

# STRATEGIES AND PERCEIVED RISKS OF SENDING SENSITIVE DOCUMENTS

Noel Warford, Collins Munyendo, Ashna Mediratta,  
Adam J. Aviv, and Michelle L. Mazurek



4/28/21



**Imagine sending a document...**

# Imagine sending a document...

- ... that contains sensitive information ...

# Imagine sending a document...

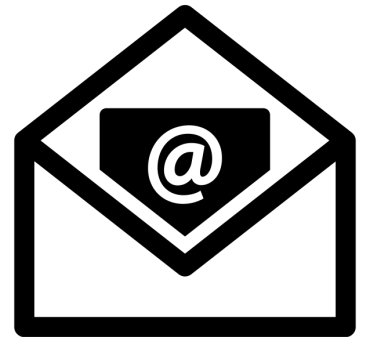
- ... that contains sensitive information ...
- ... to a person you do not necessarily know.

# Imagine sending a document...

- ... that contains sensitive information ...
- ... to a person you do not necessarily know.
- How might you do this?

# Imagine sending a document...

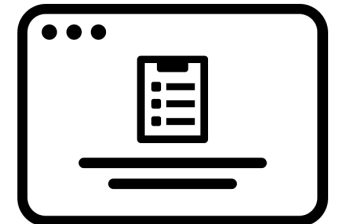
- ... that contains sensitive information ...
- ... to a person you do not necessarily know.
- How might you do this?
  - Send them an email?



Created by Anwar Hossain  
from Noun Project

# Imagine sending a document...

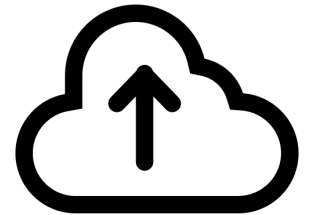
- ... that contains sensitive information ...
- ... to a person you do not necessarily know.
- How might you do this?
  - Send them an email?
  - Use an online form or portal?



Created by Aneeqe Ahmed  
from Noun Project

# Imagine sending a document...

- ... that contains sensitive information ...
- ... to a person you do not necessarily know.
- How might you do this?
  - Send them an email?
  - Use an online form or portal?
  - Upload it to a document sharing service?



Created by Manglayang studio  
from Noun Project



**This is an understudied task!**

# **This is an understudied task!**

- Lots of great work on encrypted communication

# This is an understudied task!

- Lots of great work on encrypted communication
- “Why Johnny Can’t Encrypt”, Whitten & Tygar 1999, includes attachments...

# This is an understudied task!

- Lots of great work on encrypted communication
- “Why Johnny Can’t Encrypt”, Whitten & Tygar 1999, includes attachments...
- ... but modern work focuses on the direct messaging use case!

# How do people send sensitive documents?

# How do people send sensitive documents?

- What methods do people choose when sending sensitive information, and why?

# How do people send sensitive documents?

- What methods do people choose when sending sensitive information, and why?
- Are participants satisfied with their current approaches, particularly in terms of whether they offer sufficient privacy? Why or why not?

# How do people send sensitive documents?

- What methods do people choose when sending sensitive information, and why?
- Are participants satisfied with their current approaches, particularly in terms of whether they offer sufficient privacy? Why or why not?
- What risks are people most concerned about when sending sensitive information?





# Survey One



# Survey Two

# Survey One

- Open-ended

# Survey Two

# Survey One

- Open-ended
- $n=60$

# Survey Two

# Survey One

- Open-ended
- $n=60$
- Find out what people are doing

# Survey Two

# Survey One

- Open-ended
- $n=60$
- Find out what people are doing
- Create hypotheses

# Survey Two

# Survey One

- Open-ended
- $n=60$
- Find out what people are doing
- Create hypotheses

# Survey Two

- Closed-answer

# Survey One

- Open-ended
- $n=60$
- Find out what people are doing
- Create hypotheses

# Survey Two

- Closed-answer
- $n=250$

# Survey One

- Open-ended
- $n=60$
- Find out what people are doing
- Create hypotheses

# Survey Two

- Closed-answer
- $n=250$
- Evaluate hypotheses



# Survey One

# Survey One

- Scenario-based

# Survey One

- Scenario-based
- Assigned **three** transmission scenarios



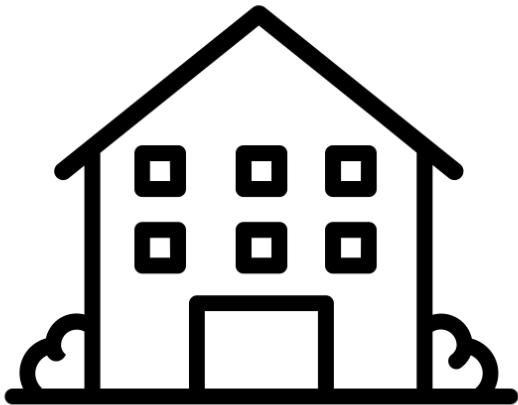
Created by yejinland  
from Noun Project

**Applying for a Mortgage** You are applying for a mortgage so you can purchase a new home. You must send the bank the following information.

- Proof of income - W-2 forms and two most recent payroll stubs or other income information
- 60 days worth of bank statements
- Monthly debt payment information - car payments, student loan payments, credit card debt payments
- Rent payment for the past twelve months
- Divorce decree, if applicable

# Survey One

- Scenario-based
- Assigned **three** transmission scenarios



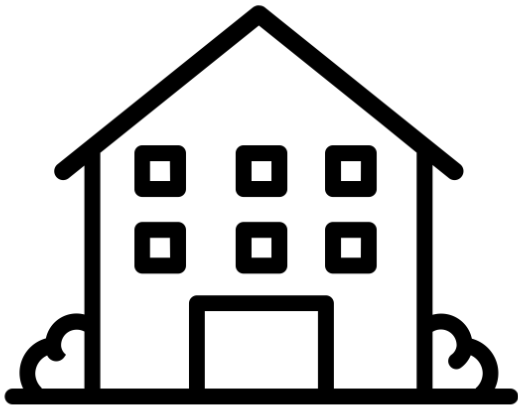
Created by yejinland  
from Noun Project

**Applying for a Mortgage** You are applying for a mortgage so you can purchase a new home. You must send the bank the following information.

- Proof of income - W-2 forms and two most recent payroll stubs or other income information
- 60 days worth of bank statements
- Monthly debt payment information - car payments, student loan payments, credit card debt payments
- Rent payment for the past twelve months
- Divorce decree, if applicable

# Survey One

- Scenario-based
- Assigned **three** transmission scenarios



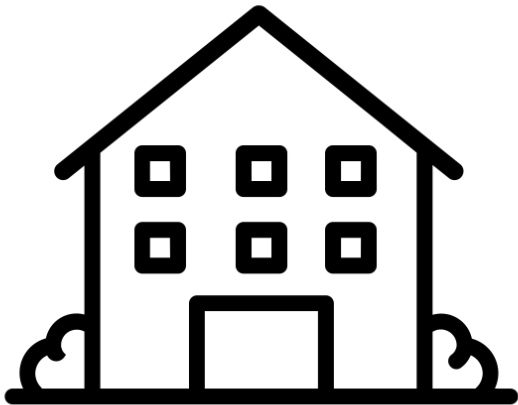
Created by yejinland  
from Noun Project

**Applying for a Mortgage** You are applying for a mortgage so you can purchase a new home. You must send the bank the following information.

- Proof of income - W-2 forms and two most recent payroll stubs or other income information
- 60 days worth of bank statements
- Monthly debt payment information - car payments, student loan payments, credit card debt payments
- Rent payment for the past twelve months
- Divorce decree, if applicable

# Survey One

- Scenario-based
- Assigned **three** transmission scenarios



Created by yejinland  
from Noun Project

**Applying for a Mortgage** You are applying for a mortgage so you can purchase a new home. You must send the bank the following information.

- Proof of income - W-2 forms and two most recent payroll stubs or other income information
- 60 days worth of bank statements
- Monthly debt payment information - car payments, student loan payments, credit card debt payments
- Rent payment for the past twelve months
- Divorce decree, if applicable

# Survey One

# Survey One

- Randomly assigned **three** scenarios



# Survey One

- Randomly assigned **three** scenarios
- Have they done this before?

# Survey One

- Randomly assigned **three** scenarios
- Have they done this before?
- What method did they or would they use?

# Survey One

- Randomly assigned **three** scenarios
- Have they done this before?
- What method did they or would they use?
- How satisfied with privacy and convenience were they? Why?

# Survey One

- Randomly assigned **three** scenarios
- Have they done this before?
- What method did they or would they use?
- How satisfied with privacy and convenience were they? Why?
- What risks were they concerned about?

