Appendix 1 Users Feedback Survey: Artificial intelligence based clinical decision support system (AI-CDSS) for chest tube management.

Information: We are developing a clinical decision support system using our previous research in artificial intelligence and advanced statistical modeling. Our prototype "Chest tube Learning Synthesis and Evaluation Assistant" (CheLSEA) transforms and integrates demographic, physiologic, clinical, and radiologic data into recommendations relevant to the care of patients with chest drains. The purpose of this artificial intelligence-based clinical decision support system (AI-CDSS) is to assist the healthcare team in forecasting the optimal time point for chest tube removal or discharge with a tube in place in future 12-hour time frames post-surgery.

Instructions: Please choose *only one* option from each of the questions below:

Please state your role in the healthcare team

a. Surgeon

b. Nurse

c. Resident

d. Research Member

e. Other

How would you rate the usefulness of an AI-CDSS as described?

a. Not Helpful	b. Neutral	c. Helpful

How do you think the AI-CDSS will impact chest tube care?

a. Negative Impact	b. Neutral Impact	c. Positive Impact

How would using the AI-CDSS impact your daily workload?

a. Low Impact	b. Medium Impact	c. High Impact

How would using the AI-CDSS impact your daily workflow?

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a. Low Impact	b. Medium Impact	c. High Impact

Do you think there is a need for an AI-CDSS to assist in the management of patients requiring chest tube drainage?

a. No	b. Maybe	c. Yes

Do you think that this research and development has the potential to improve the care of patients requiring chest drainage?

a. No	b. Not Sure	c. Yes

Please share any concerns on the clinical implementation of an AI-CDDS such as CheLSEA?

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Appendix 2 Chest Tube Learning Synthesis and Evaluation Assistant (CheLSEA) System Interface Usability Sessions

Date (dd/mm/yy): _____
Time: _____
Moderator: _____
Participant's ID: _____
User Type:
□ Staff MD □ Resident MD □ Nurse □ Research Member

CHEST TUBE LEARNING SYNTHESIS AND EVALUATION ASSISTANT "CHELSEA",
An artificial Intelligence Based Decision Support System (AI-CDSS):
User Interface Evaluation

INCIDENT LOG SHEET – To be completed by the moderator while observing the participant as they work through the DSS user interface. The interview questions (based on the incidents that were flagged) will be asked following the decision aid walkthrough session.
Time at Start of Session: _____

Data Element	FLAG (*)	*INCIDENTS TO LOOK OUT FOR*			Incident Interview Questions with Participant *(I noticed that when you reviewed Data Element X, X happened. Can you tell me what happened?)*
		Hesitation	Request for help	Comments	
1. Patient's Information					
†Name					
†Operation					
†Surgery Ended					
†PAL Score					
†POD					
†Air Leak Criteria					

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Data Element	FLAG (*)	*INCIDENTS TO LOOK OUT FOR*			Incident Interview Questions with Participant *(I noticed that when you reviewed Data Element X, X happened. Can you tell me what happened?)*
		Hesitation	**Request for help**	**Comments**	
†Fluid Criteria					
2. System's Information					
†System Message(s)					
†Recommendation					
†Request time					
†Recommendation expires					
†POD Table					
†Graph Data Button					
3. Graph's Information					
Pleural Space Data Graph					
Pleural Space (Smoothing) Graph					
CXR Graph					
Chest Tube Liquid Output Graph					
Total Volume of Air Drained per 12h Graph					

Once the participant has finished reviewing the DSS user interface, note the exact time and elapsed time:

Time: _____ **Elapsed Time**: _____

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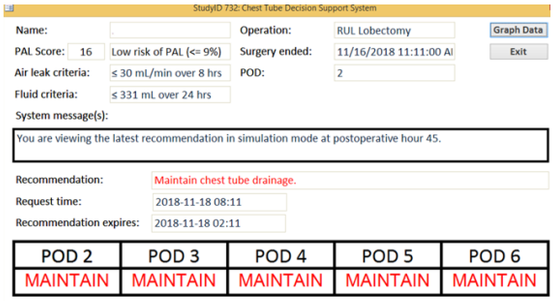
Specific Sections of the Interface

INSTRUCTIONS: Next, I would like to go over some specific parts of the CheLSEA user interface and ask you some questions about it.



