APPENDIX

Statistical methods

To generate the weighted category score for each concept we include mentions of all the concepts in the category and the associated links to the category. For example, to calculate a category score for "Patient Understanding" (node 11 in Figure 1), we included mentions of the sub-concepts "see reality" and "competent" as well as expressed relationships between "Patient Understanding" and "Patient History". The relationship between two concepts in our mental model is referred to as a link and is represented by a line connecting two concept categories in Figure 1. Each link has a calculated ratio (termed the relative frequency) consisting of a numerator representing the number of mentions of the link and a denominator generated from a summation of the all the mentioned links and the concept categories as a binary. The numerator represents the connectedness of a concept category. The denominator represents both the extent to which the subject uses the expert model concepts (model saturation) and the connectedness of the categories to each other. A higher number could reflect either greater use of the expert model or a highly connected but focused use of the model. A lower number reflects a more focused use of the model (i.e., a more focused thought process). Each link related to the concept category in question is then summed to create the category score which represents an emphasis of the concept category during the interview. To demonstrate this calculation in detail, we have included the raw data and resulting calculation for the category concept "Patient Preferences" for Subject A14 in Appendix Figure 2.

Appendix Table 1. Debriefing Interview Questions

Section 1: Physician goals when entering the simulation room

"What were your goals when you entered the room?"

Section 2: Thought process at two minutes intervals
(Stopping video playback every 2 minutes and/or at select scripted patient/surrogate statements)

"What is going on? / What are you thinking?"

"Did that change your assessment of the situation?"

Section 3: Intention to intubate patient

"Was there anything about this patient that made you think that you might need to intubate him?"

"What made you think that?"

Section 4: Difference between simulated patient and those with similar prognosis

"Was there anything about this particular patient that might be different from patients with a similar prognosis?"

"What made you think that?"

Section 5: Patient preference for intubation

"Was there anything about this patient that made you think he might not want to be intubated?"

For those who stated that they thought the patient might not want to be intubated:
"At what point did you first think he might not want to be intubated?"

Appendix Table 2. Descriptive interview quotes demonstrating the application of concept categories and sub-concept codes

Concept Category	Concept Category Item	Example text or explanation
Physician evaluation (1)[†]	Reading chart examining patient looking at patient looking at surrogate looking at monitors talking to nurse	Physician would report they were performing the coded behavior
Patient situation (2)	End-of-life	Subject C11: "…he is, you know end-stage, and I am trying to figure out do they sort of want everything done or they don't want anything done, and if they really understand, you know this is probably terminal. I mean definitely terminal, but how they want to sort of proceed from now on."
	Emergency	Subject BX3: "..that this patient seems to be in a crisis, and the crisis could either be averted by going all the way or you allow the patient to have the comfort measures and die peacefully."
	Reversibility	Subject B14: "He's suffering from an irreversible deterioration of his already chronic irreversible condition."
	Imminence	Subject C10: "…I did not address end of life or what their resuscitation preferences were because I was in an acute situation and that is generally not the time to have that discussion. Those discussions should be had when things are relatively stable if possible and the other thing is that, the other reason that may have influenced me not going there is this patient looked hale and hearty really except for his breathing trouble."
Physician action (3)	Admit to ICU No ICU admission Curative therapies Palliative therapies Activate emergency response system Intubated	Physician would report they were performing the coded behavior