# Survey One analysis

# Survey One analysis

- Primarily qualitative

# Survey One analysis

- Primarily qualitative
- Open coding of free response questions

# Survey One analysis

- Primarily qualitative
- Open coding of free response questions
- Informed Survey Two questions



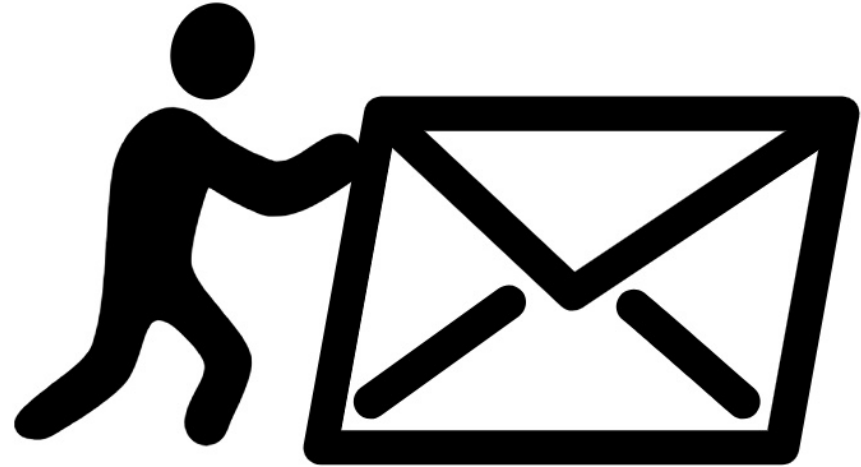
# Methods used

# Methods used

- Most common:

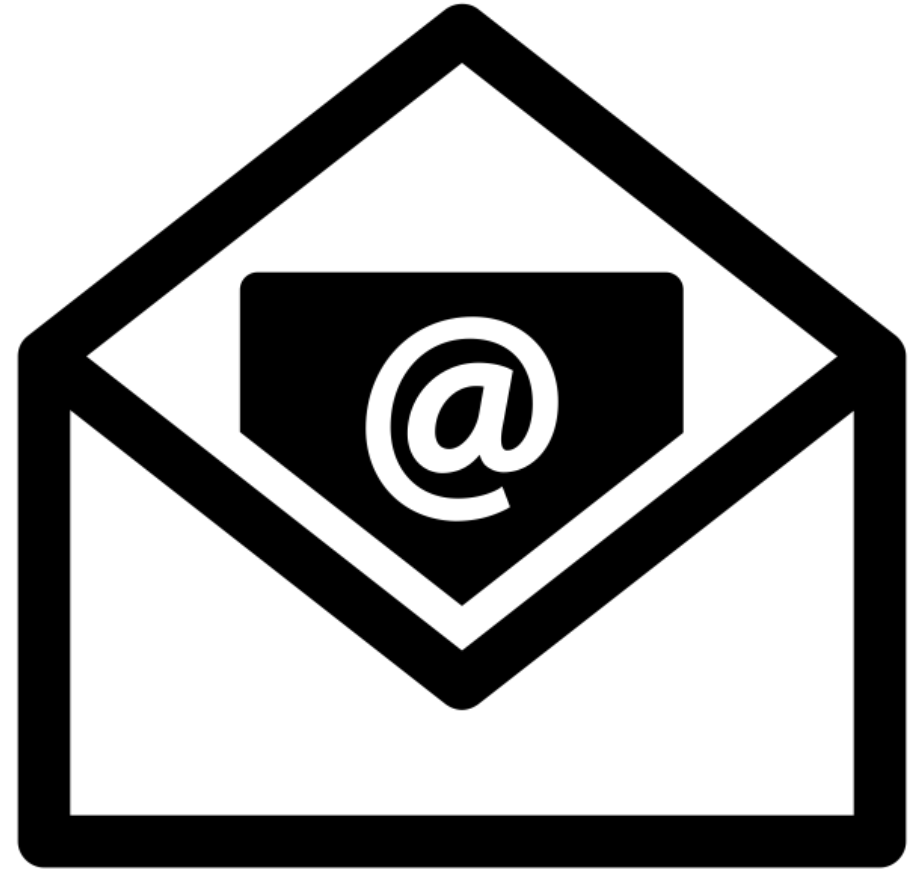
# Methods used

- Most common:
  - in person



# Methods used

- Most common:
  - in person
  - email



Created by Anwar Hossain  
from Noun Project

# Methods used

- Most common:
  - in person
  - email
  - online form



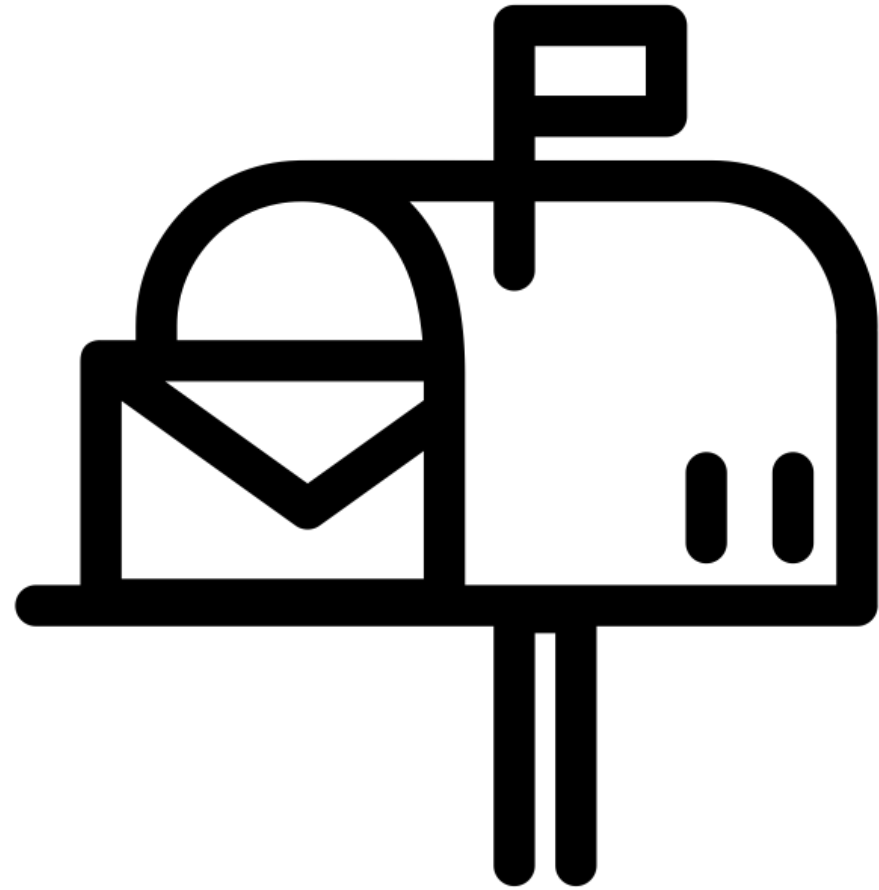
Created by Aneeque Ahmed  
from Noun Project

# Methods used

- Most common:
  - in person
  - email
  - online form
- Least common:

# Methods used

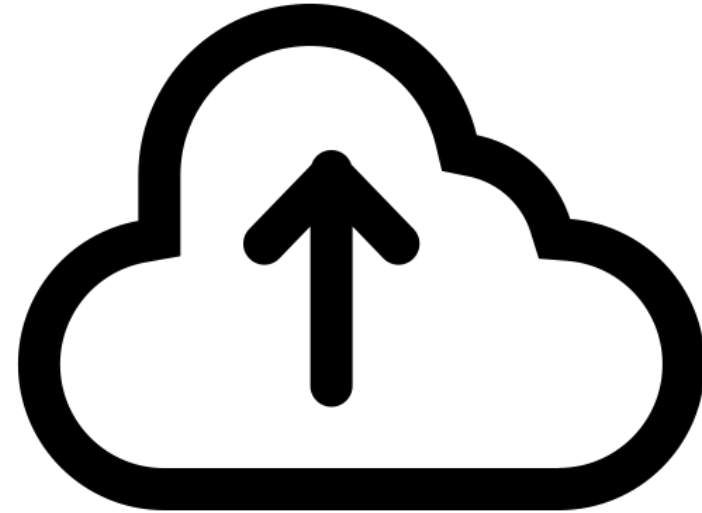
- Most common:
  - in person
  - email
  - online form
- Least common:
  - Physical mail



Created by Chanut is Industries  
from Noun Project

# Methods used

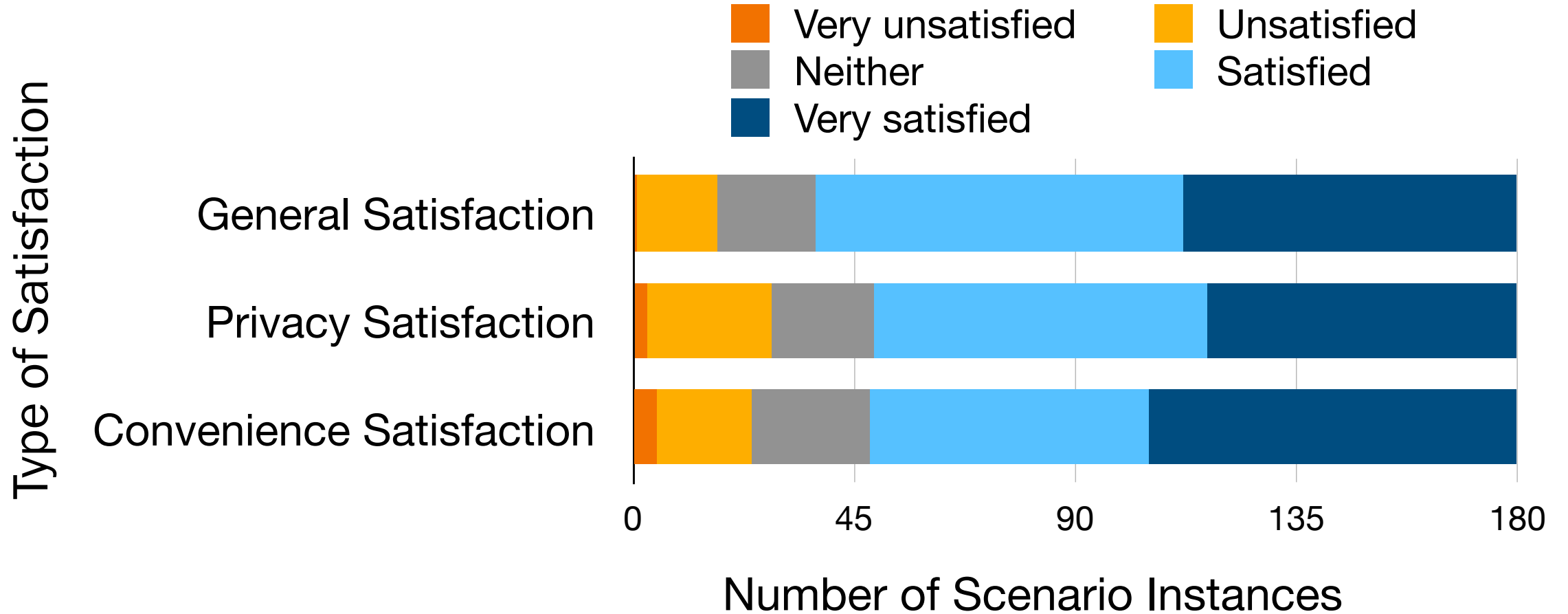
- Most common:
  - in person
  - email
  - online form
- Least common:
  - Physical mail
  - Document sharing service



