# Santé publique pour la prévention des attaques par logiciels malveillants

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Journée de la recherche du FRQNT
16 mai 2018

# Computer threats

## What's the problem ?

**2.3** connected devices *per capita* in 2016 → **3.6** in 2021 [1]
**4.6** trillion of Internet users in 2021 [1]

**285,000** new malware samples everyday in 2017 [2]
**136** public data breaches in 2005 → **7,885** in 2018 [3]

Ransomware alone costed **5** billion USD in 2017 [4]
Global cost of attacks estimated at **6** trillion USD in 2021 [4]

[1] Cisco System, 2017. [2] PandaLabs, 2017. [3] Privacy Rights ClearingHouse, 2018. [4] Cybersecurity Ventures, 2017.

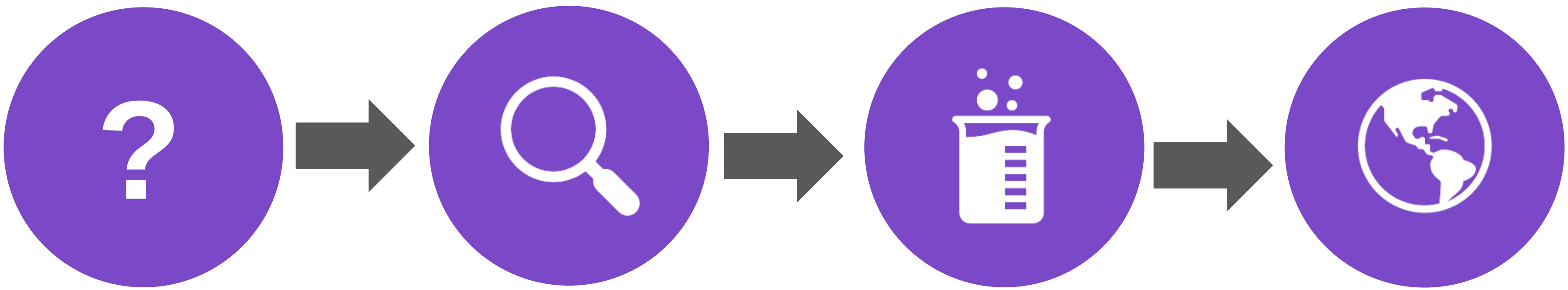
# Prevention

## What are the solutions ?

# Public health

> “Public health is defined as the science of protecting the safety and improving the health of communities through education, policy making and research for disease and injury prevention.”
>
> — Public Health Agency of Canada

# Public health framework



**Define the problem**

Identify and understand ‘who’, ‘what’, ‘when’, ‘where’, and ‘how’.

**Identify risk and protective factors**

Identify the causes and correlates related to the problem

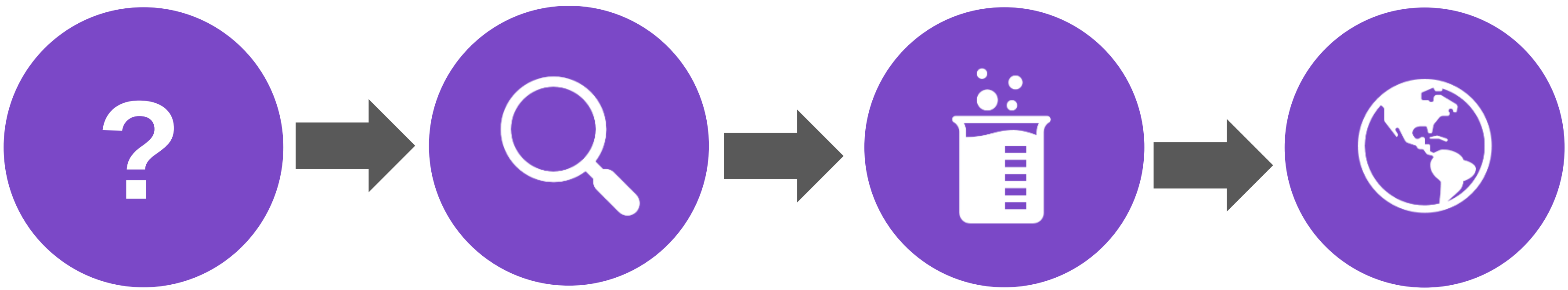
**Develop and test strategies**

Develop and evaluate prevention strategies

**Ensure global adoption**

Implement and disseminate the strategies

# Application to malware prevention



**Define the problem**

Study the trends and patterns of malware attacks

**Identify risk and protective factors**

Identify the causes and correlates related to Malware attacks

**Develop and test strategies**

Develop and evaluate strategies aimed at preventing and/or reducing malware attacks

**Ensure global adoption**

Implement and promote strategies proven effective at preventing and/or reducing malware attacks

