# XAI: Fundamental Challenge ROUND 2

Delphi study on explainable health-AI

This study investigates two fundamental questions regarding explainability of AI in healthcare:

1. **What is an explanation for AI in healthcare?**
2. **What are the attributes for a good explanation for AI in healthcare?**

The study aims to provide a definition and a global list of characteristics of a good explanation for health-AI that can be used by AI developers and healthcare professionals.

**LET'S BEGIN!**

There are 22 questions in this survey.

# Consent

This study has been reviewed and approved by QMUL Electronic Engineering and Computer Science Devolved School Research Ethics Committee (QMERC20.565.DSEECS23.052)

## How will my data be stored and who will have access to it?

Your data will be maintained in pseudonymised form. This means your name and other identifiers in the working dataset will be replaced by a unique id. To reduce the risk of disclosure, personal identifiers will be stored separately from the research data in a separate secured university computer and will only be accessible to the primary investigator. This will be the only document that will link your unique id to your real identity.

## When and how will my data be destroyed?

The data of this study will be retained until 2028. We will follow QMUL information disposal policy to ensure secure deletion of any electronic record, a product that overwrites data many times will be used, such that the information cannot be recovered. IT Services will provide guidance and advice about the use of these products. In addition, any media holding electronic data will be physically destroyed.

## Can I withdraw for the study?

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**Do you consent to participate on this study?** *

Please choose **only one** of the following:

◯ Yes

◯ No

# Demographics

# Please specify your full name *

Only answer this question if the following conditions are met:

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Please write your answer here:

_____

# Which group does best describe your job profile? *

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Choose one of the following answers
Please choose **only one** of the following:

◯ End user decision maker (e.g. health professional)

◯ AI developer (e.g. engineer, computer scientist, data scientist)

◯ XAI theorist (e.g. phycologist, cognitive scientist, philosopher, legal theorist)

◯ Regulator (e.g. administrator, hospital manager, policymaker)

◯ Other [                                        ]

How many years have you been working on explainable AI? ✳

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Choose one of the following answers
Please choose **only one** of the following:

○ <2 years

○ [2 - 6) years

○ [6 - 10) years

○ >10 years

# What is an explanation of AI in healthcare?

Providing a unique definition for an explanation of AI in healthcare is challenging as it is highly depending on who is needing the explanation and for what reasons.

There are three main components in the definition of explanation in AI:

- **User:** who is intended to use the explanation, such as: doctor, patient, model expert, lawyer, regulator etc
- **Purpose:** the purpose for requiring an explanation, such as: increase the trust in model's recommendation, improve the understanding of model's outcome, debug the model, ensure fair and unbiased decisions, inspect the model's

properties etc.

- **Output:** the type of explanation output, such as: a counterfactual statement, a justification, a list of relevant inputs etc.

Therefore, *"an explanation of AI is an **output** that assist the **user** to achieve his/her **purpose**."*

Given the context this abstract definition can be reformed accordingly, such as:

- Scenario 1 - A model expert that needs to debug a model: **"An explanation is a detailed presentation of evidence and the chains of reasoning from the evidence to the output that assist the model expert to debug the model".**

- Scenario 2 - A doctor that wishes to understand why the model gave a certain recommendation: **"An explanation is the process of describing the supporting and conflicting evidence to clinicians for understanding the model's reasoning".**

- Scenario 3 - A judge that wishes to understand evidence of the outcome of an AI prediction: **"An explanation is a detailed description of what data was provided, both how and where it was used by the algorithm to produce the prediction, and how that outcome is relevant to the question being decided in the case at hand".**

Rate your agreement with the abstract definition provided below for explanation of an AI in healthcare: *

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Please choose the appropriate response for each item:

| | Do not agree | 2 | 3 | Somewhat agree | 5 | 6 | Totally agree |
|---|---|---|---|---|---|---|---|
| **"An explanation of AI is an output that assist the user to achieve his/her purpose"** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |

Could you please propose any additional component of an explanation definition that is not included in the above definition. If none, please enter NA.  *

Only answer this question if the following conditions are met:
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Please write your answer here:

## Comment

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Please write your answer here:

# What are the attributes of a "good" explanation in healthcare?

If someone wanted to explain to you why an AI *gives* or *does not give* a certain recommendation, what elements would you like to see provided in the explanation to improve your understanding and confidence in that AI.