	Do not intubate	
Physician perception (4)	Comfort level	Interviewer: [asks if they have discussed end of life care] Subject B14: "It is always difficult to approach…It's not always difficult, well, it is not always difficult, but it's a bit uncomfortable approaching that particularly in the presence of the patient, hence the hesitation."
	Confidence	Subject B29 "…and then again I am worried, am I moving too quickly down this road? That is what I am thinking."
	Own preferences	Subject BX6: "…mainly his problem was acute pneumonic process on top of cancer. Had he been my father I would have intubated him and taken him to the ICU."
Physician goal (5)	Diagnosis	Subject BX2: "Right now I am trying to see what can be the cause of the condition."
	Curative treatment	Subject BX6: "So if I could fix the hypoxemia by giving him oxygen we can then give him volume, then I can raise his blood pressure…"
	Palliative treatment	SubjectB37: "So in my mind the next thing is to control his pain."
	Obtain code status	Subject BX4: "Yeah, um basically just to assess him to see his level of stability and then also to find out what their desires were with regard to end-of-life care and the ultimate measure to which he wanted to be resuscitated because it seemed like he was unstable."
Patient preferences (6)	Explicitly stated	Subject BX6: "So then now I am discussing with them clearly at this point they do not want intubation, they do not want CPR."
	Inferred	Subject B14: "Even that act of coming from the nursing home. Really tells you that they want something done."
Physician explanation (8)	Goal implications	Subject BX13: " I think at this point I just want to just be clear with the wife in terms of the things that we were doing for him, making him comfortable and that they may change how is able to interact with her as well so that she was clear in terms of, even though we were going to be focusing on his comfort that there may be some side effects, I guess to a certain degree or some other consequences for that that would change

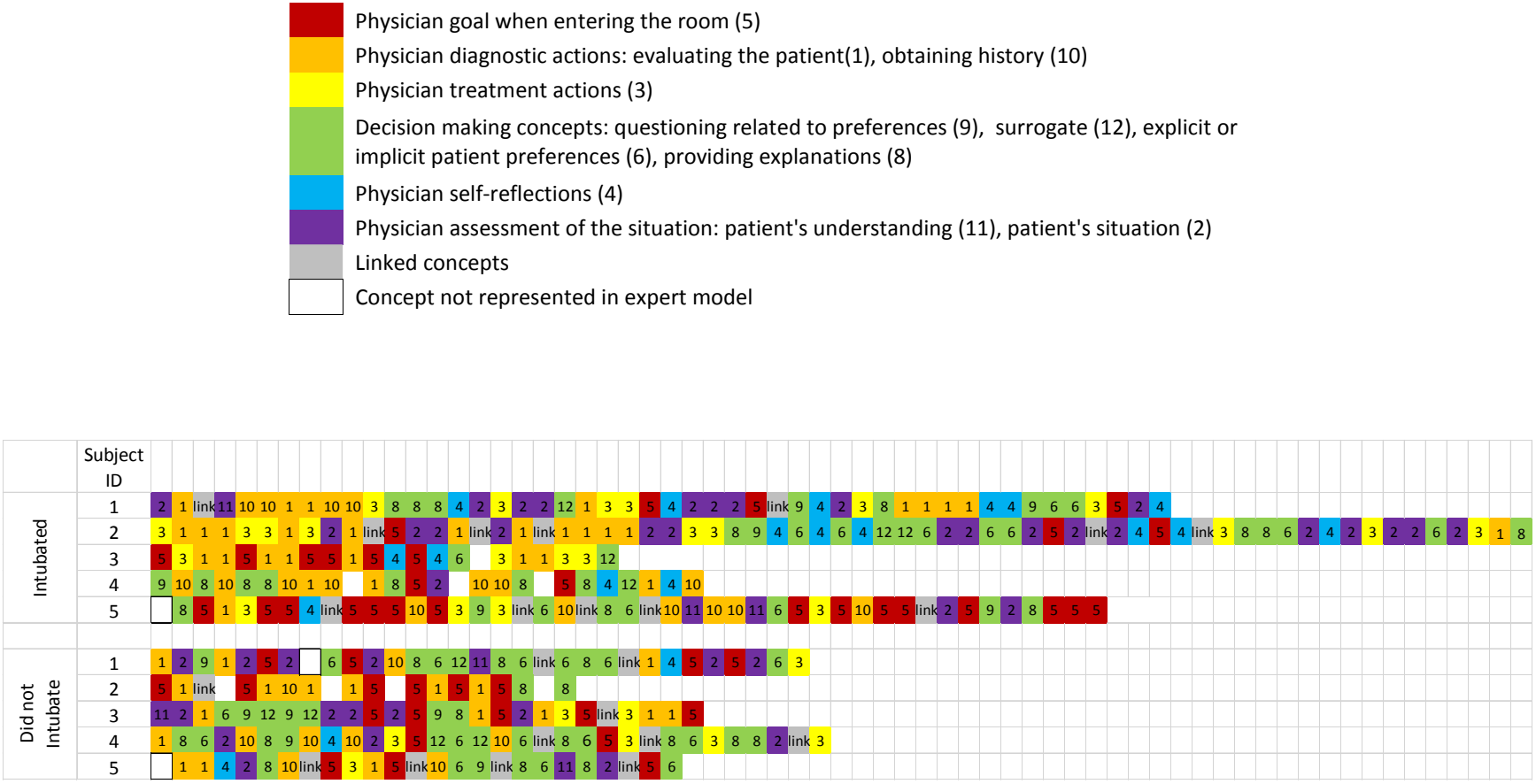
		other parameters of how he was able to interact with her."
	Explain options	Subject B14: "But I can intubate you, I can start pressors, and I can stop them. We can always, and one thing I always make clear to my patients is that all that we are doing we can stop it at any time."
	Empathic reactions	Subject B04: "Sometimes they [surrogates] end up with guilt feelings or did we do the right thing or not do the right thing and I think just a positive reinforcement that they decided that it is, you know, that is what we decided and the doctor to tell them that was the right decision, is much more reassuring than somebody says "Oh, you know what, you should not have done that and your decision was not the right one."
	Explain situation	Subject C19:"…clarifying that basically he is going to die. Making sure that she understood this was imminent and not going to happen necessarily a few days from now…"
	Recommendation	Subject B54: "I think that is where when I was telling them, you know, maybe we should just really focus on the comfort measures now."
Physician questioning (9)	Eliciting goals	Subject BX3: "And so what I was trying to get at was, you know, he will die of his cancer and then so if he has got limited time, how does he want to spend that time, you know, with his family"
	Treatment preferences	Subject BX2: "So, I'm trying to flush out exactly what the discussions had been between the two of them about what the preferences would be since he's, you know, I decided in this instance that having a discussion with him was going to be too difficult and that he'd probably be too hypercarbic and just too short of breath to carry on a meaningful conversation about something this complicated, and so I focused on his immediate surrogate and to see what kind of conversations they had had."
	Asking about support	Subject BX6: "In my experience, I find that the family is very grateful when I start getting the priest and social services involved."
	Eliciting questions	Interviewer: "Now you asked her if she had any questions?" Subject A14: "Yes…Well, you know, we use a lot of jargon and so if there

