



Revealing the Difference Between Offender and Non-Offender Password Creation Strategies: What can we learn from criminals?

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Influence of the environment on password choice

- **Country** (Grobler et al., 2020)
- **Level of literacy in their country** (Bergeron, 2022)
- **Data breaches exposure** (Bergeron, 2022)
- **Sexe** (Juozapavičius et al., 2022)
- **Age** (Juozapavičius et al., 2022)
- **Religion** (He et al., 2021)
- **Web services** (Wei et al., 2018)



Objective

➤ Observe if the criminal nature of a network influences password characteristics and strength

➤ Characteristics of the passwords of both networks will be different from one another

Hypotheses

➤ Criminal network of online offenders will be more likely to choose stronger password than a non-offenders' network

Method

➤ Open-source data

- *Databases were illegally hacked by individuals and put online*
- *Leaked databases found online*

Database with passwords

Username	Password
mvilleneuve@hotmail.com	llovemom
ddh@yahoo.com	password
fuegofranco@gmail.com	qwerty
nathalieGobeil@gmail.com	P@ssword123
cutecatlove@hotmail.com	LouisH2019
fredaubin222@gmail.com	43556423111

What is a hash?

Objective: attributing
unique value

Irreversible

Example:

andrea = 1c42f9c1ca2f65441465b43cd9339d6c

Andrea = 28f719c89ef7f33ce2e178490676b5ab

Hashed passwords

9c898fc91987d3a07e92efdb22f0a533:2fnKDAsf

b2bd18b0081c0ddfb4abd5996ac62916:OE2SuGcP

1d61f91492b6c2144adf33bbad7c9918:7FcsIRvM

fae2dff15bd864fdf13a9f71dddd35d4:PTYPYK6M

207ea21eaa47b28728bc298a786fb101:JoRrEUV7

d9bf6bb63cdc61ead6e288557973bc54:aCy54uQC

Tables to compare hash values

Popular passwords

Dictionnary words

Names

Word in clear text	Hash value
123456	e10adc3949ba59abbe56e057f20883e
123456789	25f9e794323b453885f5181f16624d0b
Password	5f4dcc3b5aa765d61d8327deb882cf99
Adobe123	7558af202997483d3afef3bb265a709d
12345678	25d55ad283a400af464c76d713c07ad
Qwerty	d8578edf8458ce06fbc5bb76a585ca4
1234567	fcea920f7412b5da7be0cf42b8c93759
111111	96e79218965eb72c92a549dd5a330112
Photoshop	c7c9cfbb7ed7d1cebb7a4442de308776
123123	4297f441395523524562497399d7a93



Brute force attacks

Trying everything

Time to crack a password according to its characteristics

Number of Characters	Numbers Only	Lowercase Letters	Upper and Lowercase Letters	Numbers, Upper and Lowercase Letters	Numbers, Upper and Lowercase Letters, Symbols
4	Instantly	Instantly	Instantly	Instantly	Instantly
5	Instantly	Instantly	Instantly	Instantly	Instantly
6	Instantly	Instantly	Instantly	1 sec	5 secs
7	Instantly	Instantly	25 secs	1 min	6 mins
8	Instantly	5 secs	22 mins	1 hour	8 hours
9	Instantly	2 mins	19 hours	3 days	3 weeks
10	Instantly	58 mins	1 month	7 months	5 years
11	2 secs	1 day	5 years	41 years	400 years
12	25 secs	3 weeks	300 years	2k years	34k years
13	4 mins	1 year	16k years	100k years	2m years
14	41 mins	51 years	800k years	9m years	200m years
15	6 hours	1k years	43m years	600m years	15 bn years
16	2 days	34k years	2bn years	37bn years	1tn years
17	4 weeks	800k years	100bn years	2tn years	93tn years
18	9 months	23m years	6tn years	100 tn years	7qd years

 HIVE SYSTEMS

-Data sourced from HowSecureisMyPassword.net

ASC2022!



