Survey about diffusion and adoption of glycaemic controller in European intensive care units

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- Method
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- Limitations
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Introduction

Problem

Critical illness

(stress and inflammatory responses)

↓

Stress-induced hyperglycaemia

Reduced insulin sensitivity

Glycaemic variability

↓

Worsened patient outcome

Increased mortality

Introduction

Problem	Solution
Critical illness	Glycaemic control
(stress and inflammatory responses)	(exogenous insulin/nutrition inputs)
↓	↓
Stress-induced hyperglycaemia	Reduce hyperglycaemia
Reduced insulin sensitivity	Limit hypoglycaemic risk
Glycaemic variability	Stabilise blood glucose levels
↓	↓
Worsened patient outcome	Improve patient outcome
Increased mortality	

Introduction

Problem	Solution	Questions
Critical illness (stress and inflammatory responses)	Glycaemic control (exogenous insulin/nutrition inputs)	Control guidelines? (controller, adjustment, administration mode)
↓	↓	
Stress-induced hyperglycaemia Reduced insulin sensitivity Glycaemic variability	Reduce hyperglycaemia Limit hypoglycaemic risk Stabilise blood glucose levels	Hyperglycaemia level? Hypoglycaemia level? Glycaemic target?
↓	↓	
Worsened patient outcome Increased mortality	Improve patient outcome	Beneficial?

Introduction

Questions

Control guidelines?
(controller, adjustment,
administration mode)

Hyperglycaemia level?
Hypoglycaemia level?
Glycaemic target?

Beneficial?

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Control guidelines?
(controller, adjustment,
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Nationally-conducted surveys

More overall European overview

Hyperglycaemia level?
Hypoglycaemia level?
Glycaemic target?

Beneficial?

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Control guidelines?
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More overall European overview

(1) What are the control guidelines that should be taken into account for the development of a new glycaemic control system in Europe?

Hyperglycaemia level?
Hypoglycaemia level?
Glycaemic target?

Beneficial?

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Hyperglycaemia level?
Hypoglycaemia level?
Glycaemic target?

Beneficial?

Aspects related to glycaemia levels and outcome
↓
Investigation of others aspects related to glycaemic control

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More overall European overview

(1) What are the control guidelines that should be taken into account for the development of a new glycaemic control system in Europe?

Interest?
Expectations?
Key success factors?

Aspects related to glycaemia levels and outcome
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Investigation of others aspects related to glycaemic control

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Interest?
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Investigation of others aspects related to glycaemic control

(2) How to design a new glycaemic control system that meets clinician expectations and requirements?

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Method

Format

Easy-to-use

Free

Fast to design

Method

Format

Easy-to-use

Free

Fast to design

Support

Fast

Answered at anytime

Easy and consistent data-gathering

Method

Format

Easy-to-use

Free

Fast to design

Support

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Answered at anytime

Easy and consistent data-gathering

Population

Europe

Intensive care units

Medical and nursing staff

Method

Survey about glycemic control in intensive care units

Who am I? I am a PhD student in Biomedical Engineering working on computerized glycemic control.

Main goals of this survey:
Understand clinician opinions about glycemic control for critically ill patients.
Identify clinician expectations about computerized glycemic controller.

*Required

Where is your hospital ? *
(city, country)?

Is your hospital a tertiary or university affiliated? *
("Yes" means that your hospital is a tertiary one or a university one)

- ◯ Yes
- ◯ No
- ◯ Do not wish to answer

What is your position or function in the hospital? *

What is the total number of beds in your IC unit(s)?
(If you are working in several ICUs, please specify the number of beds per ICU.)

Do you have a formal glycemic control protocol in your ICU? *

- ◯ Yes
- ◯ No

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Results

(1) What are the control guidelines that should be taken into account for the development of a new glycaemic control system?