Created by Manglayang studio  
from Noun Project



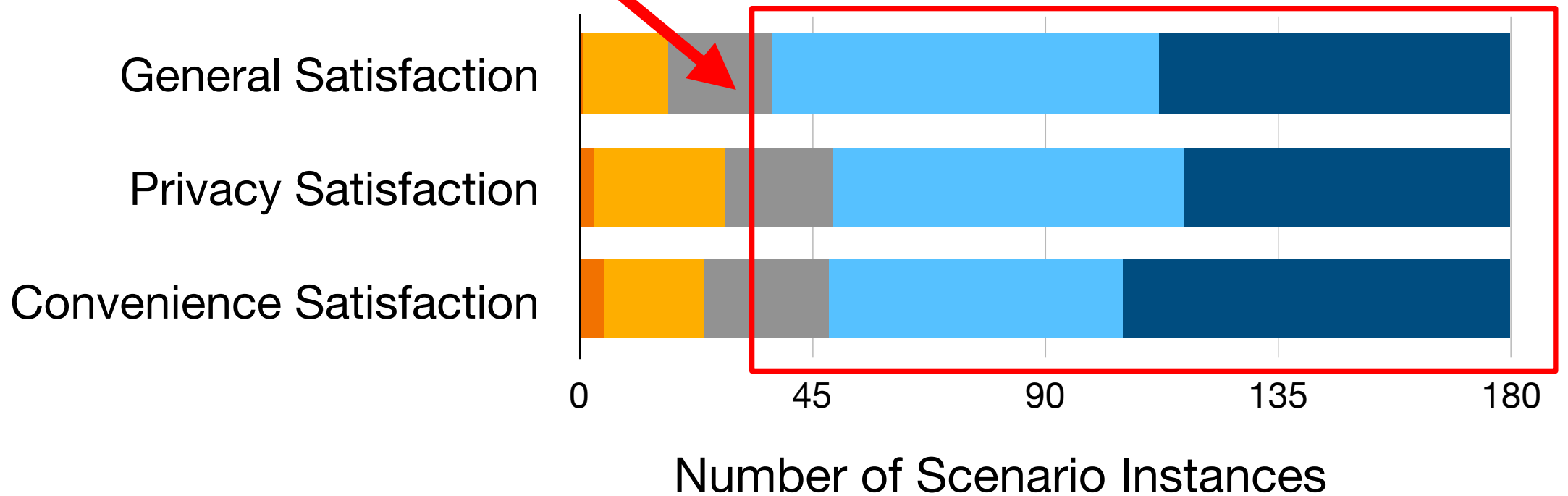
# Satisfaction



# Satisfaction

Overwhelmingly satisfied!

Type of Satisfaction



# Reasons for satisfaction

# Reasons for satisfaction

- My method of sending is secure

# Reasons for satisfaction

- My method of sending is secure

“Feel like this is a very secure way to provide documents.”

# Reasons for satisfaction

- My method of sending is secure
- The recipient will keep my data safe

# Reasons for satisfaction

- My method of sending is secure
- The recipient will keep my data safe

“I would assume that my taxes are handled with the utmost security and privacy”

# Reasons for satisfaction

- My method of sending is secure
- The recipient will keep my data safe
- The data will be received by the recipient



# Reasons for satisfaction

- My method of sending is secure
- The recipient will keep my data safe
- The data will be received by the recipient

I would know the sensitive information is going directly to the people who need it so I wouldn't have to second guess it.

# Reasons for dissatisfaction

# Reasons for dissatisfaction

- The method is insecure

# Reasons for dissatisfaction

- The method is insecure

“I am not satisfied with the security or privacy of sending this information over email. I understand that it could be easily accessible by others.”

# Reasons for dissatisfaction

- The method is insecure
- The recipient may accidentally disclose my data

# Reasons for dissatisfaction

- The method is insecure
- The recipient may accidentally disclose my data

“It just seems like a lot of information for a school to have and I don’t know how secure their system is.”

# Risks

# Risks

“A facility or institution misplacing, losing, or selling my information to a 3rd party can be worrisome.”



# Risks

“A facility or institution misplacing, losing, or selling my information to a 3rd party can be worrisome.”

“How the place I give these documents stores or disposes of them.”

# Risks

“A facility or institution misplacing, losing, or selling my information to a 3rd party can be worrisome.”

“How the place I give these documents stores or disposes of them.”

“Not knowing if the information will be kept safe.”

# Risks

“A facility or institution misplacing, losing, or selling my information to a 3rd party can be worrisome.”

“How the place I give these documents stores or disposes of them.”

**The data is at risk  
at the destination**

“Not knowing if the information will be kept safe.”

**What else do we need to know?**

# What else do we need to know?

- Have participants heard of the methods that were reported less frequently?

# What else do we need to know?

- Have participants heard of the methods that were reported less frequently?
- What factors are associated with more or less privacy satisfaction?

# What else do we need to know?

- Have participants heard of the methods that were reported less frequently?
- What factors are associated with more or less privacy satisfaction?
- What's going on with the data at rest?

# What else do we need to know?

- Have participants heard of the methods that were reported less frequently?
- What factors are associated with more or less privacy satisfaction?
- What's going on with the data at rest?
- Bonus: larger sample size to increase robustness



# Survey Two

# Survey Two

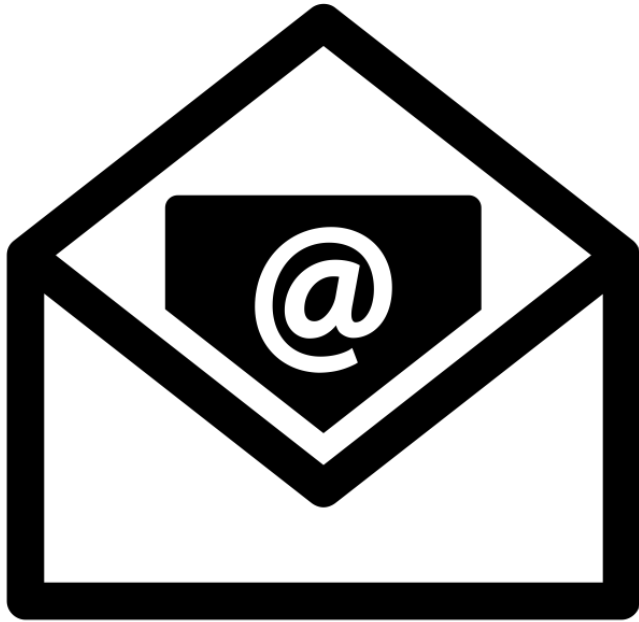
- Method-based

# Survey Two

- Method-based
- Assigned **one** transmission method

# Survey Two

- Method-based
- Assigned **one** transmission method



- In person
- Online portal
- Email
- Physical mail
- Phone call
- Document sharing services
- Fax
- Direct messaging

Created by Anwar Hossain  
from Noun Project

# Survey Two analysis

# Survey Two analysis

- Qualitative and quantitative

# Survey Two analysis

- Qualitative and quantitative
- Report prevalence

# Survey Two analysis

- Qualitative and quantitative
- Report prevalence
- Regression on privacy satisfaction



# Survey Two analysis

- Qualitative and quantitative
- Report prevalence
- Regression on privacy satisfaction
- Open coding on occasional free responses



# Survey One



# Survey Two

# Survey One

- Randomly assigned **three** scenarios
- Have they done this before?
- What method did they or would they use?
- How satisfied with privacy and convenience were they? Why?
- What risks were they concerned about?

# Survey Two

# Survey One

- ~~Randomly assigned three scenarios~~
- Have they done this before?
- What method did they or would they use?
- How satisfied with privacy and convenience were they? Why?
- What risks were they concerned about?

# Survey Two

- First: what methods have you used to send sensitive docs?

# Survey One

- ~~Randomly assigned **three** scenarios~~
- ~~Have they done this before?~~
- What method did they or would they use?
- How satisfied with privacy and convenience were they? Why?
- What risks were they concerned about?

# Survey Two

- First: what methods have you used to send sensitive docs?
- Randomly assigned **one** method they had successfully used

# Survey One

- ~~Randomly assigned **three** scenarios~~
- ~~Have they done this before?~~
- ~~What method did they or would they use?~~
- How satisfied with privacy and convenience were they? Why?
- What risks were they concerned about?

# Survey Two

- First: what methods have you used to send sensitive docs?
- Randomly assigned **one** method they had successfully used
- What were they sending? To whom?

# Survey One

- ~~Randomly assigned **three** scenarios~~
- ~~Have they done this before?~~
- ~~What method did they or would they use?~~
- How satisfied with privacy and convenience were they? Why?
- What risks were they concerned about?

# Survey Two

- First: what methods have you used to send sensitive docs?
- Randomly assigned **one** method they had successfully used
- What were they sending? To whom?
- How satisfied with privacy and convenience were they? Why?

# Survey One

- ~~Randomly assigned **three** scenarios~~
- ~~Have they done this before?~~
- ~~What method did they or would they use?~~
- How satisfied with privacy and convenience were they? Why?
- What risks were they concerned about?