The below list of attributes for a "good" explanation are based on a literature review and the results from the first round of this Delphi study. Please rate their importance.

Please rate the importance of the attributes below related to the FOCUS of a "good explanation". *

Only answer this question if the following conditions are met:
Answer was 'Yes' at question ' [Consent]' (This study has been reviewed and approved by QMUL Electronic Engineering and Computer Science Devolved School Research Ethics Committee (QMERC20.565.DSEECS23.052)   How will my data be stored and who will have access to it? Your data will be maintained in pseudonymised form. This means your name and other identifiers in the working dataset will be replaced by a unique id. To reduce the risk of disclosure, personal identifiers will be stored separately from the research data in a separate secured university computer and will only be accessible to the primary investigator. This will be the only document that will link your unique id to your real identity.   When and how will my data be destroyed?   The data of this study will be retained until 2028. We will follow QMUL information disposal policy to ensure secure deletion of any electronic record, a product that overwrites data many times will be used, such that the information cannot be recovered. IT Services will provide guidance and advice about the use of these products. In addition, any media holding electronic data will be physically destroyed.   Can I withdraw for the study?   You can withdraw from this study at any time without providing a reason. However, any collected data relating to you up to the time of withdrawal that has already been anonymised and incorporated into that iteration of the ongoing process will be used to the study. For instance, if you decide not to participate in the second Delphi round, the data collected from the first round will still be used.     Do you consent to participate on this study? )

Please choose the appropriate response for each item:

|  | Not important | 2 | 3 | Somewhat important | 5 | 6 | Extremely important |
|---|---|---|---|---|---|---|---|
| **Domain-aware: should be tailored to the domain, incorporating the relevant terms of the domain.** | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| **Purpose-aware: different explanation purposes require different explanations. Therefore, should be tailored to a specific purpose (e.g. an explanation to an AI developer working on improving the AI; an** | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

| | Not important | 2 | 3 | Somewhat important | 5 | 6 | Extremely important |
|---|---|---|---|---|---|---|---|
| explanation to a patient about their treatment). | | | | | | | |
| **Context-aware: Relevant to the decision output to be made (e.g. improve patient outcomes, improve use of clinicians time).** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| **User-aware: should be tailored to the user's needs and abilities.** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| **Time-aware: should be tailored to the user's time to engage with the explanation.** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |

# Comment

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Please write your answer here:

Please rate the importance of the attributes below related to the CONTENT of a "good explanation". &ast;

Only answer this question if the following conditions are met:
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Please choose the appropriate response for each item:

| | Not important | 2 | 3 | Somewhat important | 5 | 6 | Extremely important |
|---|---|---|---|---|---|---|---|
| **Causal: should provide relevant causal information.** | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| **Informative: should provide the necessary and sufficient information to close the user's knowledge gap.** | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| **Robust: should withstand small perturbations of the input that do not change the output.** | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

| | Not important | 2 | 3 | Somewhat important | 5 | 6 | Extremely important |
|---|---|---|---|---|---|---|---|
| **Faithful: should accurately matches the input-output mapping of the AI system.** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| **Comprehensible: should be clear and understandable to users.** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| **Objective: should be as objective as possible to minimize the amount of subjectivity a user might have when interpreting the explanations.** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| **Communicate uncertainty: should explain how certain the prediction is.** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| **Evaluative: should present evidence to support or refute human judgements and explain trade-offs between any set of options.** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| **Transparent: should help the user in understanding the underlying logic of the AI system, and possibly identifying that the system is wrong.** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| **Selected: should be specific and not consist of the complete cause of an event, highlighting the most important features for a decision.** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |

# Comment

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Please write your answer here:

Please rate the importance of the attributes below related to the OUTPUT of a "good explanation".    *