- Controller type
- Controller format
- Adjustment
- Insulin administration mode

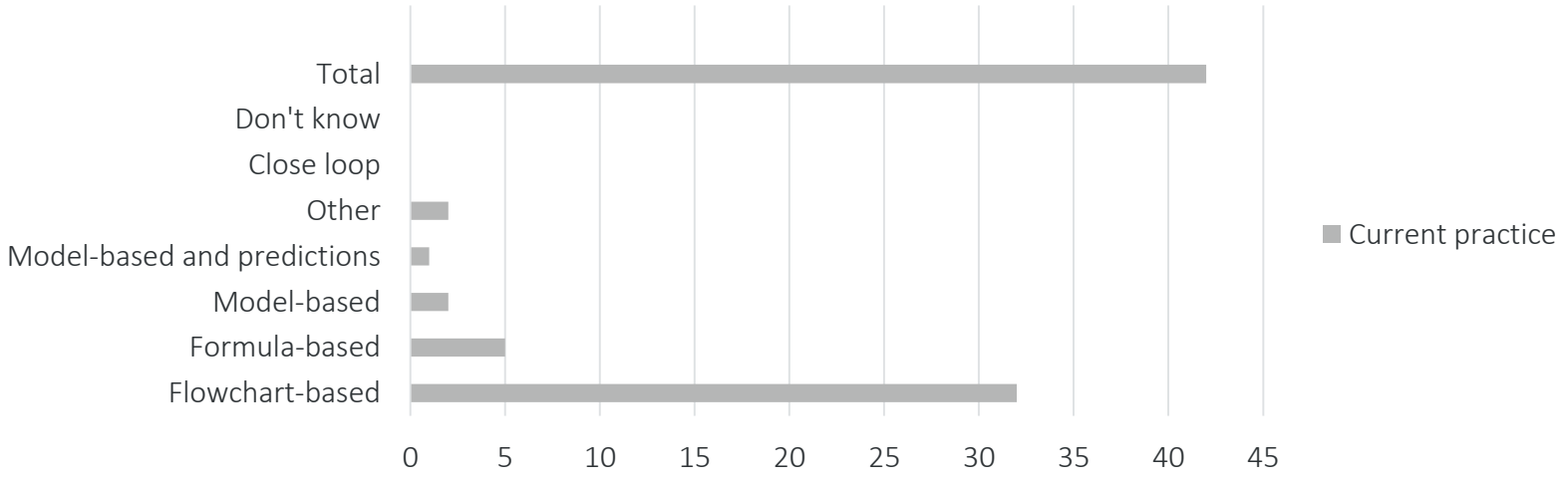
Results

- Controller type

Current practice : Flowchart-based

General approach based on empirical rules

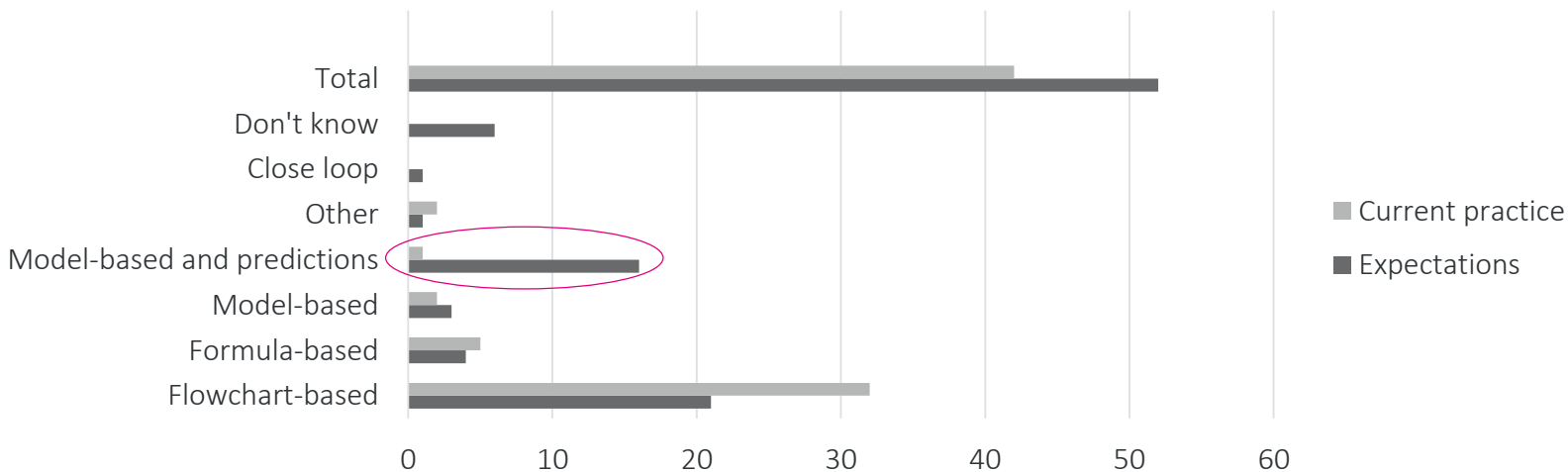
Patient variability managed by nurses



Results

- <u>Controller type</u>

Current practice :	Flowchart-based	General approach based on empirical rules Patient variability managed by nurses