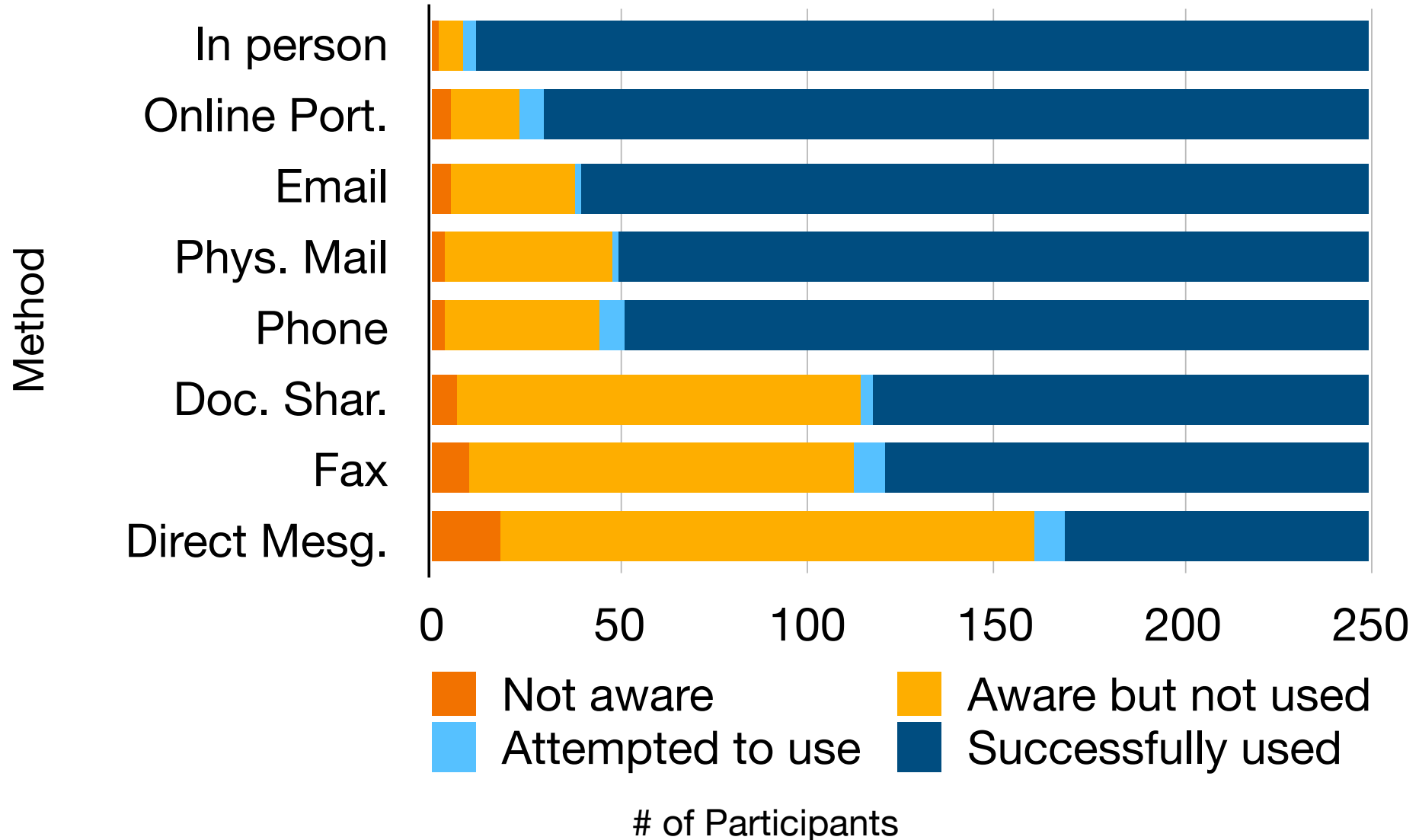
# Survey Two

- First: what methods have you used to send sensitive docs?
- Randomly assigned **one** method they had successfully used
- What were they sending? To whom?
- How satisfied with privacy and convenience were they? Why?
- What risks were they concerned about?

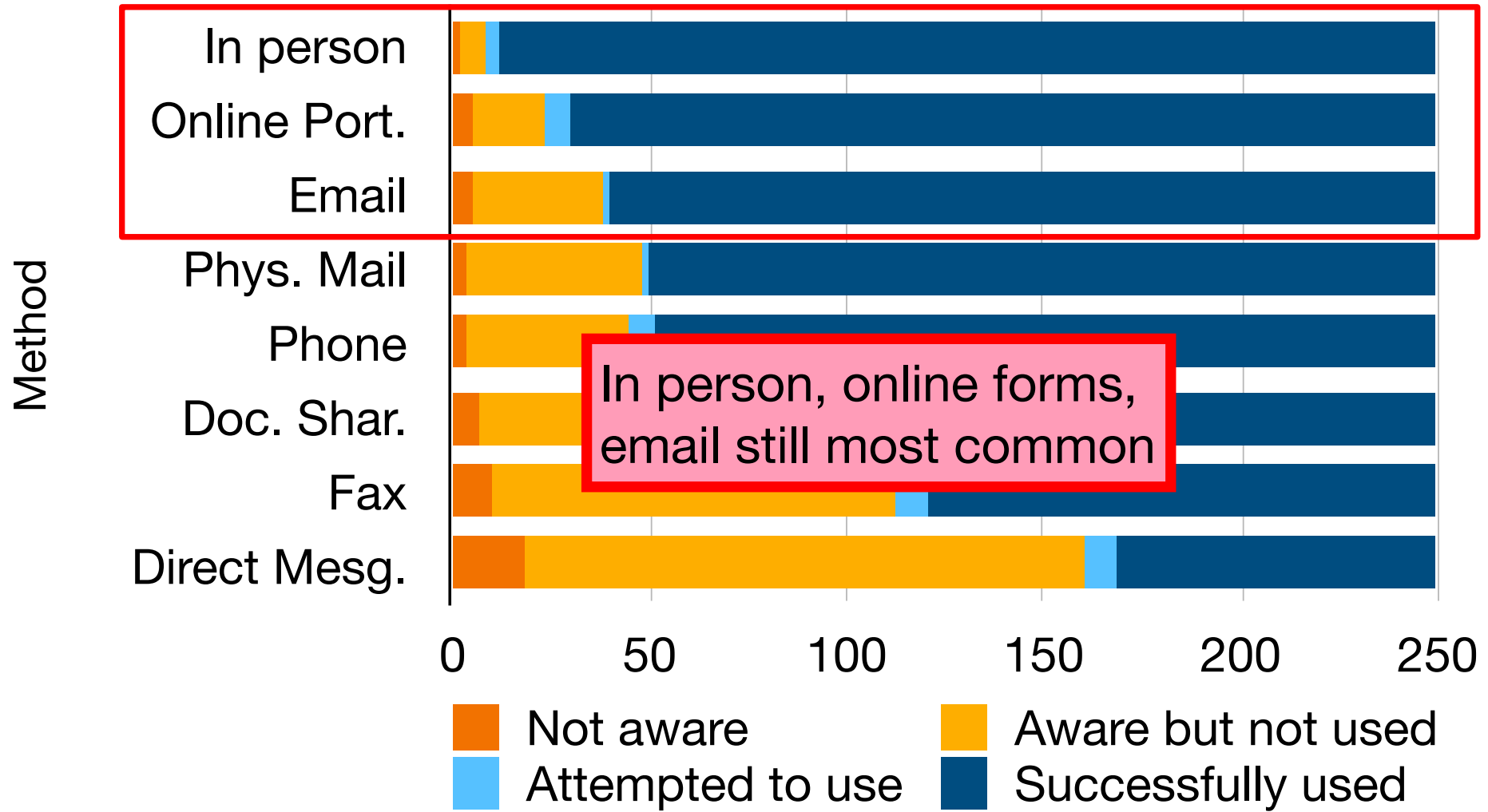


**What methods did people use?**

# What methods did people use?



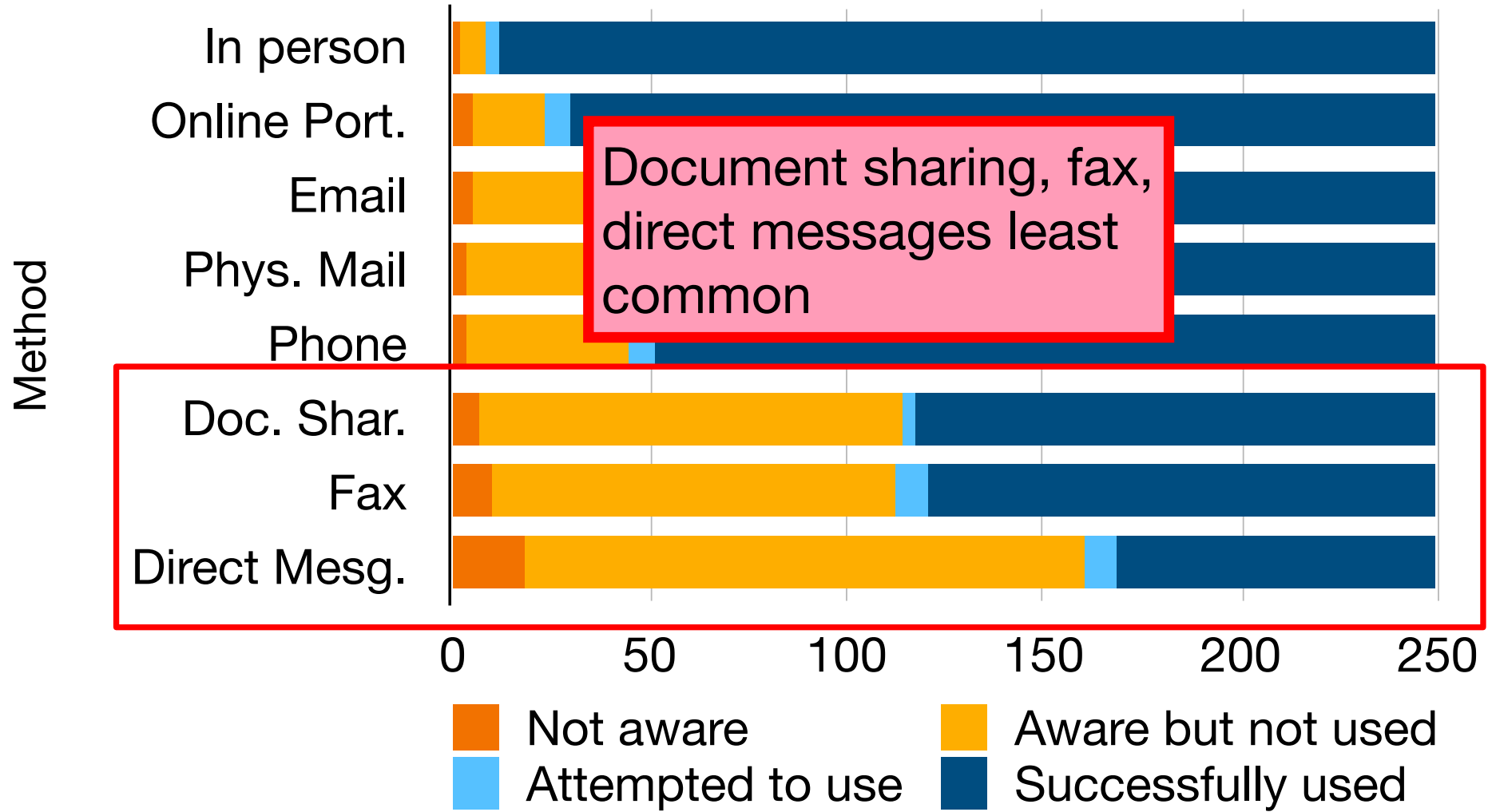
# What methods did people use?