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Please choose the appropriate response for each item:

| | Not important | 2 | 3 | Somewhat important | 5 | 6 | Extremely important |
|---|---|---|---|---|---|---|---|
| **Interactive: should be a transfer of knowledge, presented as part of a conversation or interaction. Should understand the needs of the user, and adapt.** | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| **Constructive: should explain questions in the constructive form "Why x and not y?".** | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| **Counterfactual: should explain questions in the** | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

| | Not important | 2 | 3 | Somewhat important | 5 | 6 | Extremely important |
|---|---|---|---|---|---|---|---|
| constructive form "What would happen if?". | | | | | | | |

# Comment

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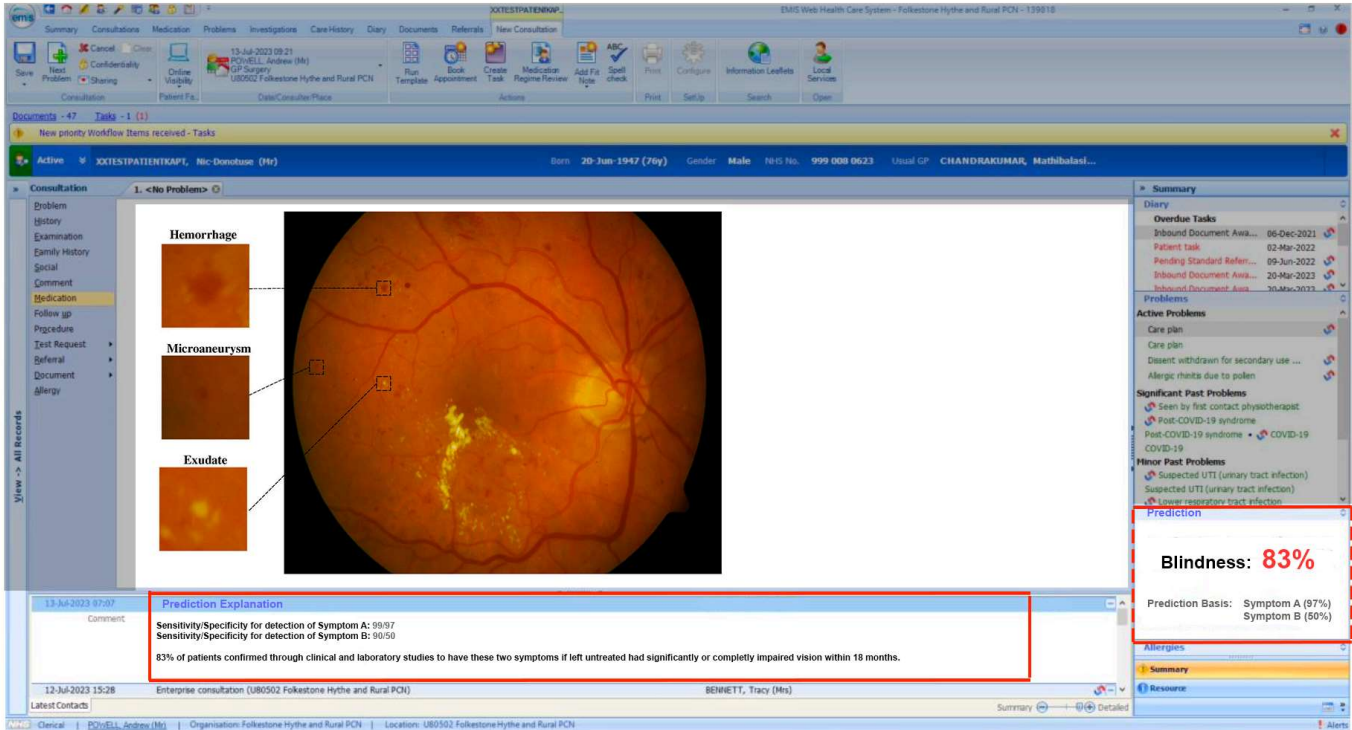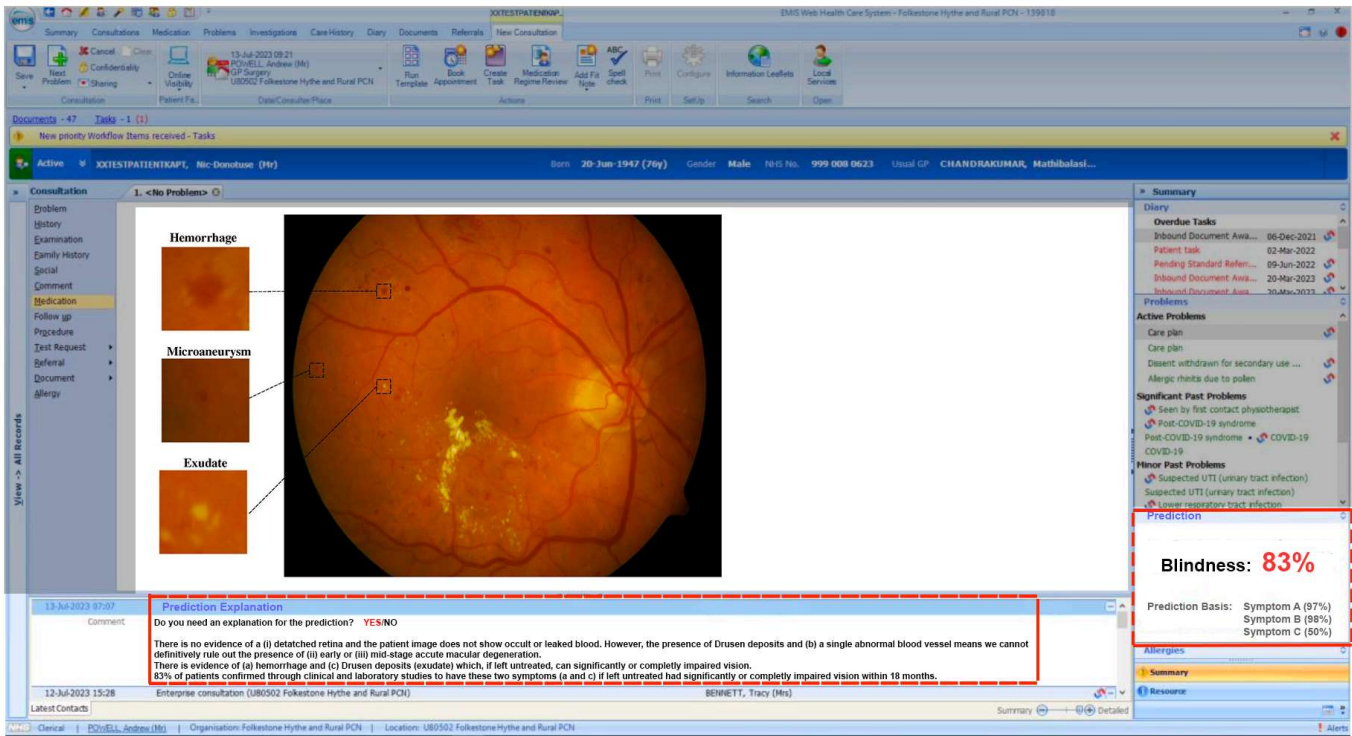
Please write your answer here:

Could you please propose any attributes of a "good" explanation of AI for use in healthcare and their definition that you consider important and are not included in the above list? If none, please enter NA. *

Only answer this question if the following conditions are met:
Answer was 'Yes' at question ' [Consent]' (This study has been reviewed and approved by QMUL Electronic Engineering and Computer Science Devolved School Research Ethics Committee (QMERC20.565.DSEECS23.052)   How will my data be stored and who will have access to it? Your data will be maintained in pseudonymised form. This means your name and other identifiers in the working dataset will be replaced by a unique id. To reduce the risk of disclosure, personal identifiers will be stored separately from the research data in a separate secured university computer and will only be accessible to the primary investigator. This will be the only document that will link your unique id to your real identity.   When and how will my data be destroyed?   The data of this study will be retained until 2028. We will follow QMUL information disposal policy to ensure secure deletion of any electronic record, a product that overwrites data many times will be used, such that the information cannot be recovered. IT Services will provide guidance and advice about the use of these products. In addition, any media holding electronic data will be physically destroyed.   Can I withdraw for the study?   You can withdraw from this study at any time without providing a reason. However, any collected data relating to you up to the time of withdrawal that has already been anonymised and incorporated into that iteration of the ongoing process will be used to the study. For instance, if you decide not to participate in the second Delphi round, the data collected from the first round will still be used.     Do you consent to participate on this study? )

Please write your answer here:

Explanation - Case Study 1

Moorfields Eye Hospital in London recently began using an AI tool to examine images of the back layer of the eyeball that contains the cells sensitive to light known as the retina. It is claimed this AI is capable of identifying symptoms related to age-related and acute macular degeneration and diabetic retinopathy - two common diseases that can significantly damage sight and lead to blindness. In this example, a patient has been referred to the hospital and the AI has identified three artefacts in the retinal image of their eye that could be indicative of retinal disease.