Expectations:	Emerging interest for model-based with predictions	Patient-specific approach Variability managed by the controller



Results

- Controller format

Current practice : 7% of computerised Minimal links to patient records

Difficult to audit

Results

- <u>Controller format</u>

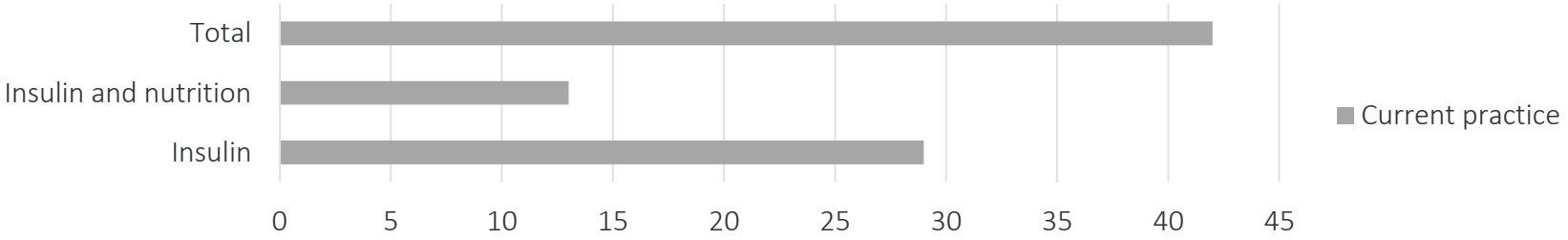
Current practice :	7% of computerised	Minimal links to patient records Difficult to audit
	↓	
Expectations:	67 % of computerised	Increased links to patient records Easy audit and oversight