		are questions about what we think might be wrong or what are the things that we're going to do. People sometimes have questions about whether we think they're going to live."
Patient history (10)	From chart	Subject BCX5: "The chart did tip me that the CAT scan was indicative of lymphangitic spread of the tumor in multiple areas of the lung."
	From questioning	Subject A21: And the reason I asked him if he has been in the ICU before and been intubated is patients who have been through that experience they are more likely to be willing to do it again and if that experience was a very negative one and they have made a very clear decision against it, they make it very clear to me right then and there as well."
Patient understanding (11)	See reality	Subject BX5: "My overall sense was that they did not have as good a handle on what was going on with him, his underlying problems, as I would hope."
	Competent	Subject C14: "I was just assessing his mental status and whether, again, just further gathering evidence that what his clinical status was. Was he hypoxic to the point of being altered, he was not but it does not really change the fact that his vital signs were terrible and it makes it so that I can feel like I can talk to him and have a reasonable conversation, you know, like he knows, you know, is capable of understanding what I am talking about."
Surrogate (12)	Trustworthy	Subject BX6: "I don't put as much store in a sister as a wife, I am not really sure why, as I have been married for 28 years, but usually because siblings can often be detached from their sibling, but where as though there can be secondary gain or loss, basically a spouse tend to have a much more understanding this early of their spouse."
	Knows patient preferences	Subject C04: "… you have either the patient and the family have not thought about it or even though they have thought about it, they have not talked about it. They [actors in scenario] had been so clear about their wishes and been so on the same page."

See reality	Subject B11: "Well, again I do not know. If he has had cancer for 5 years, it would be different than if he just had it for 3 weeks because their level of understanding and acceptance are different between the two cases"

† The adjacent number corresponds to the identification number in Figure 1.