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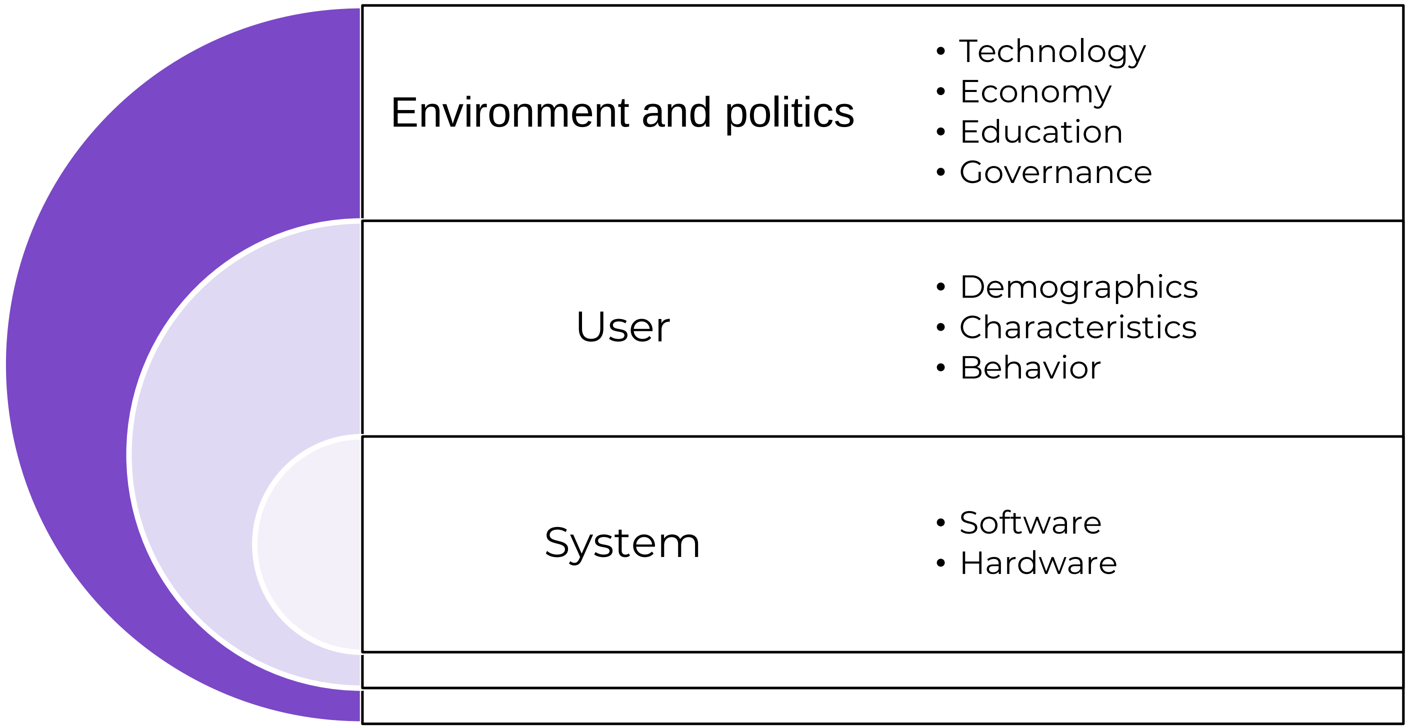
# Identify risk and protective factors



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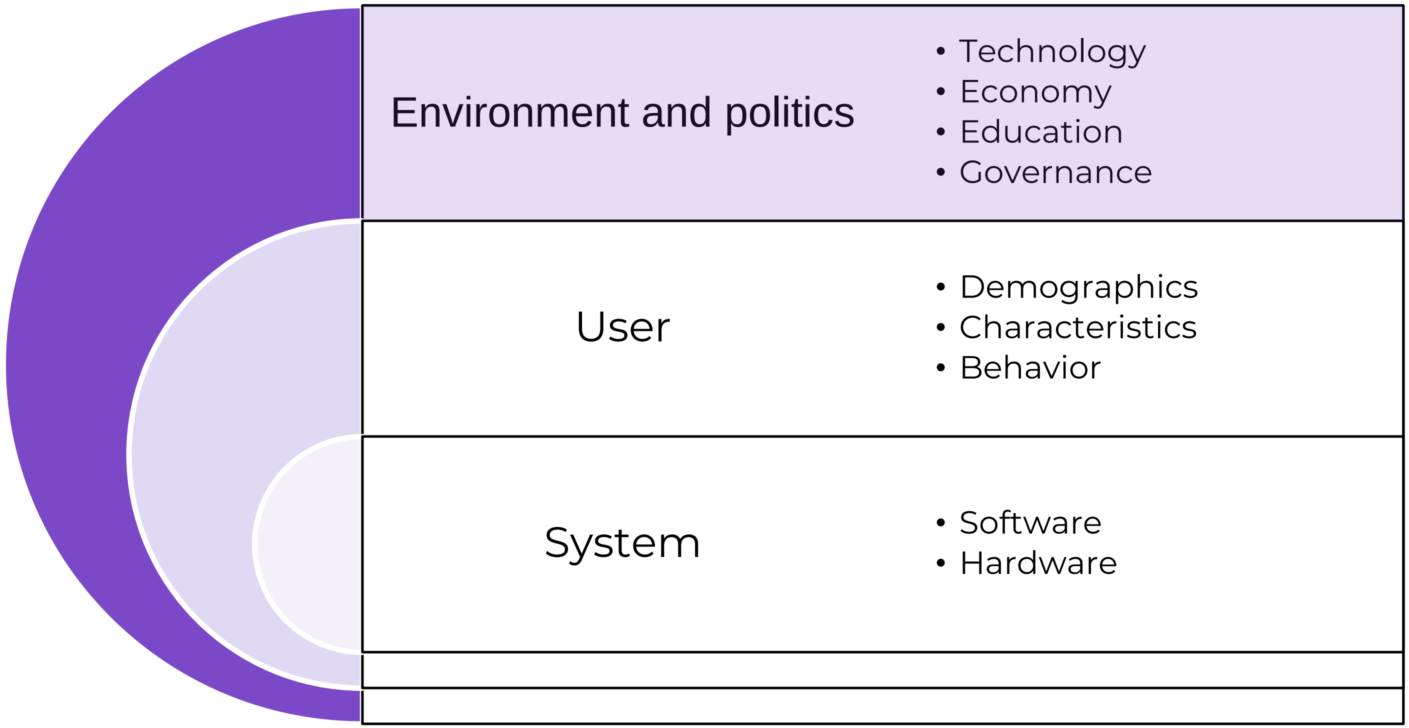


# National-level factors

What **national-level** factors correlate with the rate of malware infections ?