1. What is your overall impression of the appearance of the display?

_____
_____
_____
_____
_____

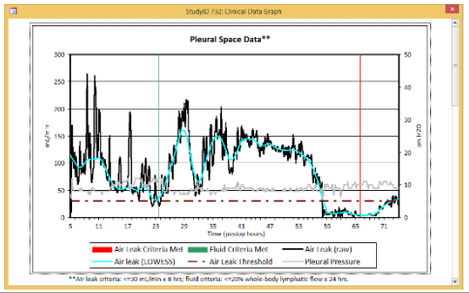
2. On a 5-point scale from 1 (Strongly Disagree) to 5 (Strongly Agree) can you please tell me your agreement with the following questions.

Questions about this section	**Strongly Disagree**				**Strongly Agree**
	1	**2**	**3**	**4**	**5**
Information is easy to read					
Information is easy to understand					
I like the general format					

3. Was there anything you did not like, or would change about this part of the interface?

_____
_____
_____

4.



Are you able to interpret this graph? 0 Yes 0 No

Comments: _____
_____
_____
_____
_____
_____

Was there anything you did not like, or would change about how to display the information on the graphs?

_____
_____
_____
_____

Please tell me your agreement with the following question:
The information available on this graph would be useful to me in caring for patients.

strongly agree — agree — neutral — disagree — strongly disagree

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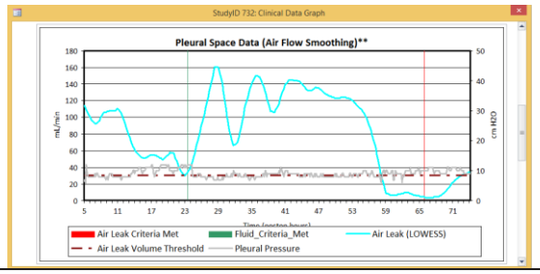
5.



Are you able to interpret this graph? 0 Yes 0 No

Comments: _____
_____
_____
_____
_____

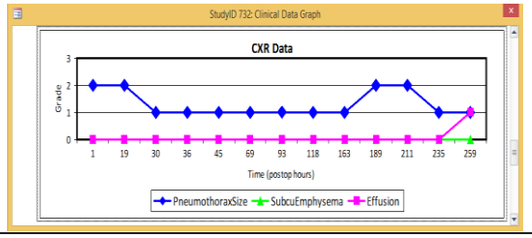
Was there anything you did not like, or would change about how to display the information on the graphs?

_____
_____
_____

Please tell me your agreement with the following question:
The information available on this graph would be useful to me in caring for patients.

strongly agree — agree — neutral — disagre — strongly disagre

6.



Are you able to interpret this graph? 0 Yes 0 No

Comments: _____
_____
_____
_____
_____

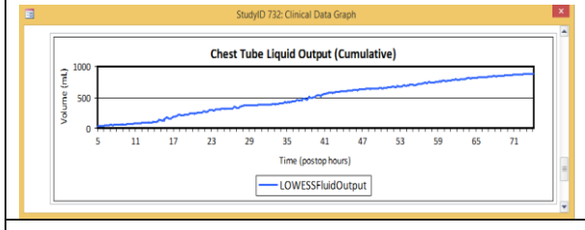
Was there anything you did not like, or would change about how to display the information on the graphs?

_____
_____
_____

Please tell me your agreement with the following question:
The information available on this graph would be useful to me in caring for patients.

strongly agree — agree — neutral — disagre — strongly disagre

7.



Are you able to interpret this graph? 0 Yes 0 No

Comments: _____
_____
_____
_____
_____

Was there anything you did not like, or would change about how to display the information on the graphs?

_____
_____
_____

Please tell me your agreement with the following question:
The information available on this graph would be useful to me in caring for patients.

strongly agree — agree — neutral — disagre — strongly disagre

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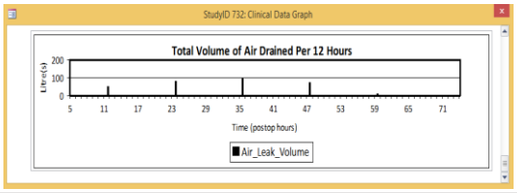
8. 	Are you able to interpret this graph? 0 Yes 0 No Comments: _____ _____ _____ _____ _____
Was there anything you did not like, or would change about how to display the information on the graphs? _____ _____ _____	Please tell me your agreement with the following question: **The information available on this graph would be useful to me in caring for patients.** strongly agree — agree — neutral — disagre — strongly disagre

Overall Questions – Open Ended

1. How would you describe your experience navigating the interface? **Probe:** What did you think about the overall amount of information displayed?

