0	+	0	+	0	+	0	+	+	+	0	0	+	0	+	0	+		0	0	2+			3
4	D275	0	+	0	+	+	0	0	0	+	+	+	+	0	0	0	0	+	0	+	0	0	0	+	+	+	+		0	0	0			4
5	E164	0	0	+	+	+	0	0	0	0	+	0	+	+	+	0	0	+	0	+	0	0	0	+	+	0	+		2+	0	0			5
6	F065	+	+	0	0	+	0	0	0	+	0	+	+	+	0	+	0	+	0	+	0	0	+	0	+	+	0		0	0	2+			6
7	G163	+	0	0	+	+	0	0	0	+	+	+	0	+	+	0	0	+	0	+	0	0	0	0	+	+	+		2+	0	0			7
8	H168	+	0	+	+	0	0	0	0	0	+	0	+	+	0	+	0	+	0	+	0	0	+	0	0	+	+		0	0	2+			8
9	R331	+	+	+	0	+	0	0	0	+	+	0	+	0	0	+	0	+	0	+	0	0	+	+	+	+	+		0	0	1+			9
10	A624	+	0	0	+	+	0	0	0	+	+	0	+	+	0	0	0	+	0	+	0	0	0	0	+	0	+		0	0	0			10
	AutoCtrl																												0	0	0			
		D	C	E	c	e	f	V	C	M	N	S	s	P_1	Le^3	Le^b	Lu^3	Lu^b	K	k	Kp^3	Js^3	Fy^3	Fy^b	Jk^3	Jk^b	Xg^3							

Cognitive Processes and Decision Making in Healthcare

Experimental design

- 4 test cases (masking; weak antibody; 3 antibodies)
- 29 practicing blood bankers
- Between subject design
  - Pre-Test Case and first Post-Test Case were matched cases
  - Randomly assignment of theses two cases
  - After solving first Post-Test Case, both groups solved three more c

Highlight | Ruled Out | Unlikely | Likely | Confirmed

	Donor				Rh-	hr					MN	Ss		P	Lewis		Luth'n			Kell			Duffy		Kidd			Special Type		Test Methods				
		D	C	E	c	e	f	V	C^w	M	N	S	s	P_1	Le^3	Le^b	Lu^3	Lu^b	K	k	Kp^3	Js^3	Fy^3	Fy^b	Jk^3	Jk^b	Xg^3		IS	LISS	IgG	RT	4°	
1	A478	0	0	0	+	+	0	0	0	+	+	0	+	+	0	+	0	+	+	+	0	0	0	+	0	+	+		0	0	0			1
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3	C559	0	0	0	+	+	0	0	0	+	0	+	0	+	0	+	0	+	+	+	0	0	+	0	+	0	+		0	0	2+			3
4	D275	0	+	0	+	+	0	0	0	+	+	+	+	0	0	0	0	+	0	+	0	0	0	+	+	+	+		0	0	0			4
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6	F065	+	+	0	0	+	0	0	0	+	0	+	+	+	0	+	0	+	0	+	0	0	+	0	+	+	0		0	0	2+			6
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10	A624	+	0	0	+	+	0	0	0	+	+	0	+	+	0	0	0	+	0	+	0	0	0	0	+	0	+		0	0	0			10
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		D	C	E	c	e	f	V	C	M	N	S	s	P_1	Le^3	Le^b	Lu^3	Lu^b	K	k	Kp^3	Js^3	Fy^3	Fy^b	Jk^3	Jk^b	Xg^3							

Cognitive Processes and Decision Making in Healthcare

Control Group

5/15 (33.3%) wrong
8/16 (50.0%) wrong
6/16 (37.5%) wrong
10/16 (62.5%) wrong

Critiquing Group

0/16 (0.0%) wrong p< .05
3/16 (18.75%) wrong p< .07
0/16 (0.0%) wrong p< .01
0/16 (0.0%) wrong p< .001

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4	D275	0	+	0	+	+	0	0	0	+	+	+	+	0	0	0	0	+	0	+	0	0	0	+	+	+	+		0	0	0			4
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6	F065	+	+	0	0	+	0	0	0	+	0	+	+	+	0	+	0	+	0	+	0	0	+	0	+	+	0		0	0	2+			6
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8	H168	+	0	+	+	0	0	0	0	0	+	0	+	+	0	+	0	+	0	+	0	0	+	0	0	+	+		0	0	2+			8
9	R331	+	+	+	0	+	0	0	0	+	+	0	+	0	0	+	0	+	0	+	0	0	+	+	+	+	+		0	0	1+			9
10	A624	+	0	0	+	+	0	0	0	+	+	0	+	+	0	0	0	+	0	+	0	0	0	0	+	0	+		0	0	0			10
	AutoCtrl																												0	0	0			
		D	C	E	c	e	f	V	C	M	N	S	s	P_1	Le^3	Le^b	Lu^3	Lu^b	K	k	Kp^3	Js^3	Fy^3	Fy^b	Jk^3	Jk^b	Xg^3							

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1	A478	0	0	0	+	+	0	0	0	+	+	0	+	+	0	+	0	+	+	+	0	0	0	+	0	+	+		0	0	0			1
2	B102	0	0	0	+	+	0	0	0	+	+	0	+	+	+	0	0	+	0	+	0	0	+	0	+	+	+		2+	0	2+			2
3	C559	0	0	0	+	+	0	0	0	+	0	+	0	+	0	+	0	+	+	+	0	0	+	0	+	0	+		0	0	2+			3
4	D275	0	+	0	+	+	0	0	0	+	+	+	+	0	0	0	0	+	0	+	0	0	0	+	+	+	+		0	0	0			4
5	E164	0	0	+	+	+	0	0	0	0	+	0	+	+	+	0	0	+	0	+	0	0	0	+	+	0	+		2+	0	0			5
6	F065	+	+	0	0	+	0	0	0	+	0	+	+	+	0	+	0	+	0	+	0	0	+	0	+	+	0		0	0	2+			6
7	G163	+	0	0	+	+	0	0	0	+	+	+	0	+	+	0	0	+	0	+	0	0	0	0	+	+	+		2+	0	0			7
8	H168	+	0	+	+	0	0	0	0	0	+	0	+	+	0	+	0	+	0	+	0	0	+	0	0	+	+		0	0	2+			8
9	R331	+	+	+	0	+	0	0	0	+	+	0	+	0	0	+	0	+	0	+	0	0	+	+	+	+	+		0	0	1+			9
10	A624	+	0	0	+	+	0	0	0	+	+	0	+	+	0	0	0	+	0	+	0	0	0	0	+	0	+		0	0	0			10
	AutoCtrl																												0	0	0			
		D	C	E	c	e	f	V	C	M	N	S	s	P_1	Le^3	Le^b	Lu^3	Lu^b	K	k	Kp^3	Js^3	Fy^3	Fy^b	Jk^3	Jk^b	Xg^3							