**10+ M**

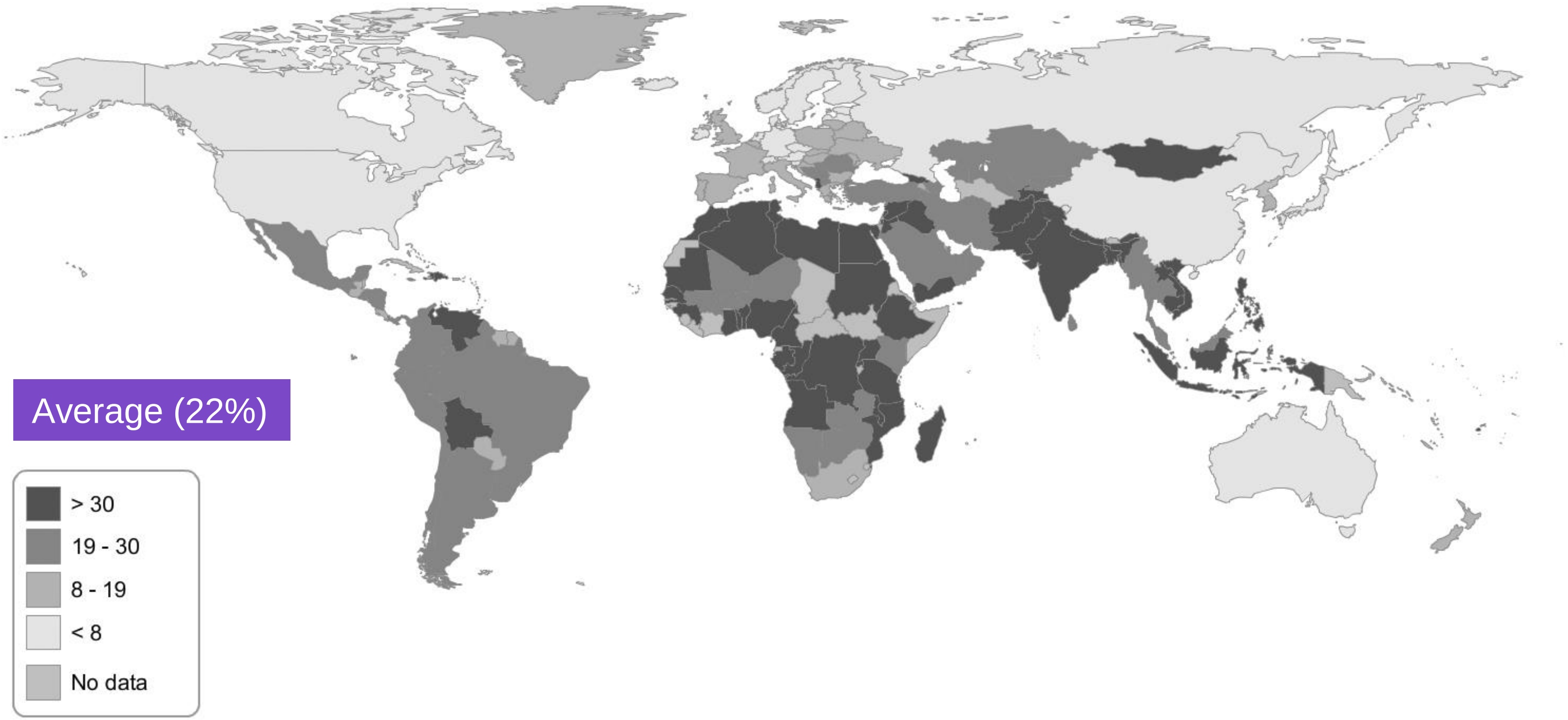
10+ million unprotected devices running Windows
Malware infections from MSRT
June to September 2014

