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HepHIV 2019
28-30 JANUARY - BUCHAREST

On Social Media Mining for HIV Pre-Exposure Prophylaxis

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Social Media Mining for Public Health



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Social Media (SoMe) Mining

«Social Media Mining is the process of representing, analyzing, and extracting actionable patterns from social media data.»

Zafarani, R., Abbasi, M. A., & Liu, H. (2014). *Social media mining: An introduction*



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How is it done?

- ◉ Natural Language Processing
- ◉ Text mining
 - Sentiment Analysis
 - Event Detection
- ◉ Network modelling



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Why is it important?

- Collection of user-generated data: spontaneous, unsolicited and up-to-date, with a high degree of variance
- Obtain insights from underrepresented groups of patients or from people that don't have easy access to the healthcare services
("Listening to the patient's voice")
- Information that patients are reluctant or even afraid to provide to healthcare providers



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What to watch out for

- Issues with credibility, recency, uniqueness, frequency and saliency
- Novel information sources
 - Different analysis approaches
 - Difficulties in evaluating results
- “Big Data Hybris”: Should complement, not replace traditional techniques
- Ethical Implications (Public data ≠ available for research?)



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Application: Mining PrEP Trends on Twitter



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Research Question

Can we identify PrEP-related trends discussed on Twitter?



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Research Question

- What is the sentiment regarding PrEP?
- Investigate public awareness, views and emotions
- Detect main discussion topics
- Are there any side-effects mentioned?
- What are the technical difficulties on the systematic collection & analysis of Twitter data regarding Public Health?



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Methodology and Implementation



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Our data gathering & analytics Web platform

- Developed and maintained by the Institute of Applied Biosciences (INAB)
- Using open-source technologies
- Unstructured data gathering from multiple sources
- Integrating various text-mining and visual analytics methods
- Aims to support public health surveillance scenarios





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Keywords

- 2 datastreams:

truvada OR (truvada AND PrEP) OR (hiv AND PreP)
OR (preexposure AND prophylaxis)

(pill AND prevent AND HIV) OR (pill AND protect
AND HIV) OR (pill AND protect AND AIDS)



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31,854 tweets

“PrEP” stream

804 tweets

“Pill” stream

~4 months

Continuous data collection





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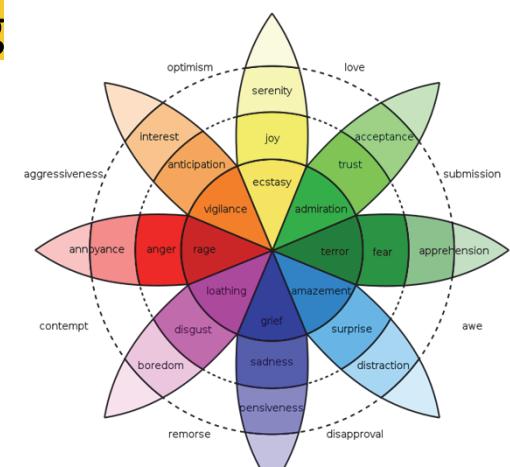
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Data Analysis

- Only tweets in English collected
- Identification of hashtags (#), mentions (@), links (t.co) and location (📍)
- Hashtags are kept in the text corpus, since they give #meaning
- Text Cleaning/Preprocessing
- Hashtags tracking
- Geographical mapping of tweets
- Sentiment Analysis → 2 adapted sentiment lexicons (AFINN & NRC)





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#PrEP #Truvada

Sample tweets



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RT @shyronn_jones: Things that protect us from HIV: Undetectable Partner, PrEP, PEP, Condoms. Things that don't: HIV Criminalization. #HIV

“



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This truvada is TEARING my stomach
tf up tonight

“



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Yes. Placebo PREP trials (more ok in women and LMICs!?)-\u003elow adherence-\u003enull results. Let's treat cis \u0026 trans women?
<https://t.co/WDNnUbFTDv>

“



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Results – Exploratory Data Analysis



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Overview – “PrEP” datastream

Analysis of Twitter data regarding the use of Pre-Exposure Prophylaxis (PrEP)

Data collected from 1 September 2017 to 21 December 2017

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Keywords used:

truvada, truvada & PrEP, PrEP & HIV, pre-exposure prophylaxis

31854

Tweets collected



19162

Retweets



111

Days collecting data



Original vs Retweets:





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Overview – “Pill” datastream

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Overview Frequent Terms Word Cloud Sentiment Analysis Influencers Hashtags References to Side Effects Terms Topics Geo Raw Data