Appendix Figure 1



Appendix Figure 1. – Chronologic use of mental model concepts during simulation debriefing interview: an illustrative sample of physicians who intubated and did not intubate the simulated patient. Each concept mentioned during the debriefing interview is noted by a box with a number corresponding to a concept number in Figure 1, in the order which is was mentioned during the debriefing interview. The colors represent post analysis grouping of ideas and processes. A color key is provided in the corresponding table.

Appendix Figure 2

Raw Data for Subject A14

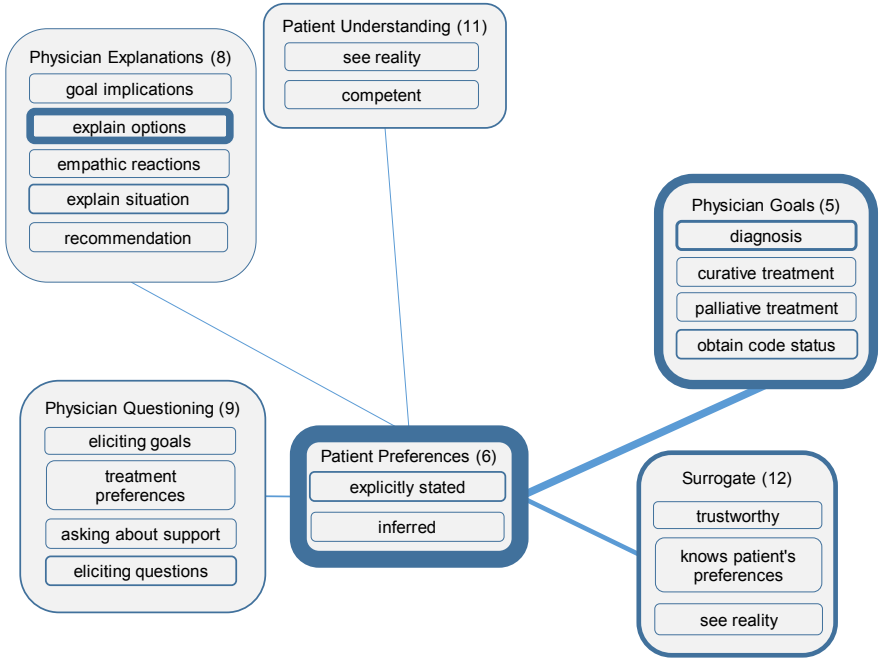
Number of times mentioned during the interview = 12
- Mentioned "Patient Preferences" =11
- Mentioned "Explicitly stated-Patient Preferences"= 1
- Mentioned "Inferred –Patient Preferences"= 0

Number of times this concept was linked to others within a statement unit = 10
- Link to "Physician Questioning"= 1
- Link to "Physician Explanations"= 0
- Link to "Patient Understanding"= 1
- Link to "Physician Goals"= 5
- Link to "Surrogate"= 3

Saturation of the expert model:
- Mentioned 5 out of 17 concept links
- Mentioned 11 out of 12 concepts

Relative frequencies of associated links:
- Link to "Physician Questioning"= 0.06
- Link to "Physician Explanations"= 0
- Link to "Patient understanding"=0.06
- Link to "Physician Goals"=0.06
- Link to "Surrogate"=0.06

Category score = 0.25



Appendix Figure 2. – Example calculation for the concept category "Patient Preferences" for Subject A14. Raw data is listed on the left for the coded interview for Subject A14. The box and line figure demonstrates the category concept of interest in the calculation ("Patient Preferences") and the associated category concepts connected by ideological relationships or links. The weight of the outlines or links represents the raw frequencies coded during this interview. Heavier outlines or links were mentioned more frequently.

A visual inspection of the raw data shows this physician used most of the expert model concept categories (11 out of 12), but their use of concept linking was focused (only using 5 out of 17 possible) on the concept category "Patient Preferences" (4 of the 5 mentioned links). Calculation of the relative frequencies of the links tempers the repeated mentions of links to physician goal and surrogate. The category score for "Patient preferences" is a summation of the five relative frequencies of the associated links to "Physician Questioning", "Physician Explanation", "Patient Understanding", "Physician Goals", and "Surrogate".