186 countries
15 factors

Economy | Education | Technology | Cybersecurity

F. Lalonde Lévesque et al., *National-level risk assessment: A multi-country study of malware infections*, WEIS 2016.

# National-level factors

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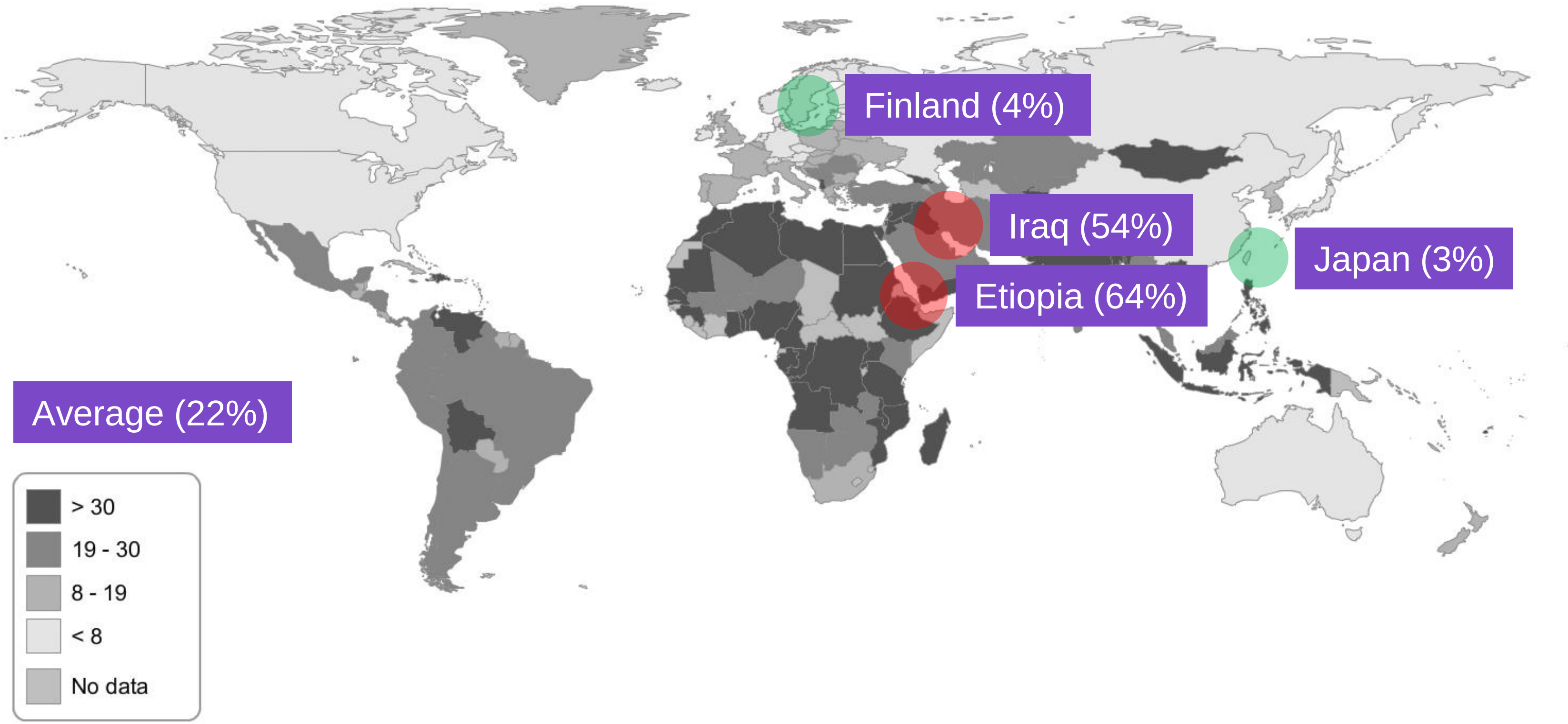


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# National-level factors

## Multi-level risk analysis by **HDI status**

**HDI**
>= 0.8

45 countries
10% average infection rate

**10%**

0.8 >
**HDI**
>= 0.55

74 countries
26% average infection rate

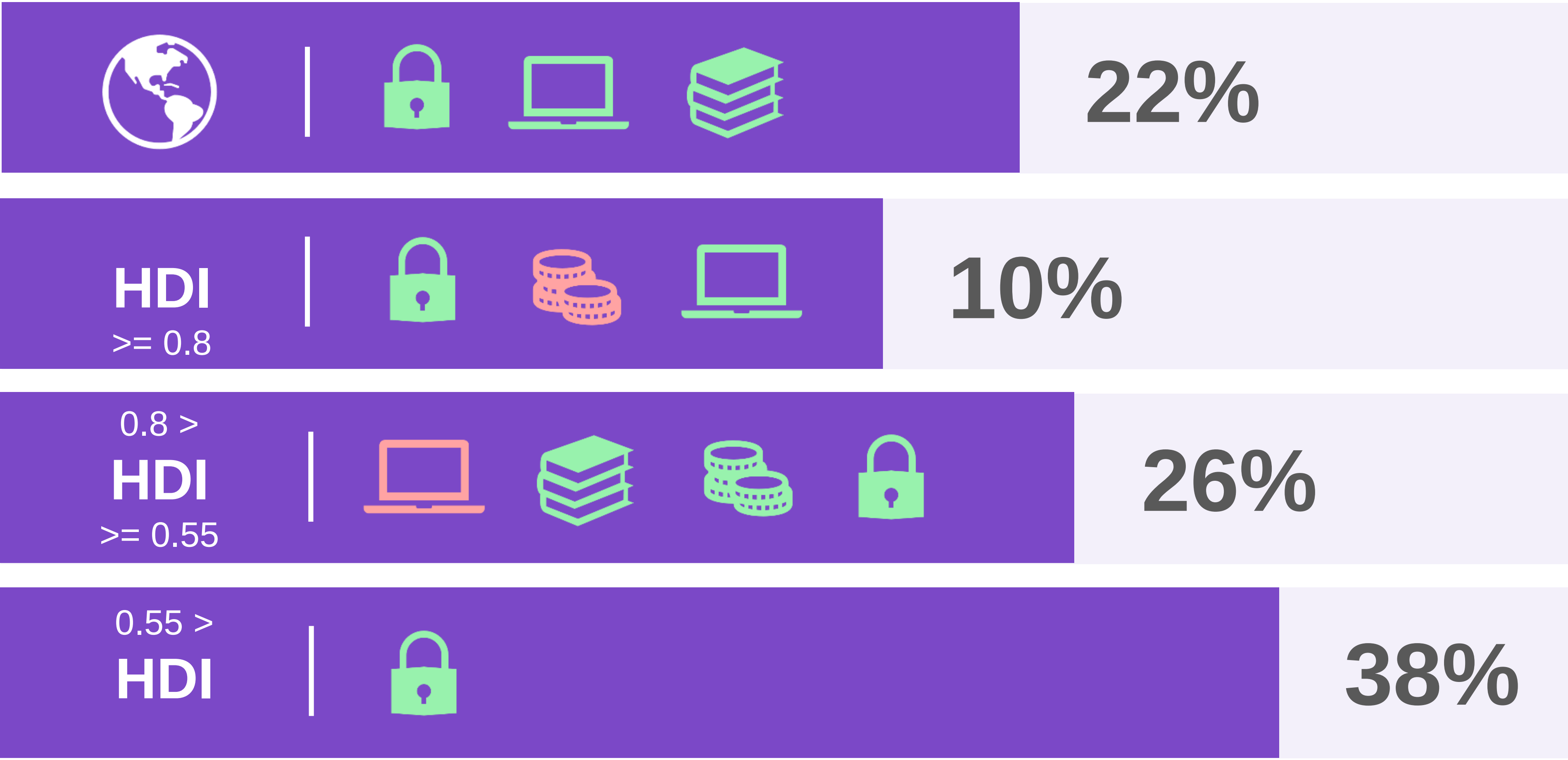
**26%**

0.55 >
**HDI**

26 countries
38% average infection rate

**38%**

F. Lalonde Lévesque et al., *National-level risk assessment: A multi-country study of malware infections*, WEIS 2016.

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# Identify risk and protective factors

| | |
|---|---|
| Environment and politics | • Technology<br>• Economy<br>• Education<br>• Governance |
| User | • Demographics<br>• Characteristics<br>• Behavior |
| System | • Software<br>• Hardware |

# User-level factors

Are **age** and **gender** independent risk factors of malware victimisation ?

