

# Weekly Pattern for Online Information Seeking on HIV – A Multi-Language Study

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**Abstract.** Studies have demonstrated that there are weekly patterns of information-seeking activities on sexual health topics in some selected languages. However, it is not known if this weekly pattern is found across the ten most commonly-used languages on the Internet, and whether international public events might have an impact on these information-seeking patterns. The objective of this study is to examine sexual health information-seeking patterns for searches performed in several languages, and also to analyze the potential impact of public events on these information-seeking rates. We extracted the number of hits on the HIV article on Wikipedia for the ten most used languages on the Internet for all of the year 2015. The results confirm the existence of a weekly pattern for the searches performed in English, Spanish, Portuguese, Japanese, Russian, French, and German. But the weekly pattern was not found for searches in Mandarin Chinese, Arabic, and Malay. The number of HIV queries increased significantly during two public events, the World AIDS Day, and the announcement regarding the HIV-positive condition of the celebrity actor Charlie Sheen. The existence of higher peaks in searching rates at the beginning of the week for some languages, and the increase in queries related to public events could represent valuable opportunities for public campaigns promoting sexual health.

**Keywords.** Health information-seeking behavior, Periodicity, Wikipedia, HIV

## 1. Introduction

Increased online health information seeking has been associated with increased health consciousness, stronger health beliefs, and higher engagement in healthy activities [1]. Interestingly, when people have constant access to the Internet, it has been found that health information seeking behavior follows specific patterns [2], and also is affected by celebrities' health announcements [3,4].

In the area of sexual health, four studies have reported the existence of seven-day patterns on sexual health seeking behaviors, with higher peaks at the beginning of the week, and lower peaks on weekends [5–8]. A study of an emergency contraception site found that the number of e-mails received in English started to rise on Sunday, peaked on Monday and steadily declined through the rest of the week [5]. A website in Spanish providing advice on AIDS and hepatitis reported the highest number of consultations on Mondays and Tuesdays [6]. A Dutch website on sexually transmitted diseases also described peaks in visitor rates every Monday [7]. An analysis of searches performed

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on Wikipedia in Norwegian on the most common sexually transmitted diseases (chlamydia, gonorrhea, herpes, HIV, and AIDS) also found this weekly pattern, with highest peaks at the beginning of the week, and the fewest searches on Saturdays [8].

The studies reporting the existence of a weekly pattern referred to searches performed in English, Spanish, Dutch, and Norwegian, however, it is not known if this weekly pattern stands for searches performed in other languages, or if public events could have an effect on sexual health information-seeking rates. The objective of this study is to examine the sexual health information-seeking pattern for searches performed in several languages, and also to analyze the potential impact of public events on these information-seeking rates.