Characteristics of strong passwords



Length



Contains letter and number
(not one or the other alone)



Contains symbols



Does not contain
dictionary words

Samples: two networks to compare



OGUsers
Offenders

125,560 passwords

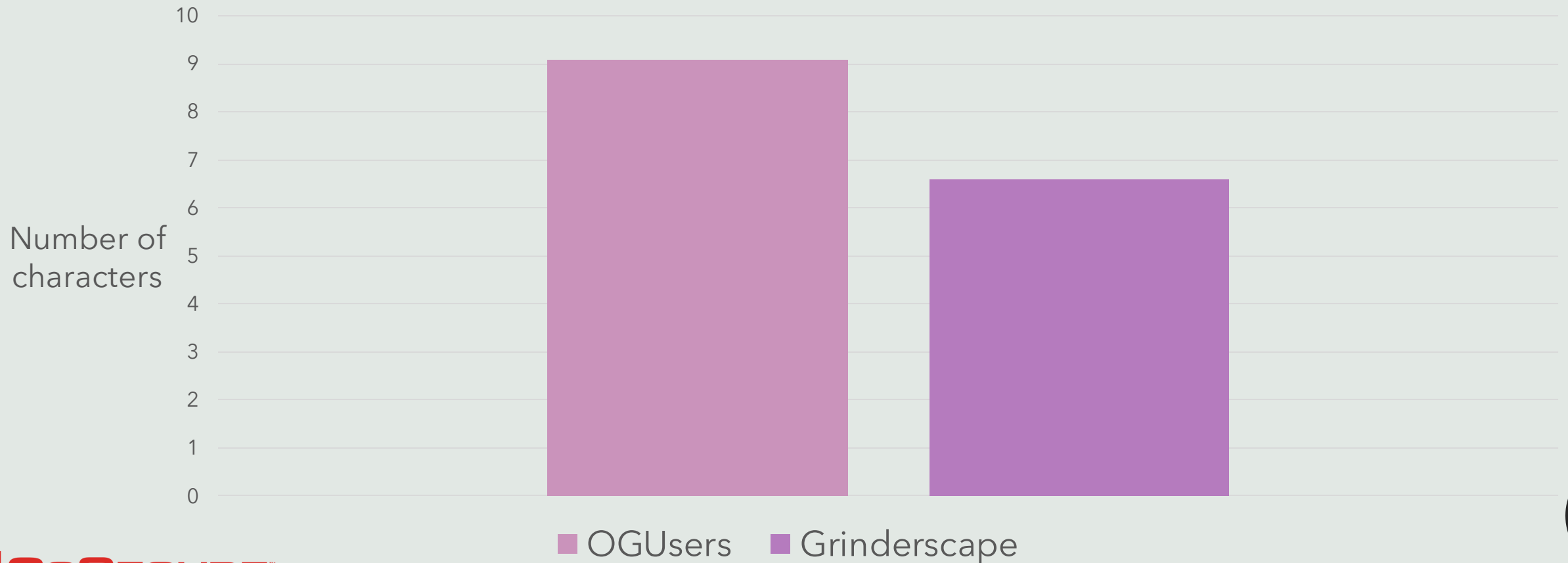


GrinderScape
Non-offenders

1,358,535 passwords