**10+ M**

10+ million devices running Windows 10
Malware encounters from Windows Defender
October to December 2015

**Male**
Female

0-17, 18-24, 25-34, 35-49, **50+**

F. Lalonde Lévesque et al., *Age and gender as independent risk factors of malware victimisation*, BHCI 2017.

# User-level factors

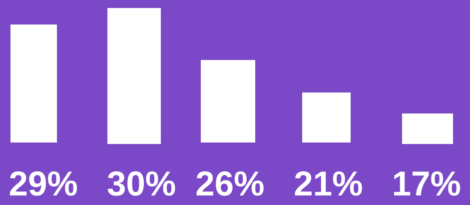
## Risk analysis of **age** and **gender**

**1.32**

Male are 1.32 more likely to encounter malware than female


**1.99**

Age group 18-24 is 1.99 more likely to encounter malware than the 50+ age group

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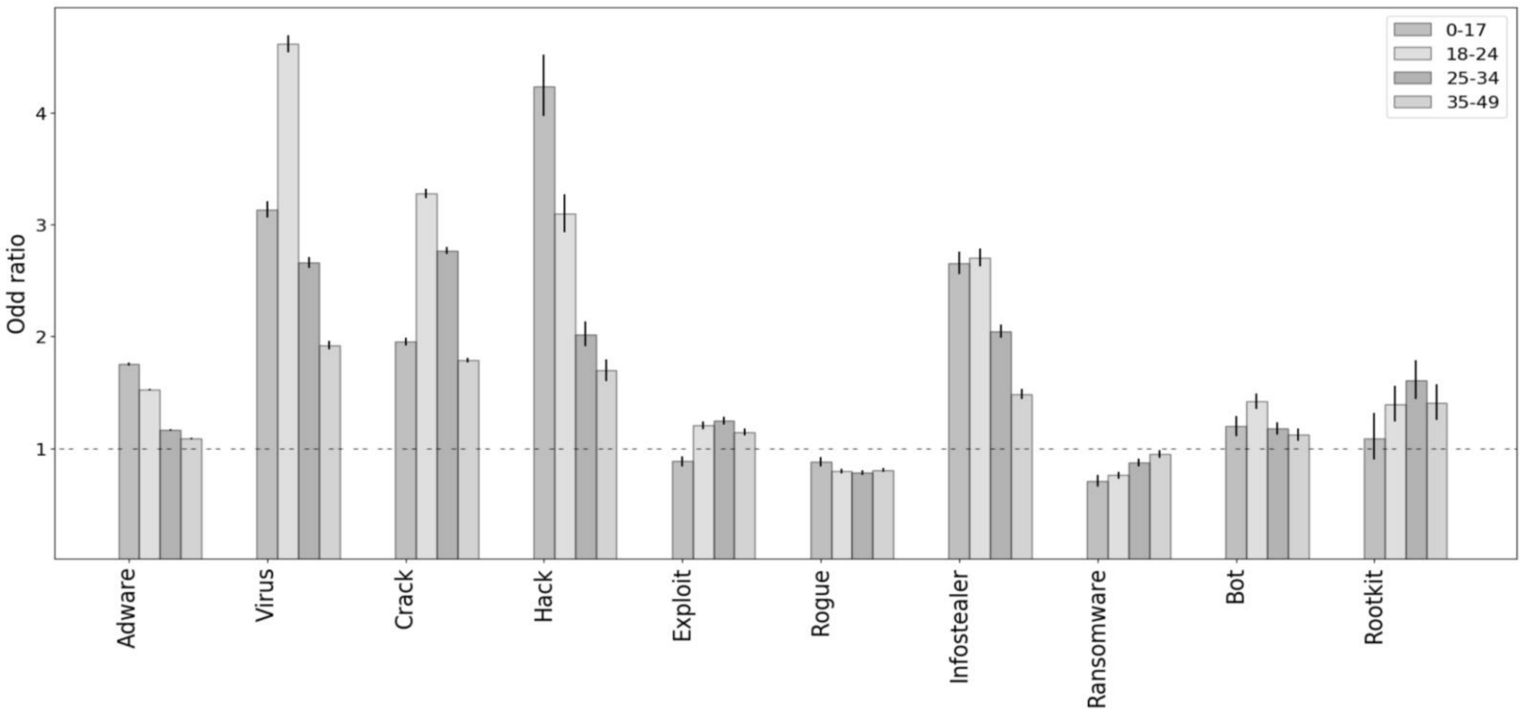
# User-level factors