_____
_____
_____

2. What parts did you find *most* useful? **Probe:** How would these elements help you in the interface navigation?

_____
_____
_____

3. What did you find *least* useful? **Probe:** How would these elements limit your interface navigation?

_____
_____
_____

4. What did you think about the Graph Data functionality?

_____
_____
_____

5. What interface improvements do you suggest?

_____
_____
__

6. What benefits would you see of using CheLSEA as a system to support the healthcare team in their chest tube management decision making? **Probe:** Why do you think this is a benefit?

_____
_____
_____

7. Would you have any concerns about using CheLSEA, an AI-CDSS, to help you decide when to remove a chest tube? P**robe**: Why is this a concern for you?

_____
_____
_____

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Appendix 3 Patients Interview Script Guide

Interview Script

Note: *Italicised text is tips and advice for the interviewer*
Normal text is question wording or examples of probes

[[Interviewer NOTE: Focus is on identifying the perspective of patients i.e. their thoughts, opinion and feedback on the use of the artificial intelligence- based computerized system by the health care team during chest tube management.]]

Research Question: *What are the patients' perception, thoughts and feedback on the use of an artificial intelligence based computerized system to assist and support the healthcare team in chest tube management post lung surgery?*
Objective: *Identify patients' perception on the use of an artificial intelligence based computerized system to support the healthcare team during chest tube management post operatively.*

1.Thank you for agreeing to be interviewed today. As discussed before and as you will have seen in the consent form, we are looking to talk to patients who have undergone lung surgery and required chest tube management post-surgery. Specifically, we would like to ask for your thoughts, opinion, and feedback on the use of an artificial intelligence-based computerized system by the healthcare team during chest tube care.

2.To assist healthcare teams during chest tube management, our team is developing an artificial intelligence-based computerized system, CheLSEA. The system analyzes data collected from patients with chest drains inserted after lung surgery. The data is then analyzed by the computer system using artificial intelligence data science in order to advise the healthcare team.

3.As part of this advice the system makes predictions about when it would be safe to remove a patient's chest tube. The hope is that these recommendations will assist doctors and nurses in deciding whether to remove a patient's chest tube or not.

4.We would like to get your opinions and feedback on the use of this system in caring for patients with chest tubes. We will be asking every participant in this study, the same series of questions.

5. <u>Have you had chance to review the information sheet that was sent to you?</u>

IF YES, then ask:
"Do you have any questions?"
Then remind that the interview is going to be audio recorded for research purposes-
PROCEED to 6.
If No,
Then Say: "Thank you. I am going to start the recording device now if that is OK and I will just get you to confirm for the record that you are happy to proceed and that you are happy for me to record the interview. Is that, OK?"

Ask for consent to record while recording so that it is documented in the audio

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Start recording here

6. Are you ok to proceed?

Start the interview by asking the patient the following questions

Education Level

High School
College
Undergraduate
Post-Graduate
Other

How familiar are you with either the term “Artificial Intelligence” or the term “Machine learning”

No familiar
Somewhat Familiar
Familiar
Intermediate Knowledge
Advanced Knowledge

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A) Experiences

Thank you. I understand that you have had a chest tube in the past.

Q. Can you start by telling me about your experience with the chest tube after your surgery? **PROBE:** What were the most important things to you in terms of how that tube was managed? **PROBE:** Do you think that your main concerns were understood by the surgeon? **PROBE:** Were there any specific issues?	***Note for interviewer**: You may find that you get a bit of a 'patient journey' story that might not immediately seem relevant to your question, but so long as they really don't go off on a tangent it is often helpful to let them give you that story as they may spontaneously start talking about topics you are interested in.* *The skill is to know your interview guide inside out so that you can jump around a bit if you need. So if they start, for example, talking about trust, it can sometimes be easier to ask those questions while it is still a 'live' topic in their mind. So this is the skill of the interviewer – making it feel like a conversation and less like a survey where it is question and answer repeatedly.* *Obviously you also need to be able to steer that conversation, but keep track or notes of any salient items they mention and you can use those as prompts to bring things back. E.g. "so you mentioned trust a little while back… In terms of the recommendations made by a physician about chest tube management post operatively; would the use of a affect your level of trust in the recommendation?" etc*

Q. Would there be any specific information that you feel a healthcare team should have to help inform their decision-making for chest tube management after surgery?