Keywords used:

pill prevent HIV, pill protect HIV, pill protect AIDS

804

Tweets collected



502

Retweets



111

Days collecting data



Original vs Retweets:





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Sentiment Analysis

Analysis of Twitter data regarding the use of Pre-Exposure Prophylaxis (PrEP)

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PrEP
dataset
is selected

0.208

Average Sentiment Polarity



Sentiment Polarity per Day





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Influencers

Accounts posting heavily about PrEP, representing more than 9% of total posts collected

Analysis of Twitter data regarding the use of Pre-Exposure Prophylaxis (PrEP)

Data collected from 1 September 2017 to 21 December 2017

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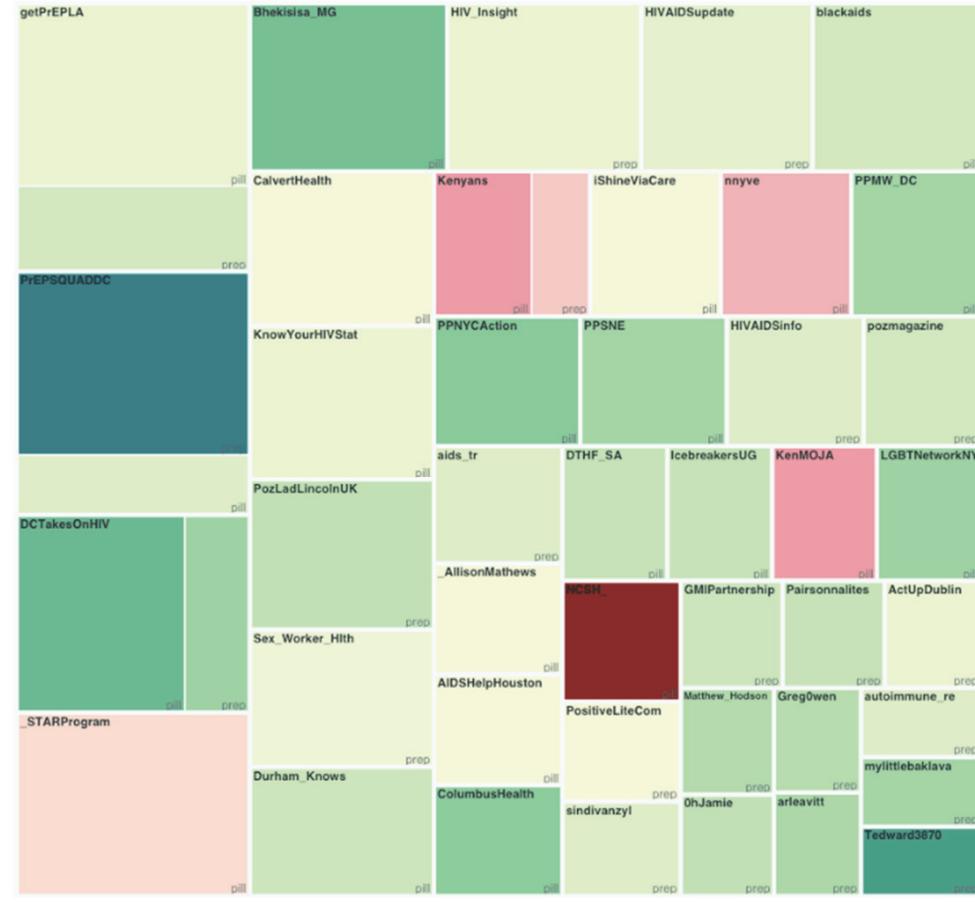
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PrEP dataset
is selected

This is a treemap showing the most prolific accounts discussing PrEP on Twitter. Each box represents one account/creator and its colour corresponds to the calculated polarity of all PrEP-related tweets posted by the account. If a creator is represented in both datasets, different metrics for each dataset are shown.

Note that a negative sentiment doesn't denote a negative opinion about PrEP, for example the "Kenyans" account often addresses issues of stigma related to PrEP administration.





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Hashtags Timeline

1,500

1,000

500

0

03/09/2017 10/09/2017 17/09/2017 24/09/2017 01/10/2017 08/10/2017 15/10/2017 22/10/2017 29/10/2017 05/11/2017 12/11/2017 19/11/2017 26/11/2017 03/12/2017 10/12/2017 17/12/2017

Select hashtag:

World AIDS Day
#WorldAIDSDay
1 Dec.

Ireland's first
clinic monitoring
PrEP opens
#Ireland
9 Nov.