## Risk analysis of **age** by **malware types**

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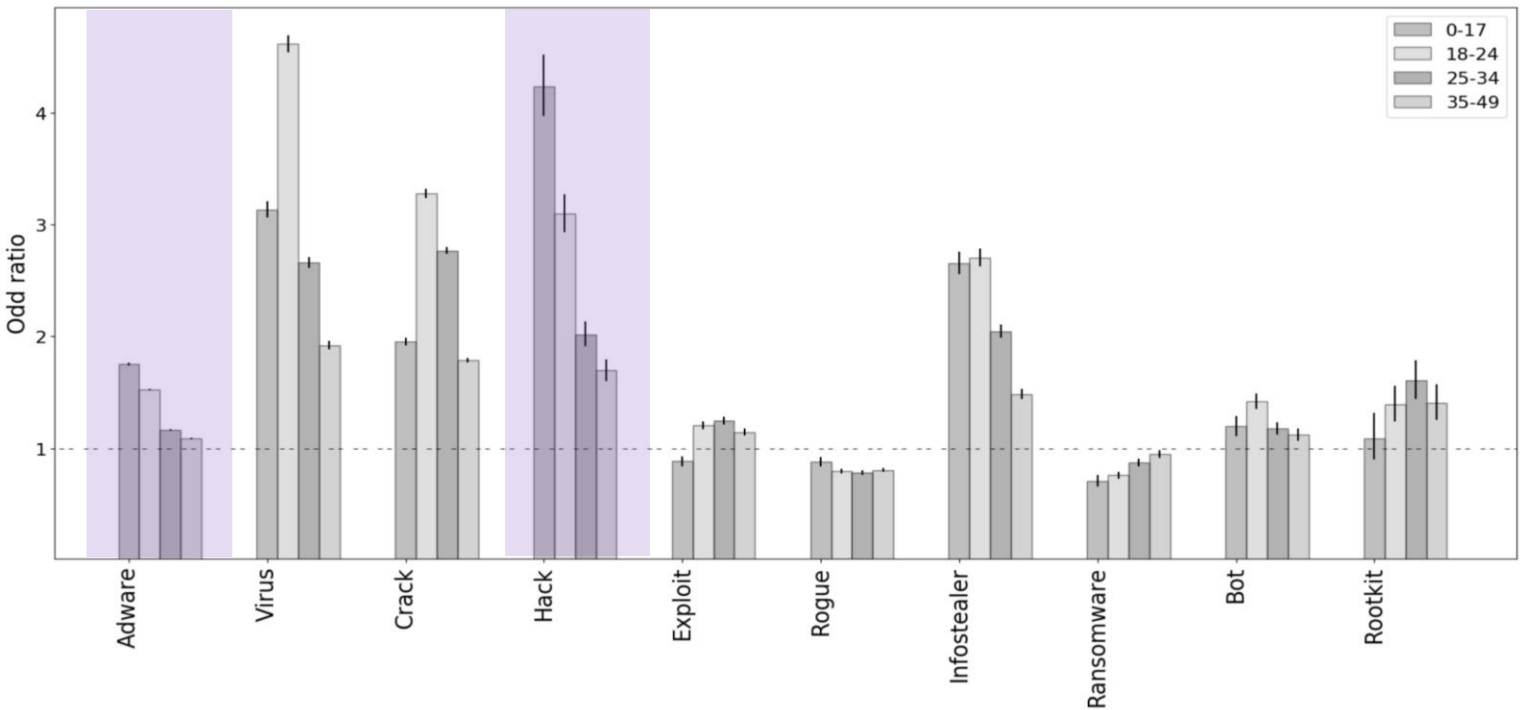


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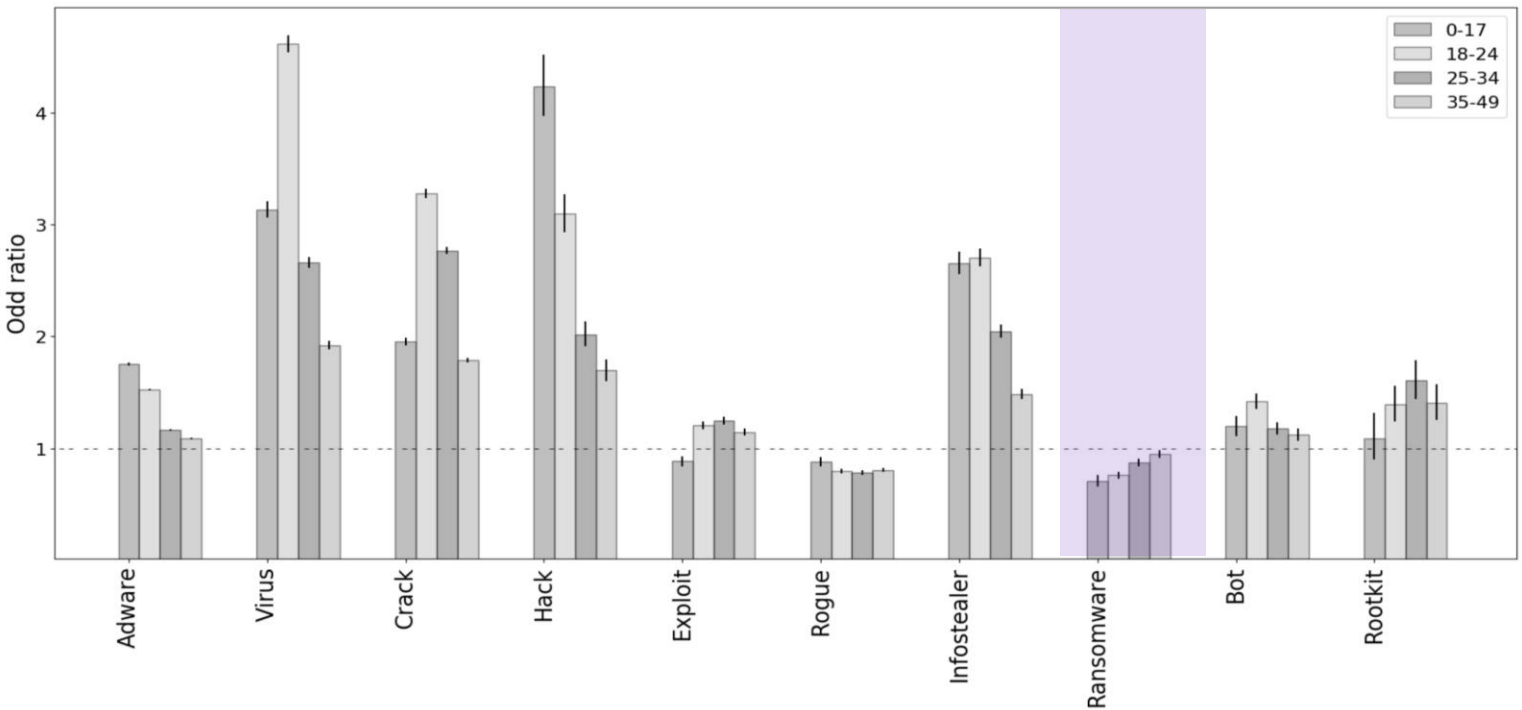