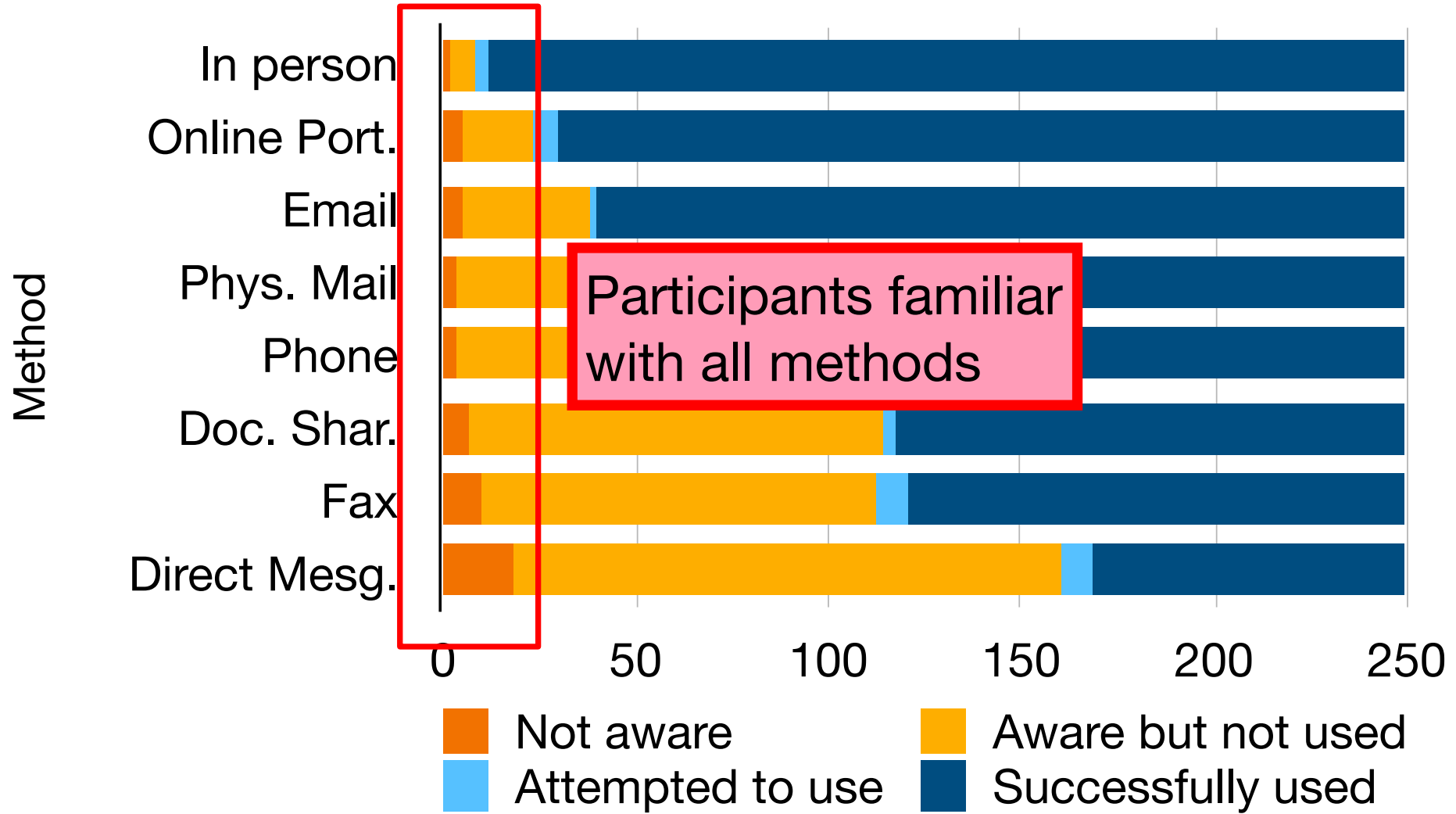
In person, online forms, email still most common

# of Participants

# What methods did people use?



# What methods did people use?

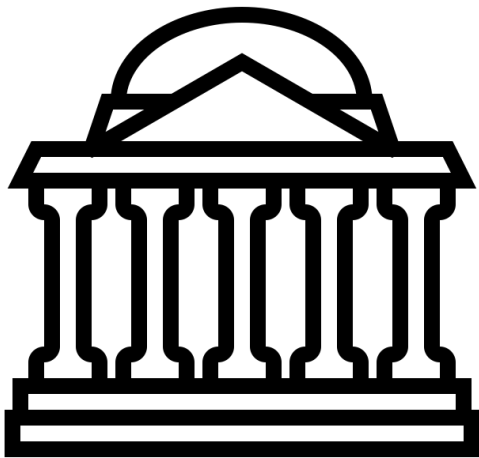


# of Participants

# Contextual details

# Contextual details

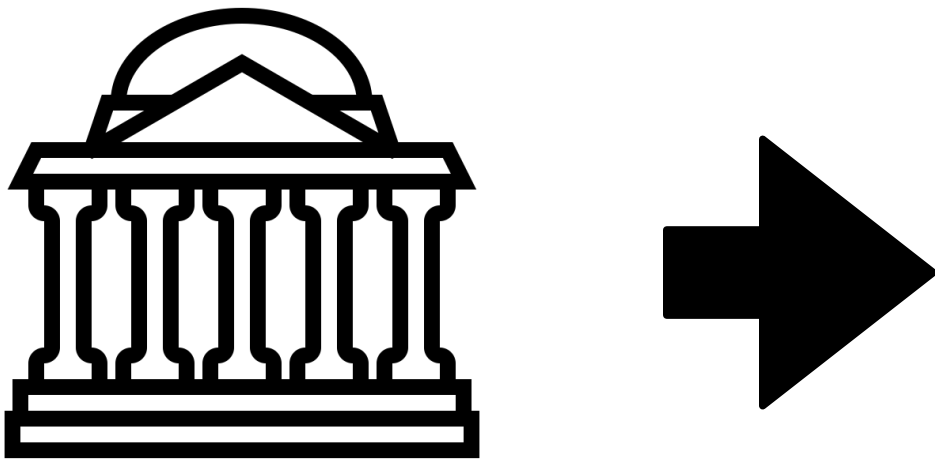
- Recipients usually “official”



Created by Mochamad Frans Kurnia  
from Noun Project

# Contextual details

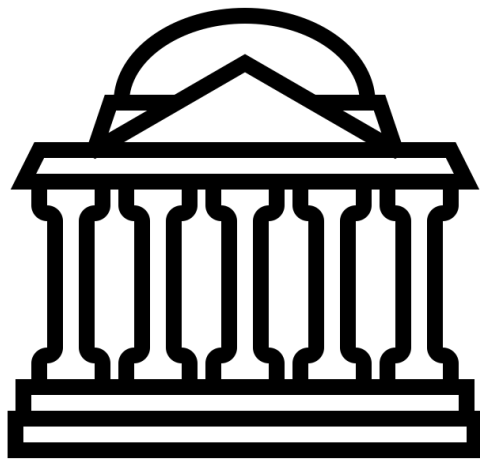
- Recipients usually “official”
- These recipients usually dictated the methods



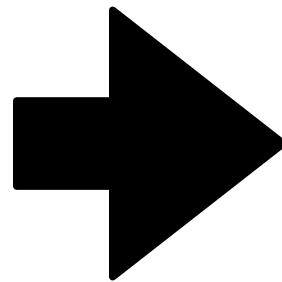


# Contextual details

- Recipients usually “official”
- These recipients usually dictated the methods
- Documents usually financial or identity-related