## **2. Methods**

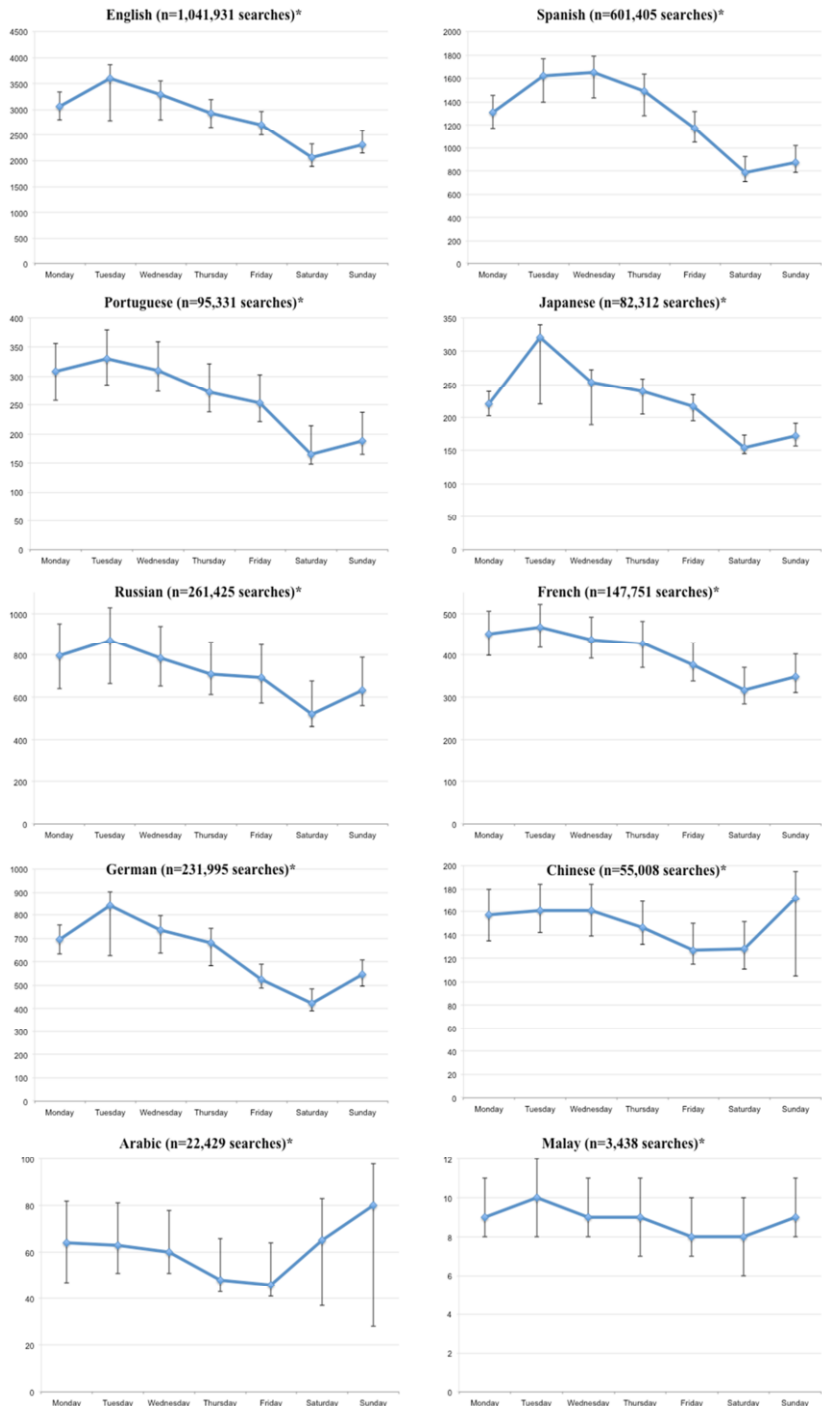
In order to examine sexual health information seeking patterns in several languages, we tracked the number of searches on the article on HIV on Wikipedia for the ten most used languages on the Internet, i.e.: English, Mandarin Chinese, Spanish, Arabic, Portuguese, Japanese, Russian, Malay, French, and German [9]. The daily rates of Wikipedia article hits were extracted from the Wikipedia article traffic statistics website for the period 1st January 2015 to 31st December 2015 [10]. Database cleansing was performed; and outliers were replaced following the last observation carried forward (LOCF) method. The dates were classified according to the day of the week. Two public events were also identified: the World AIDS Day (1<sup>st</sup> December 2015) and the public news of a celebrity, Charlie Sheen, confirming his HIV-positive condition (17<sup>th</sup> and 18<sup>th</sup> November 2015). These two events were selected due to their international coverage. Descriptive statistics were used to summarize the absolute numbers and frequencies of hits per day. ANOVA tests were used to compare the means of hits per day of the week. Kruskal-Wallis tests were used to compare the hits on general days with the two selected public events. Data were analyzed with SPSS for Mac version 23.

## **3. Results**

A total of 2,543,025 searches were performed on Wikipedia on the article on HIV in the ten most used languages on the Internet during all of 2015.