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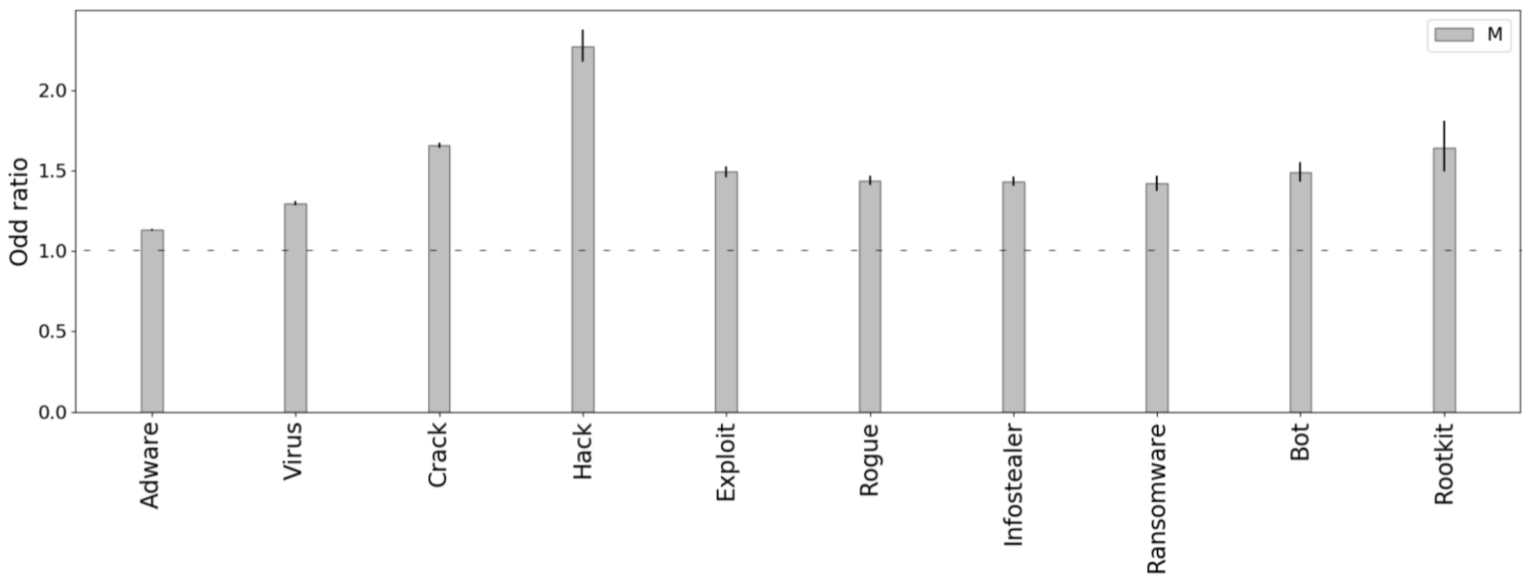
# User-level factors

## Risk analysis of **gender** by **malware types**

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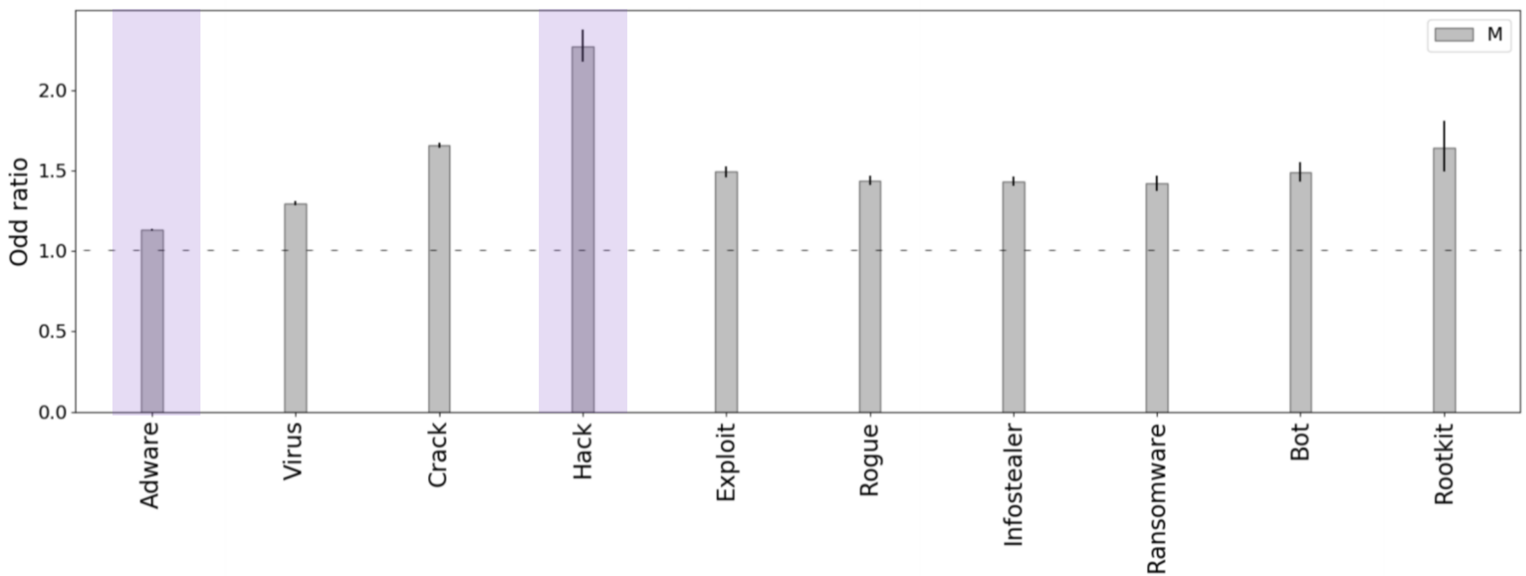