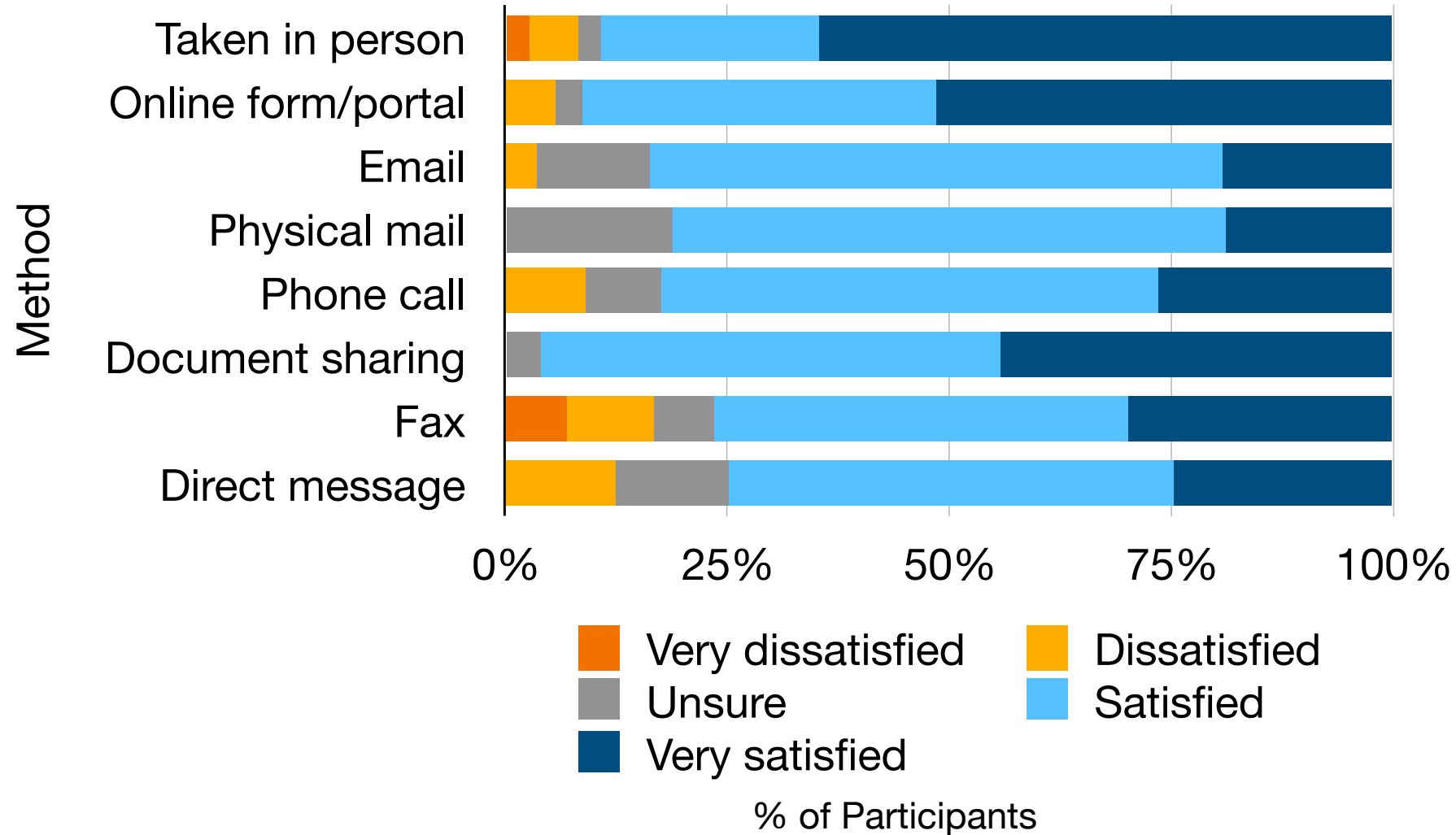


Created by Mochamad Frans Kumia  
from Noun Project

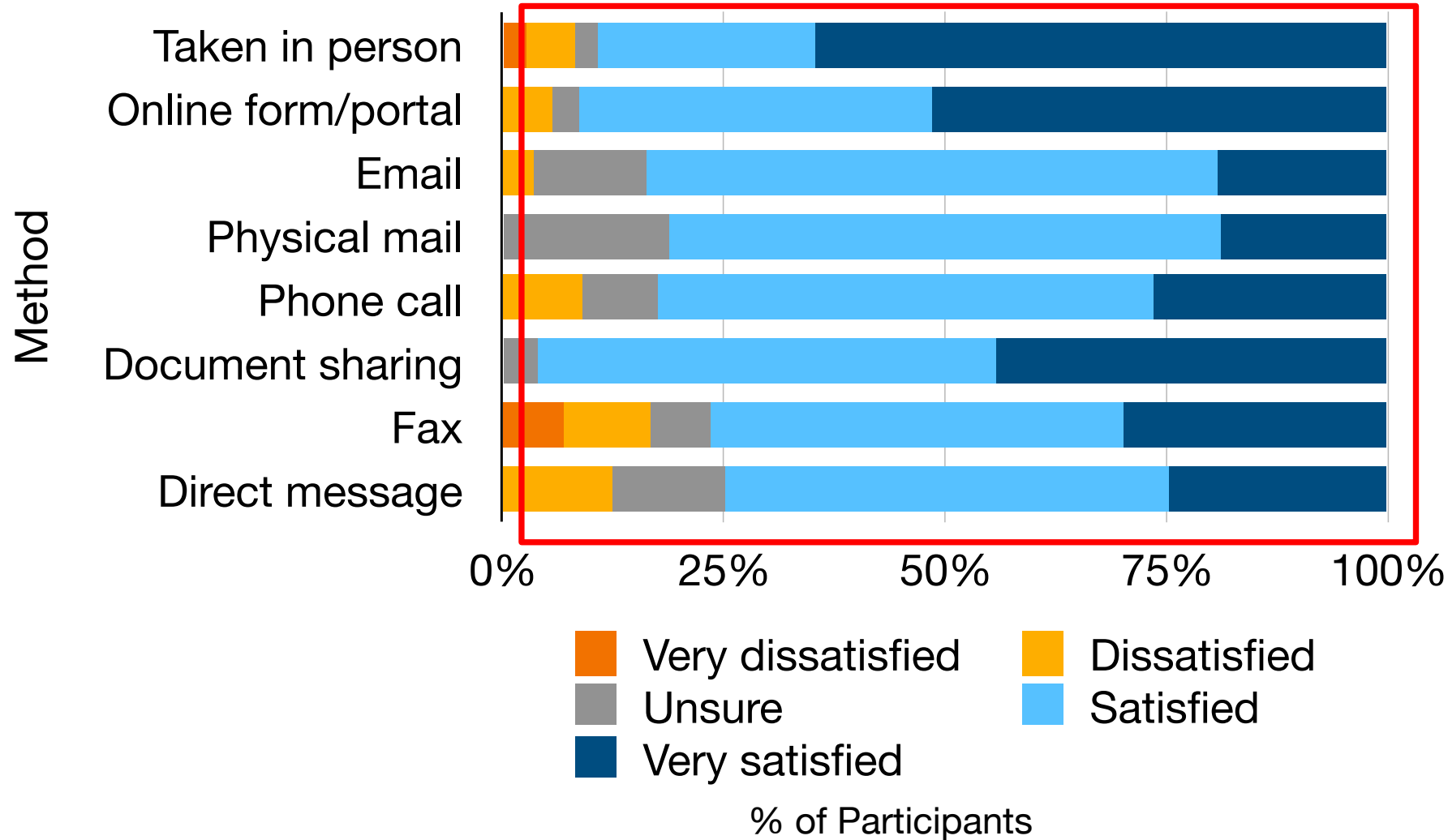


Created by I Putu Kharismayadi  
from Noun Project

# Still satisfied with privacy



# Still satisfied with privacy



Still very satisfied!

# Factors associated with privacy satisfaction

# Factors associated with privacy satisfaction

- Ordinal logistic regression

# Factors associated with privacy satisfaction

- Ordinal logistic regression
- More dissatisfied:

# Factors associated with privacy satisfaction

- Ordinal logistic regression
- More dissatisfied:
  - Email, fax, phone, mail (baseline: in person)

# Factors associated with privacy satisfaction

- Ordinal logistic regression
- More dissatisfied:
  - Email, fax, phone, mail (baseline: in person)
  - Risk at the destination



# Factors associated with privacy satisfaction

- Ordinal logistic regression
- More dissatisfied:
  - Email, fax, phone, mail (baseline: in person)
  - Risk at the destination
  - Sending financial information

# Factors associated with privacy satisfaction

- Ordinal logistic regression
- More dissatisfied:
  - Email, fax, phone, mail (baseline: in person)
  - Risk at the destination
  - Sending financial information
- More satisfied

# Factors associated with privacy satisfaction

- Ordinal logistic regression
- More dissatisfied:
  - Email, fax, phone, mail (baseline: in person)
  - Risk at the destination
  - Sending financial information
- More satisfied
  - The method is secure

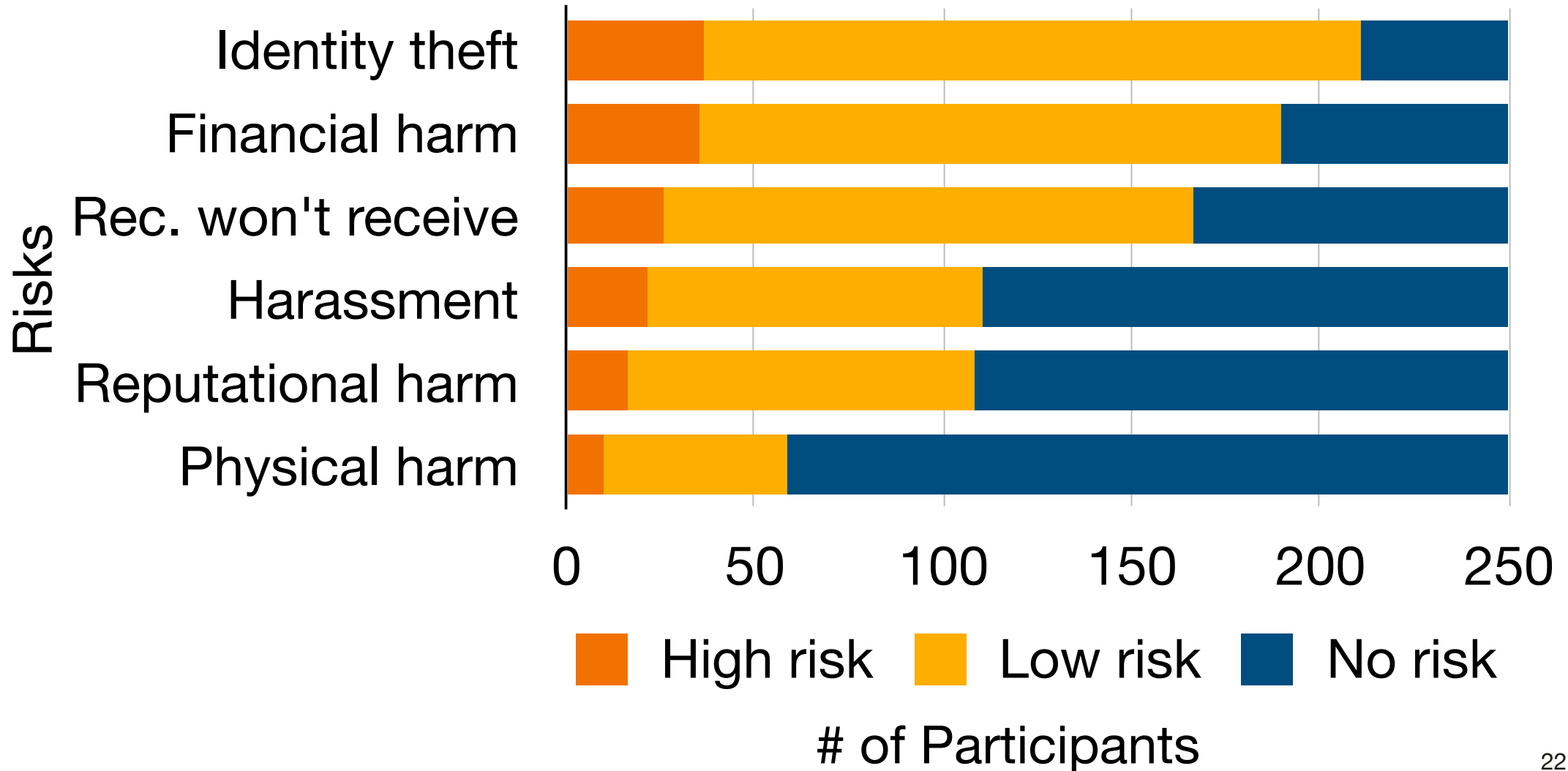
# Factors associated with privacy satisfaction