# Please select the explanation that you prefer. (When you click on each picture, the image will open in a new window/tab, becoming larger and more readable. Closing that window/tab should return you to this question)

## Explanation A



## Explanation B

**\***

Only answer this question if the following conditions are met:
((Consent.NAOK == "Y"))

Choose one of the following answers
Please choose **only one** of the following:

◯ Explanation A

◯ Explanation B

# Which of the following attributes led you to select your preferred explanation? (the definition of each attribute will appear if you hover your mouse cursor over the attribute) *

Only answer this question if the following conditions are met:
((Consent.NAOK == "Y"))

Select all that apply
Please choose **all** that apply:

- ☐ Domain-Aware
- ☐ Purpose-Aware
- ☐ Context-Aware
- ☐ User-Aware
- ☐ Time-Aware
- ☐ Causal
- ☐ Informative
- ☐ Robust
- ☐ Faithful
- ☐ Comprehensible
- ☐ Objective
- ☐ Communicate uncertainty
- ☐ Evaluative
- ☐ Transparent
- ☐ Selected
- ☐ Interactive
- ☐ Constructive
- ☐ Counterfactual

# Are there any other reasons why you chose that explanation? If none, enter NA. *

Only answer this question if the following conditions are met:
((Consent.NAOK == "Y"))

Please write your answer here:

<br>
<br>
<br>
<br>

# What other attributes would you like to see in the provided explanation? If none, enter NA *

Only answer this question if the following conditions are met:
((Consent.NAOK == "Y"))

Please write your answer here:

<br>
<br>
<br>
<br>

# Explanation - Case Study 2

A new Maternal Outcomes Bayesian network model has been developed that, amongst other things, can predict potential for the pregnant mother to develop gestational diabetes mellitus (GDM) based on her demographics and other risk factors. During the booking and screening appointment, the midwife has entered observations about the mother on the left side of the screen, and on the right side the model has made a prediction regarding the risk of GDM and Type 2 Diabetes Mellitus (T2DM) for this mother.

Please select the explanation that you prefer. (When you click on each picture, the image will open in a new window/tab, becoming larger and more readable. Closing that window/tab should return you to this question)

## Explanation A



## Explanation B

\*

Only answer this question if the following conditions are met:
((Consent.NAOK == "Y"))

Choose one of the following answers
Please choose **only one** of the following:

◯ Explanation A

◯ Explanation B

# Which of the following attributes led you to choose your preferred explanation? (the definition of each attribute will appear if you hover your mouse cursor over the attribute) *

Only answer this question if the following conditions are met:
((Consent.NAOK == "Y"))

Select all that apply
Please choose **all** that apply:

- [ ] Domain-Aware
- [ ] Purpose-Aware
- [ ] Context-Aware
- [ ] User-Aware
- [ ] Time-Aware
- [ ] Causal
- [ ] Informative
- [ ] Robust
- [ ] Faithful
- [ ] Comprehensible
- [ ] Objective
- [ ] Communicate uncertainty
- [ ] Evaluative
- [ ] Transparent
- [ ] Selected
- [ ] Interactive
- [ ] Constructive
- [ ] Counterfactual

# Are there any other reasons why you chose that explanation? If none, enter NA. *

Only answer this question if the following conditions are met:

((Consent.NAOK == "Y"))

Please write your answer here:

# What other attributes would you like to see in the provided explanation? If none, enter NA *

Only answer this question if the following conditions are met:

((Consent.NAOK == "Y"))

Please write your answer here:

**Thank you for completing the survey!**

More information about the project aims and results can be found https://exaidss.com/

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Submit your survey.

Thank you for completing this survey.