Results

- Adjustment

Current practice : Insulin Not account for nutrition impact

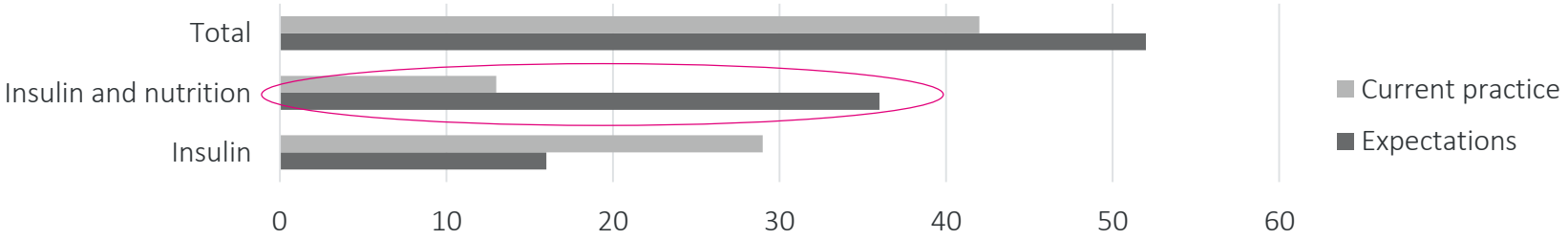
Nutrition independently managed



Results

- <u>Adjustment</u>

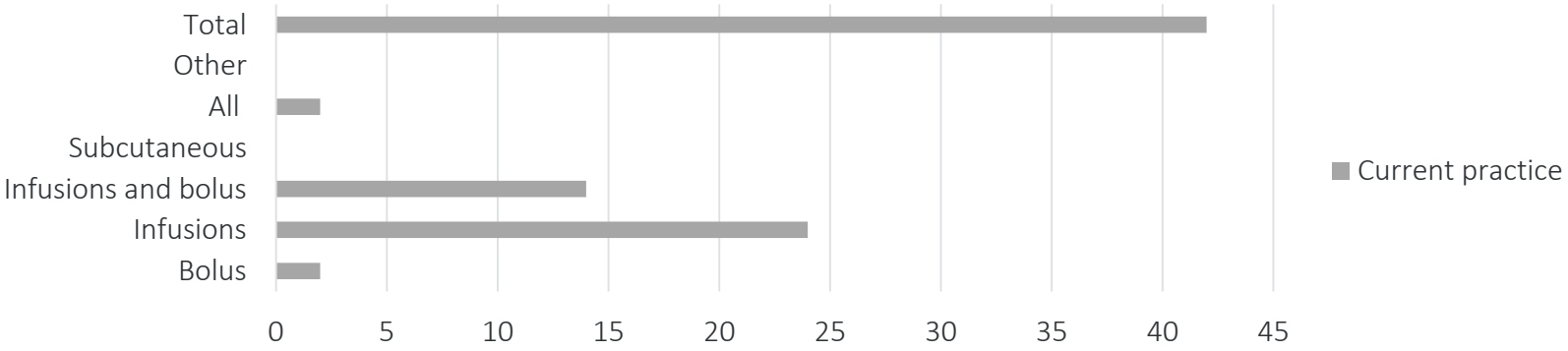
Current practice :	Insulin	Not account for nutrition impact Nutrition independently managed
	↓	
Expectations:	Insulin and nutrition	Account for nutrition impact Insulin and nutrition adjustment to better achieved glycaemic outcome



Results

- Insulin administration mode

Current practice : Mainly infusions

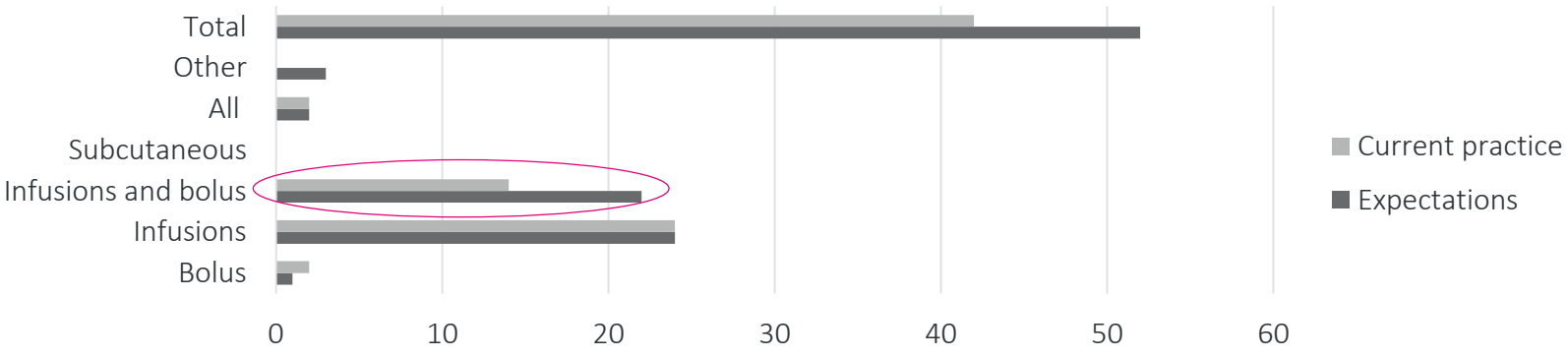


Results

- <u>Insulin administration mode</u>

Current practice : Mainly infusions

Expectations: Infusions and bolus Need for higher flexibility



Results

(1) What are the control guidelines that should be taken into account for the development of a new glycaemic control system?