The ANOVA tests showed that Wikipedia searches on HIV had a significant weekly pattern with highest peaks early in the week, mostly on Mondays and Tuesdays, and lower numbers on Saturdays, for the searches performed in English, Spanish, Portuguese, Japanese, Russian, French, and German. The weekly pattern was not significant for the HIV queries performed in Mandarin Chinese, Arabic, and Malay. The daily average of searches on HIV for the different languages are summarized in Table 1, mean and the 95% confidence intervals are shown in Figure 1.

Kruskal-Wallis Tests showed significant increases in the number of searches during the World AIDS Day, and when the HIV-positive condition of the celebrity Charlie Sheen was made public ( $p < 0.05$ ) for the searches in all the tracked languages, except for Malay ( $p = 0.6$ ) (See Table 2).



Mean and 95% CI, \*ANOVA test  $p < 0.01$ . Non-significant ANOVA test for Chinese,  $p = 0.240$ ; Arabic,  $p = 0.478$ ; and Malay languages,  $p = 0.386$

**Figure 1.** Wikipedia searches on HIV with significant weekly pattern

**Table 1.** Average weekly Wikipedia traffic on the HIV article during 2015

Language	Mon	Tue	Wed	Thu	Fri	Sat	Sun
English*	3067	3601	3293	2935	2706	2060	2316
Spanish*	1313	1625	1649	1492	1172	786	876
Portuguese*	308	330	310	272	253	165	188
Japanese*	220	321	253	239	216	154	172
Russian*	796	874	785	707	694	521	633
French*	452	469	439	429	376	317	348
German*	694	840	736	681	526	421	547
Chinese	157	161	161	146	127	128	172
Arabic	65	63	60	48	46	65	80
Malay	9	10	9	9	8	8	9

\* ANOVA tests,  $p < 0.01$ . Note: Decimal numbers have been removed to avoid enlarged table. Abbreviations: Mon (Monday); Tue (Tuesday); Wed (Wednesday); Thu (Thursday); Fri (Friday); Sat (Saturday); Sun (Sunday)

**Table 2.** Average Wikipedia traffic on the HIV article on general days, and the two selected events during 2015

Language	General days	World AIDS Day	Celebrity HIV-positive condition news
English*	2755.7	6499	18931.5
Spanish*	1248.4	3454	4863.5
Portuguese*	257.7	549	746.5
Japanese*	213.8	606	2151
Russian*	693.8	3007	3637
French*	402.3	808	653.5
German*	610.2	2655	4219
Chinese*	148.1	292	553.5
Arabic*	60.1	109	274.5
Malay	9.4	7	6

Mean traffic, \*Kruskal-Wallis Test  $p < 0.05$ . Non-significant Kruskal-Wallis Test for Malay,  $p = 0.601$

#### 4. Discussion

The results on the HIV queries on Wikipedia during 2015 show that the searches performed in English, Spanish, Portuguese, Japanese, Russian, French, and German followed the same seven-days cycle that had previously been described in the literature [4–8]. However, the weekly pattern was not found for searches on HIV performed in Mandarin Chinese, Arabic, and Malay, which could be attributed to the small number of queries performed on Wikipedia in these languages, or could be explained by the number of useful information sources on HIV on Wikipedia related to each language. Cultural differences or sexual health taboos could also play a role for the presence or absence of weekly patterns in sexual health information seeking behavior.

This study also found a significant increase in the number of HIV queries during the World AIDS Day (hits in Russian were more than quadrupled). The number of searches shot up when the HIV-positive condition of the celebrity Charlie Sheen was announced (up to tenfold higher for searches performed in Japanese), in agreement with previous studies reporting higher frequency of online searches related to celebrities' health announcements [3,4]. The findings suggest that certain times of the week and specific occasions with increased attention on the topic could represent valuable opportunities for public campaigns promoting sexual health [1].

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