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Geography of Tweets



Leaflet | © C

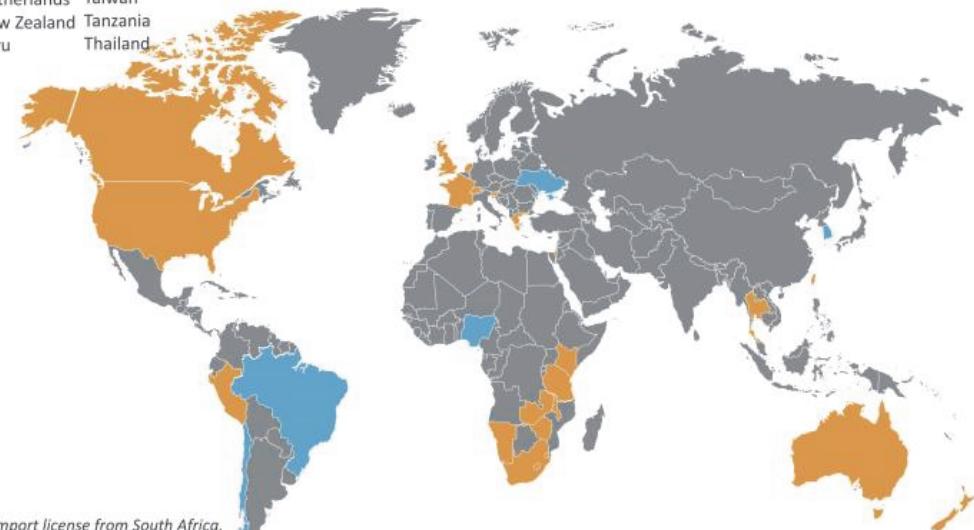
Regulatory Status of Truvada for PrEP

Truvada approved for prevention¹

Australia	Kenya	Scotland	United States
Belgium	Lesotho*	South Africa	Zambia
Canada	Malawi	Slovenia	Zimbabwe
England	Namibia	Swaziland*	
France	Netherlands	Taiwan	
Greece	New Zealand	Tanzania	
Israel	Peru	Thailand	

Regulatory application submitted for a prevention indication for Truvada²

Brazil	Nigeria
Chile	South Korea
Hong Kong	Ukraine



*Approved via import license from South Africa.

1. India, SA and Kenya have generic PrEP approval.

2. The European Commission granted Gilead marketing authorization for Truvada as PrEP in Q3 2016. This should encourage countries within the EU to make PrEP available within their national health systems, based on cost factors and individual country regulatory requirements.

Updated October 2017



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Geography of Tweets

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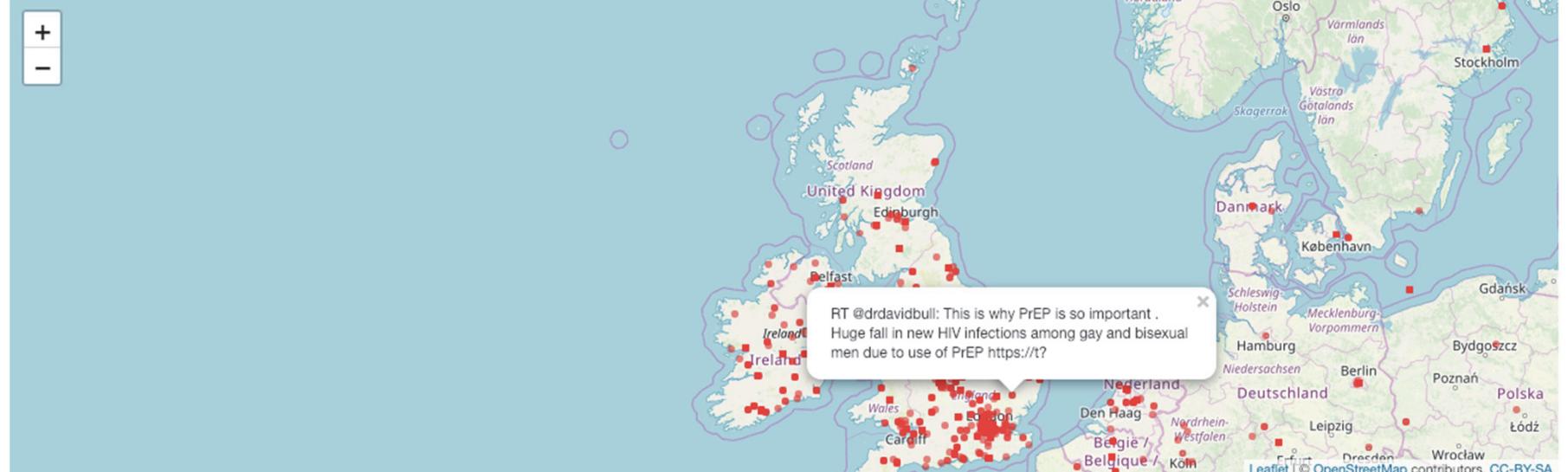
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PrEP
dataset
is
selected