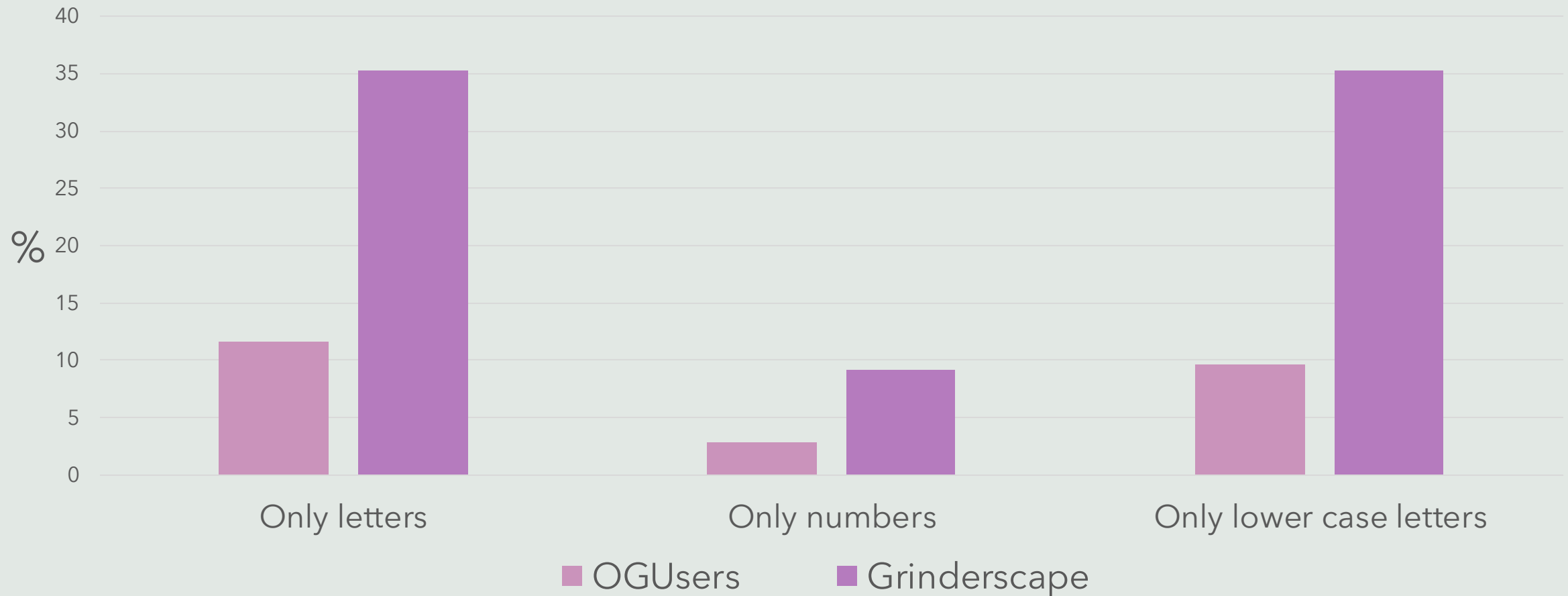
Offenders vs non-offenders network

Mean length of passwords



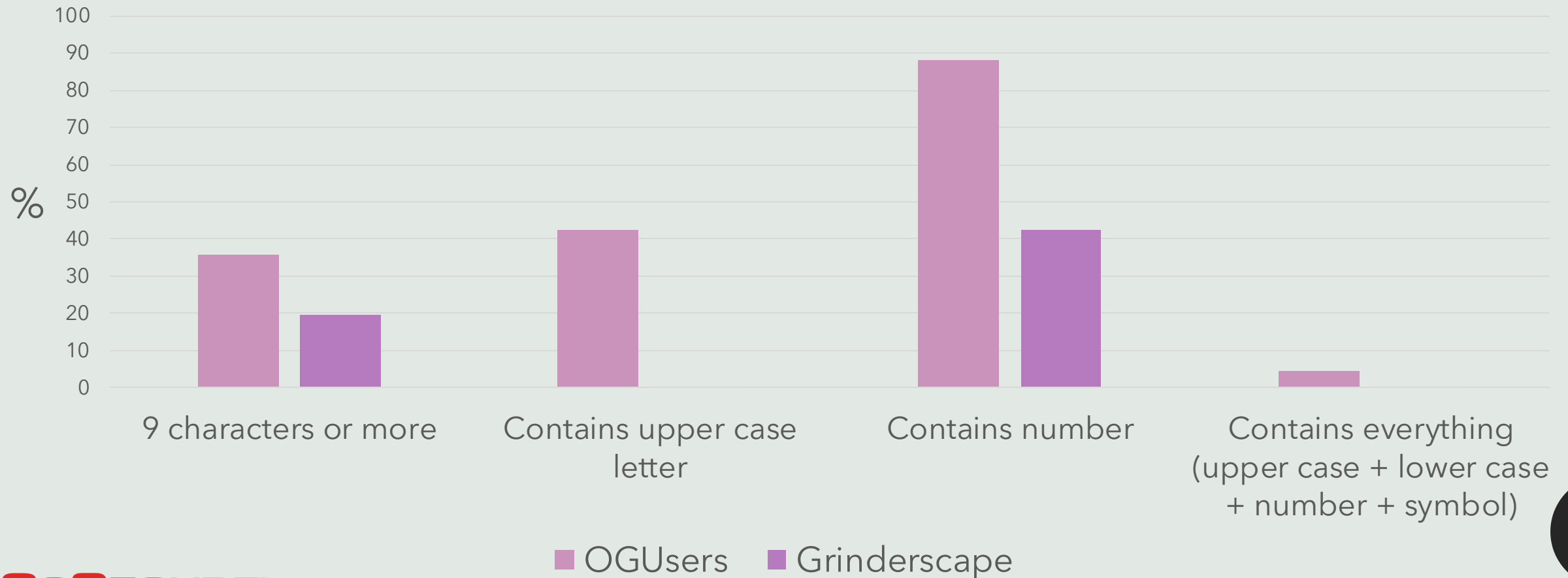
Offenders vs non-offenders network

Characteristics of weak passwords



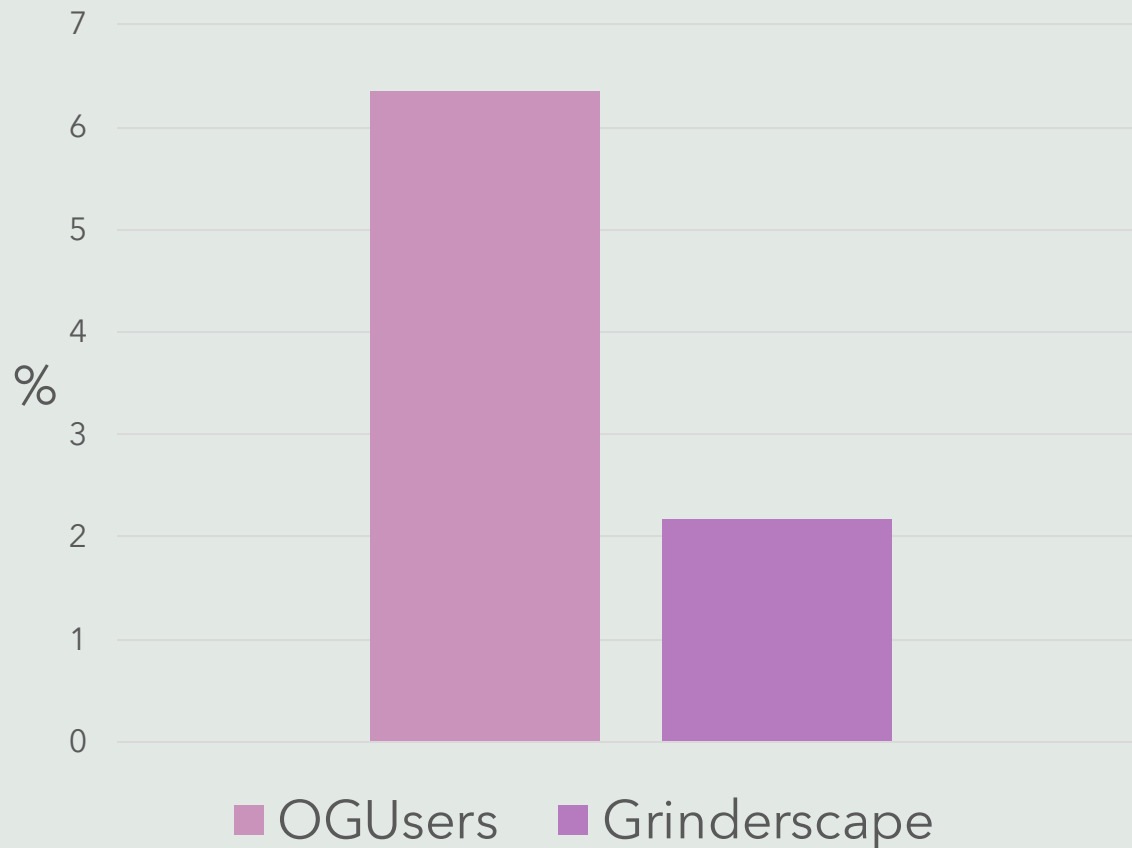
Offenders vs non-offenders network

Characteristics of stronger passwords