- Ordinal logistic regression
- More dissatisfied:
  - Email, fax, phone, mail (baseline: in person)
  - Risk at the destination
  - Sending financial information
- More satisfied
  - The method is secure
  - The recipient will protect the data

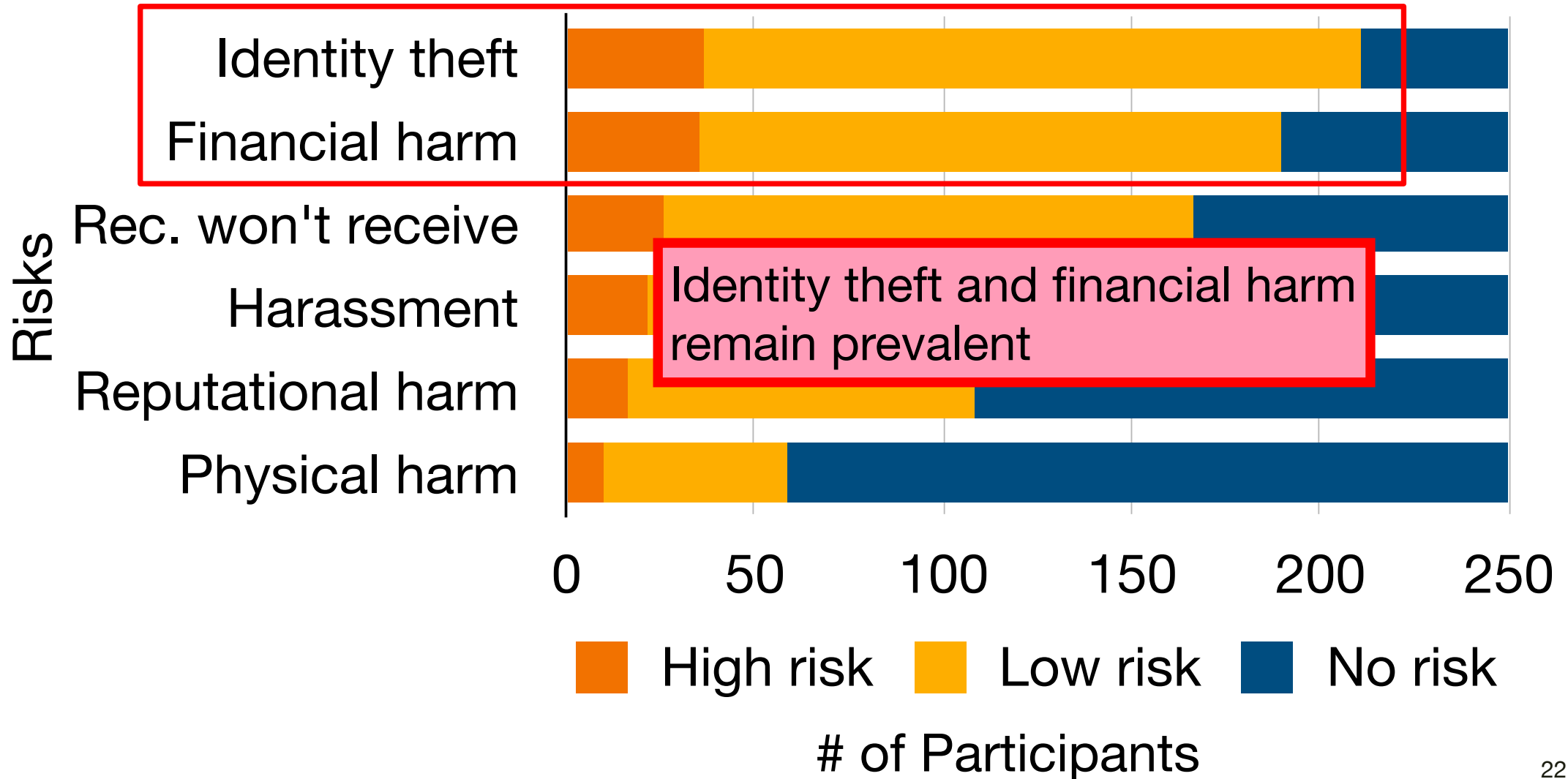
# Factors associated with privacy satisfaction

- Ordinal logistic regression
- More dissatisfied:
  - Email, fax, phone, mail (baseline: in person)
  - Risk at the destination
  - Sending financial information
- More satisfied
  - The method is secure
  - The recipient will protect the data
  - Sending social security numbers