- Controller type: interest for model-based controller with predictions

  → modelling, simulation

- Controller format: computerised controller

  → software

- Adjustment: insulin and nutrition

  → sophisticated interventions

- Insulin administration mode: flexibility

  → sophisticated interventions

Results

(2) How to design a new glycaemic control system that meets clinician expectations and requirements?

- Controller customisation
- Selection criterion

Results

- Controller customisation

Basic customisation in glycaemic target, control frequency and diabetes status

Results

- Controller customisation

Basic customisation in glycaemic target, control frequency and diabetes status

+

Patient weight

Medication

Illness

Glycaemic variability

Management of nutrition interruption

Management of hypoglycaemic risk

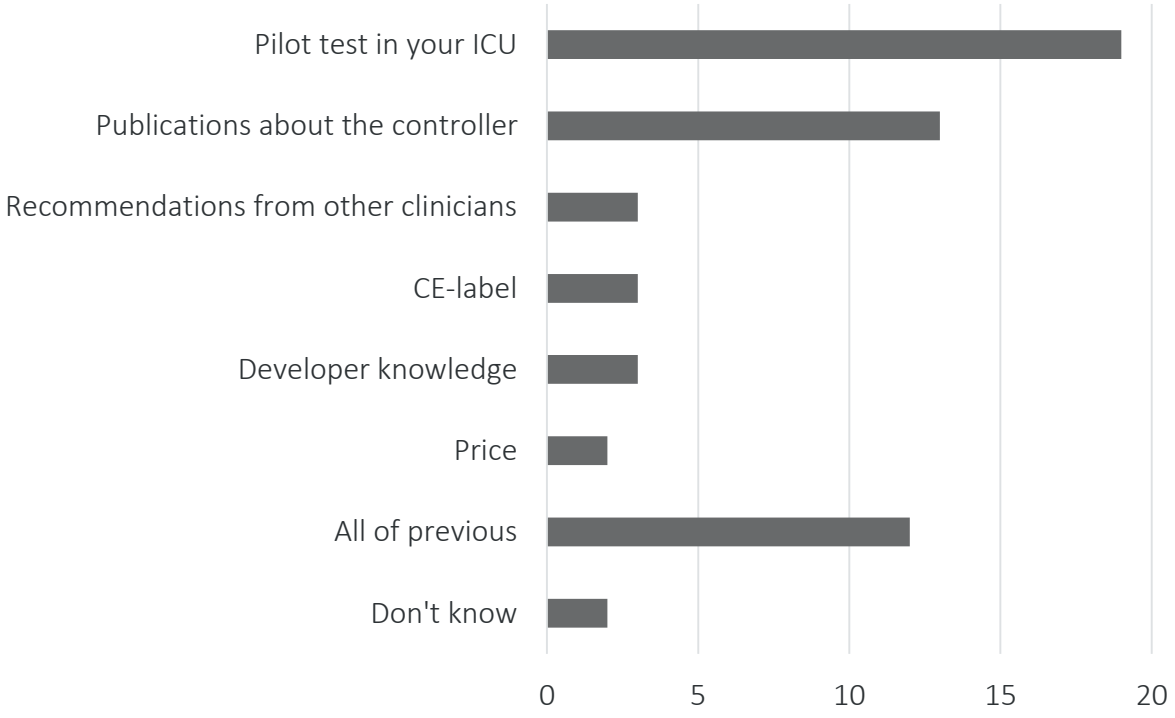
Results

- <u>Controller customisation</u>

Basic customisation in glycaemic target, control frequency and diabetes status	*Model-based controller with predictions:*
+	
Patient weight	*Model parameter*
Medication	*Additional glucose uptake or insulin sensitivity parameter*
Illness	*Insulin sensitivity parameter*
Glycaemic variability	*Insulin sensitivity parameter variability*
Management of nutrition interruption	/
Management of hypoglycaemic risk	*Glycaemic outcome predictions*