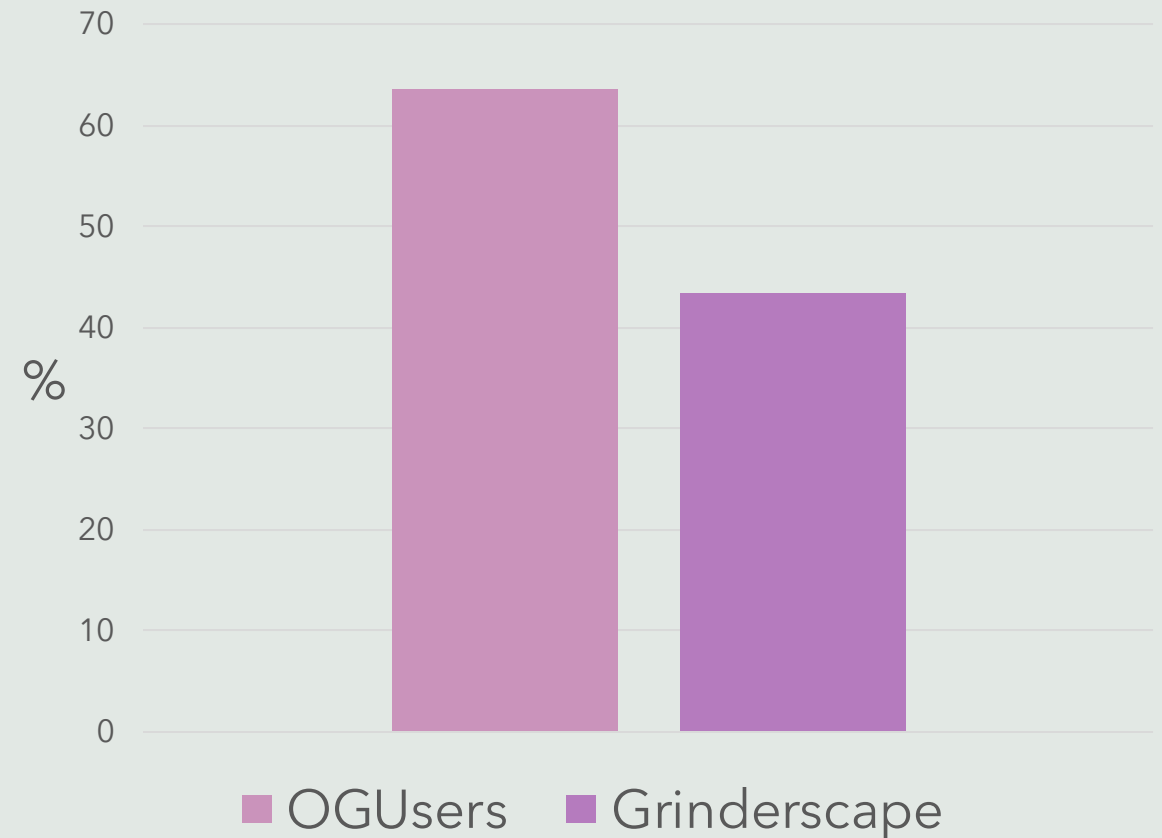


Other interesting characteristics

Use of profanity words in passwords



Use of dictionary words in passwords



Analysis – Logistic regression

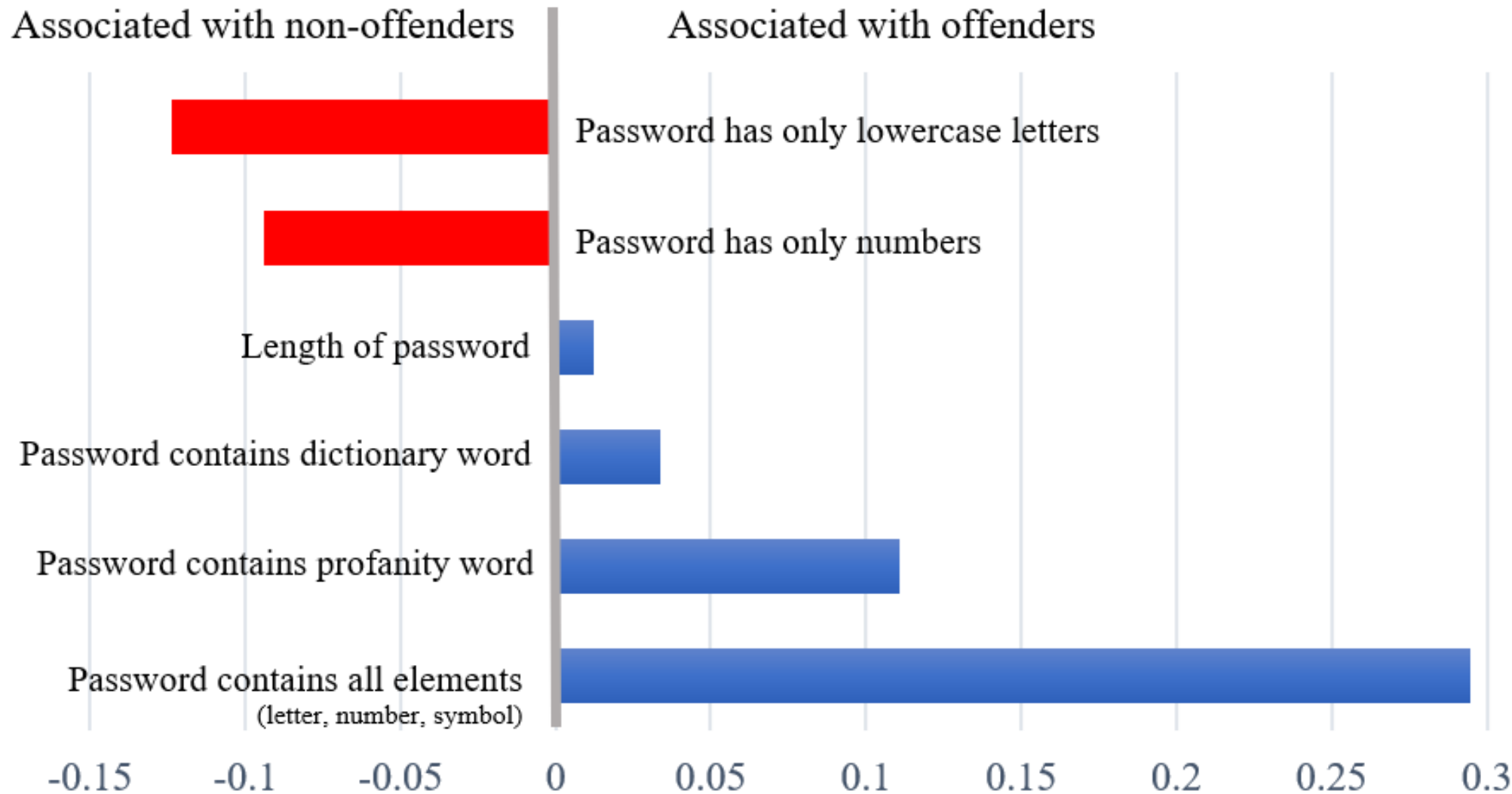
COMPARISON BETWEEN OFFENDERS AND NON-OFFENDERS' PASSWORDS CHARACTERISTICS

Length of password	0.012411***
Password is only lowercase letters	-0.12354***
Password contains all the elements (letter, number, symbol)	0.294831***
Password is only numbers	-0.09376***
Password contains a dictionary word	0.033848***
Password contains a profanity word	0.110573***

N=1,484,095

*****p<0.001**

Comparison between offenders and non-offenders' passwords characteristics (Logistic Regression)



What does it mean?

Password choice is influenced by your network

Online offenders have stronger passwords

Practical implication : Identification of different networks in databreaches

Questions?

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