B) Benefits and Concerns

"As I mentioned earlier, we are working on a project to create *an artificial intelligence based computerized system* to help the healthcare team to take care of patients requiring chest tube drainage. The system analyzes data collected from patients with chest drains inserted after lung surgery. The data is then analyzed by the computer system (CheLSEA) which then provides a recommendation (or recommendations) for the healthcare team. As part of this advice this artificial intelligence based computerized system makes predictions about when it would be safe to remove a patient's chest tube. The hope is that these recommendations will assist doctors and nurses in deciding whether to remove a patient's chest tube or not.

Q. What benefits would you see of using a computer system such as this to help decide when to remove a chest tube? **PROBE:** Why do you think this is a benefit? **PROBE**: How would it be helpful?	

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Q. Would you have any concerns about using this computer-based system to help decide when to remove a chest tube? **PROBE**: if they have a concern then **ASK** : Why is this a concern for you?	***Note to interviewer:*** *If they say they have a concern about "X". You can Probe why this is a concern for them. Sometimes the thing that is mentioned is not the underlying cause of that concern and that's what you need to get to.*

C) TRUST

Q. In terms of the recommendations made by a surgeon about chest tube management after surgery; how might the use of a computer system by your surgeon affect your level of trust in the recommendation? **PROBE:** What makes you say that?	*Probe question is to make them expand on their answer to the Q.*

D) Safety

Q. Would there be anything in your surgeon using an artificial-intelligence computerized system that would affect how safe you felt in the recommendations made by your surgeon?

Q. What are your thoughts on using this system to make future predictions about when it is safe to remove the chest tube but there could be a chance that it may be a wrong prediction? **Q.** It is possible that the computerized system may make an error. This is why your medical care remains in the hands of your doctors and nurses at all times. What is a chance of being wrong would you consider reasonable when using Artificial intelligence system to make predictions as to when it is safe to remove the chest tube? For example, a)1 wrong prediction out of 5 decisions made b)1 wrong prediction out of 10 decisions made c)1 wrong prediction out of 100 decisions made d)1 wrong prediction out of 1000 decisions made e) None of the above. **PROBE:** What margin of error do you think is acceptable	***Note to interviewer****: The purpose behind this question is to understand patients' opinion on the fact of using a system that is not perfect and that may make error.* ***Note to interviewer:*** *Since the first question is open ended, we want to follow up with a close ended question. Please present patients with the example probability. We would like to collect that information more specifically by making the patients choose a chance of error option.*

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E) Quality of Life

Q. One thing we are trying to also understand are some of the preferences patients have about how what are important issues for them when making decisions about their chest tube management and we would like to get your thoughts on a few of these:

For example, if the system predicted that you would have air leakage through your chest tube for more than 5 days, you could still go home (meaning you could go home earlier with the chest drain in place) but would have to manage this at home and come back to the hospital to have it removed the following week.	*Lay out scenarios before the question* *Probe to see what it is that is affecting their response.*
Alternatively, You could stay a few extra days which would allow for a bedside treatment (for instance, having a medication is put into your chest using your chest tube) in order to stop the air leak and remove your chest tube before you go home. **Q.** Would you say you would have a preference between those options ,and if so, What would be the things that you would be thinking about when making that decision? **Optional: PROBE:** why is this important to you?	

F) Response to Conflict

Q. How would you feel if there was a disagreement between recommendations from the AI system and recommendations from your health care team?
PROBE: Would this affect your level of trust in your doctors and nurses?
PROBE: Conversely, would this affect your level of trust in the use of artificial intelligence in your surgical care?

G) Access to decisions by the system:

Q. Would it be important for you to see the information and the recommendations of the decision system? **PROBE:** How do you think is the best way to share this information with patients?

H) LAST QUESTION to conclude the interview

"Thank you. We have talked about your experiences of a chest tube, your views about the information that might be helpful in planning to remove the chest tube or not, as well as factors that would affect how safe you felt in that decision and the level of trust you had in that decision. Would there be anything else that we haven't discussed that would affect your decision (or how comfortable you were with a decision) about whether to remove a chest tube or not?"

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