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The geography of PrEP on Twitter





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Sentiment Geography of Tweets

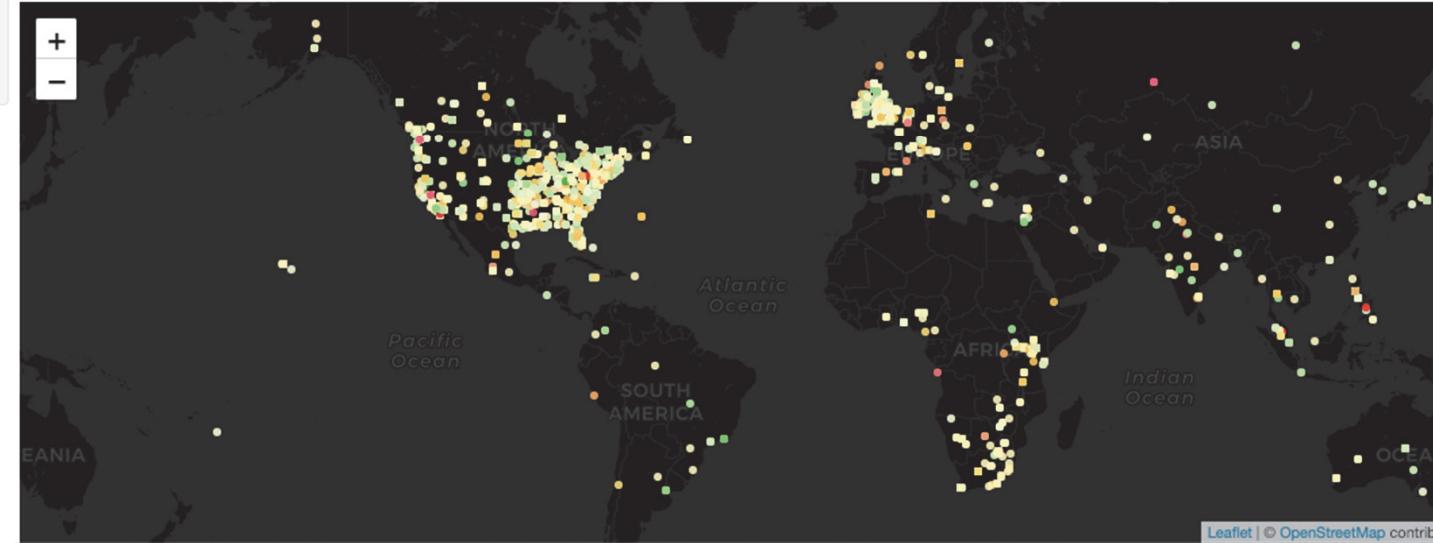
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The geography of PrEP sentiment on Twitter



Negative Sentiment

Neutral Sentiment

Positive Sentiment



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Discussion



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Conclusion

- Large volume of data with low amounts of noise (irrelevant information)
- PrEP discussions can be successfully identified on Twitter
- PrEP discourse seems to be continuously increasing
- Overall sentiment is positive
- Main concerns: stigma, medication cost, insurance coverage and vulnerable population groups
- Detection of critical events is possible



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Challenges / Points of Interest

- ◉ NLP tasks harder for short & medical-related twitter text
- ◉ Sarcasm, humour, subculture references hard to detect
- ◉ Machine learning needed to classify personal to informational tweets
- ◉ «Prolific» Tweeters: Analyse timeline and social sphere/network
- ◉ Monitoring of the propagation of information through the retweeted/shared links



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Future Work

- Create a specialized HIV/PrEP lexicon
- Create an annotated dataset by domain experts (sentiment, NLP Tasks, personal experience detection)
- Improve text mining and NLP analysis of data
- Further use of medical terminologies (MeSH, MedDRA)
- Exploit emoticons for further sentiment analysis
- Make the platform available to researchers, healthcare professionals and policy makers



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Thank you! Questions?

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