Results

- Selection criterion



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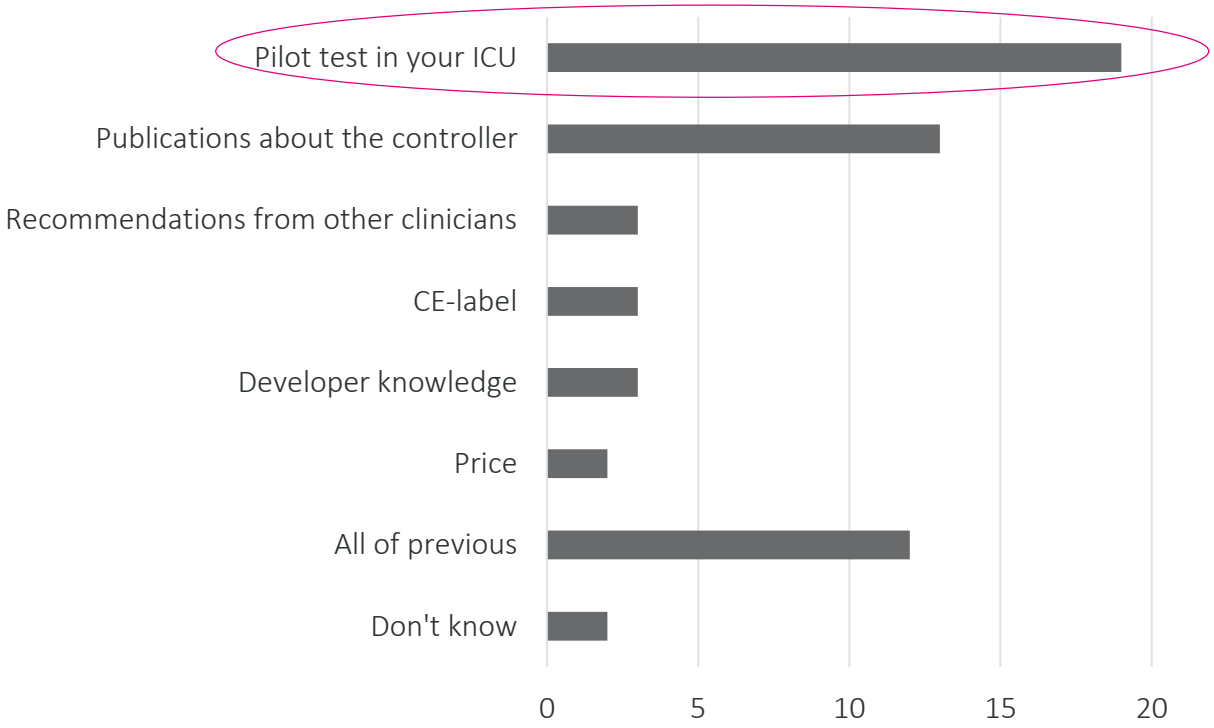

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(2) How to design a new glycaemic control system that meets clinician expectations and requirements?

- Controller customisation: patient details, medical condition, evolving patient condition, management of nutrition interruption and of hypoglycaemic risk

  → Sophisticated control approach that minimise nursing workload

- Selection criterion: pilot test and publications

  → Scientific and self approval

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Limitations

• Voluntary participation	→	Non-representative results
• Questionnaire design (closed questions)	→	Bias into the responses
• Human factors	→	Responses ≠ Reality
• Respondent geographic repartition	→	Belgian influence

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Support an engineered design approach

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Support an engineered design approach

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Support the importance of informing future users and interacting with them along the design process

Acknowledgement

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Thank you for your attention

Questions ?