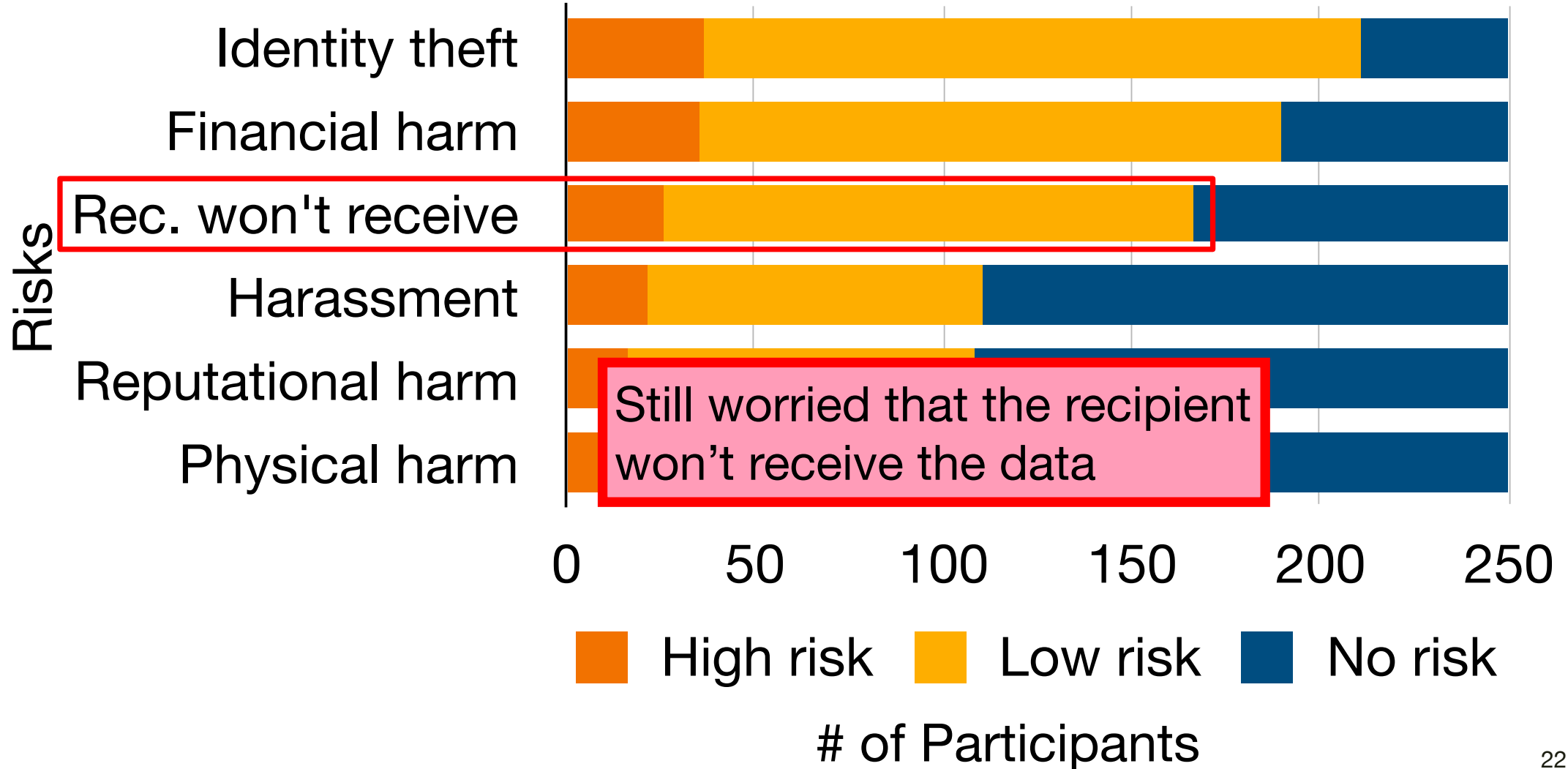
# Identified risks



# Identified risks

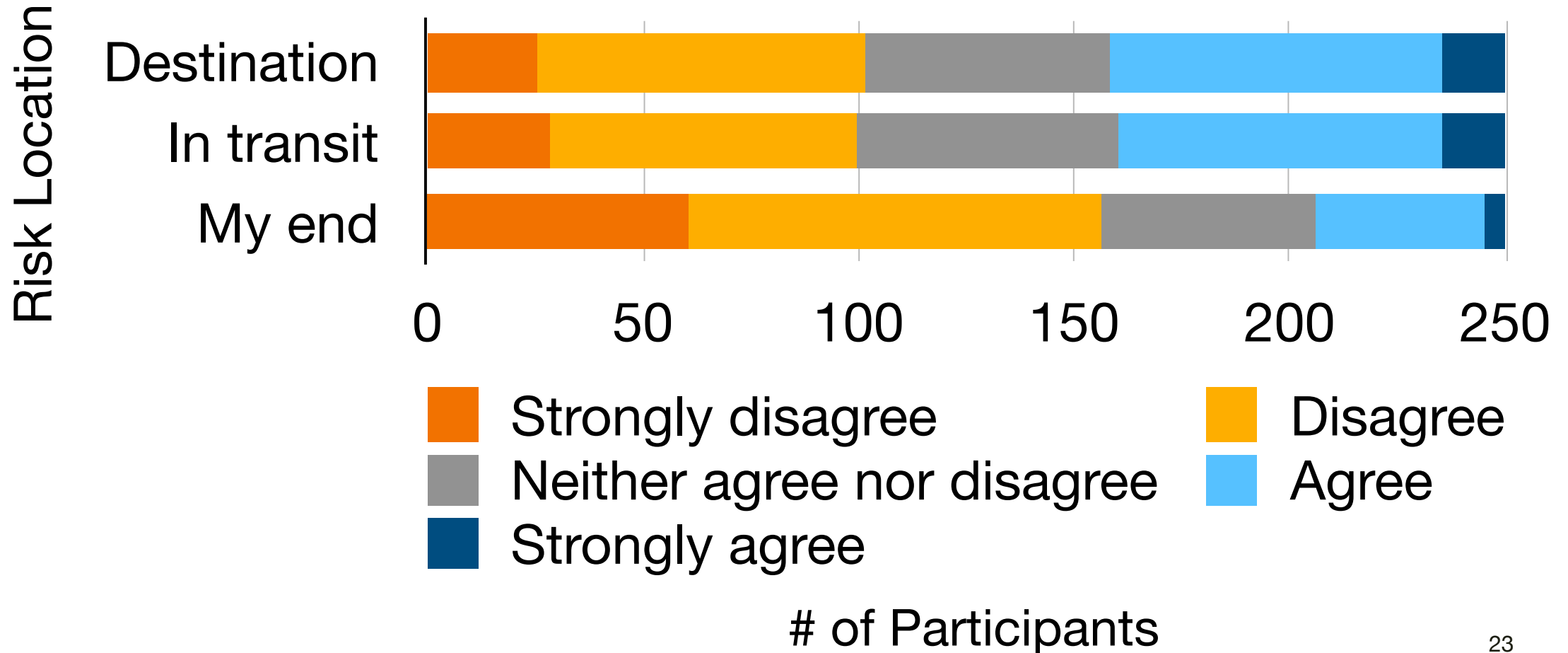


# Identified risks



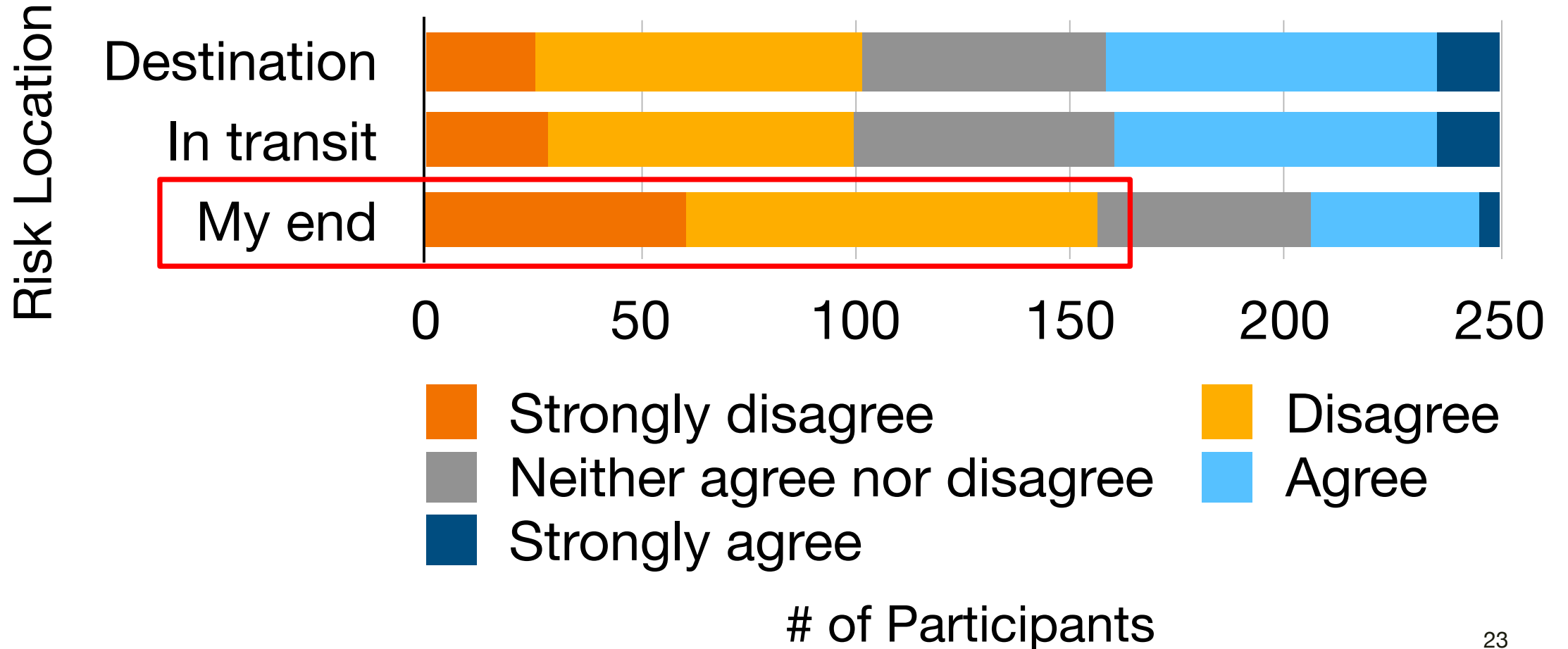


# Location of risk is not at my end



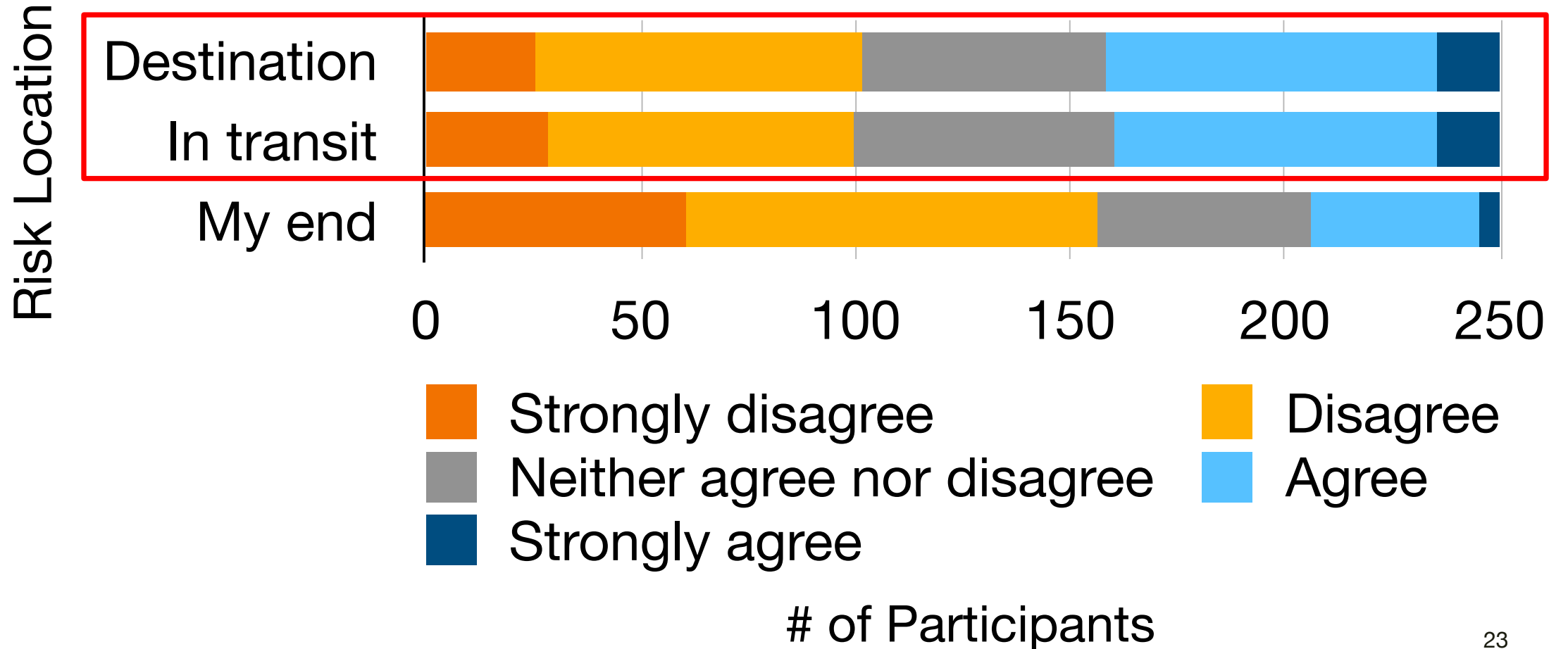
# Location of risk is not at my end

Less risk on the participant's end



# Location of risk is not at my end

Risk at destination similar to risk in transit when prompted



# Summary

# Summary

- Two surveys to identify methods, perception of privacy, and risks of sending sensitive docs

# Summary

- Two surveys to identify methods, perception of privacy, and risks of sending sensitive docs
- Participants primarily use email, online forms, or simply take the documents in person

# Summary

- Two surveys to identify methods, perception of privacy, and risks of sending sensitive docs
- Participants primarily use email, online forms, or simply take the documents in person
- Participants are aware of other methods

# Summary

- Two surveys to identify methods, perception of privacy, and risks of sending sensitive docs
- Participants primarily use email, online forms, or simply take the documents in person
- Participants are aware of other methods
- The data is at risk at the destination



# Summary

- Two surveys to identify methods, perception of privacy, and risks of sending sensitive docs
- Participants primarily use email, online forms, or simply take the documents in person
- Participants are aware of other methods
- The data is at risk at the destination

Noel Warford – [nwarford@cs.umd.edu](mailto:nwarford@cs.umd.edu)  
University of Maryland, College Park