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# Findings and implications

Identification of risk and protective factors at the national and user level

Identification of *at-risk* populations

Direction and magnitude of  factors differ depending on the context

Support evidence-based decision making and prioritisation of effort

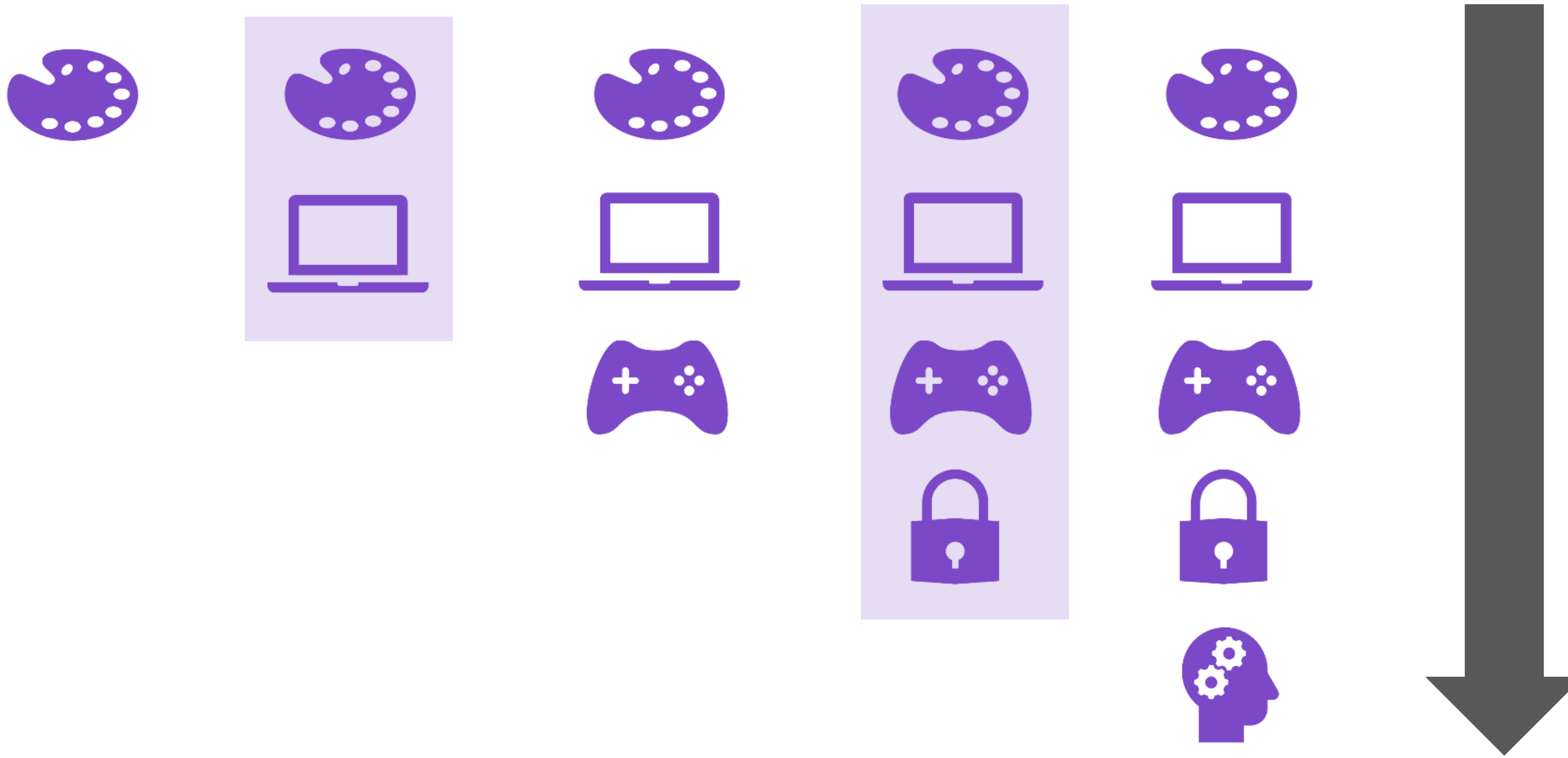
Design of targeted interventions

Development of *ecologic* strategies

# Future perspectives

- Establish sound causation
- Investigate more multi-level factors
- Extend the application of the public health model to information security

# About me...



POLYTECHNIQUE MONTRÉAL

Carleton UNIVERSITY

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# Thanks !

Fonds de recherche sur la nature et les technologies Québec

NSERC CRSNG

Microsoft

ELEMENT AI

# Questions ?

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