

# Information seeking behaviour regarding antibiotics and common infectious ailments in Hungary: a Google Trends-based infodemiological study

Péter Pallós<sup>1</sup>, Zsuzsanna Kívés<sup>2</sup>, Márió Gajdács<sup>1,\*</sup>

<sup>1</sup>Department of Oral Biology and Experimental Dental Research, Faculty of Dentistry, University of Szeged, Tisza Lajos krt. 63, 6720 Szeged, Hungary; <sup>2</sup>Institute of Health Insurance, Faculty of Health Sciences, University of Pécs, Vörösmarty M. u. 4., 7621 Pécs, Hungary

Correspondence to: [gajdacs.mario@stoma.szote.u-szeged.hu](mailto:gajdacs.mario@stoma.szote.u-szeged.hu); 6720 Szeged, Tisza Lajos krt. 63., Hungary

## Introduction

Antibiotics are medicines of critical importance, but the emergence of antimicrobial resistance (AMR) is a serious threat to healthcare institutions worldwide. One of the most important hallmarks in the development of resistance is the imprudent use of antibiotics, including their non-prescription procurement and self-medication, bypassing diagnostic and consultative healthcare services. Many international campaigns have aimed to educate the general public regarding the dangers of AMR, including the European Antibiotic Awareness Day (EAAD) and the World Antibiotic Awareness Week (WAAW).

The Internet has become the main source of health-related information for millions of people, due to its easy accessibility. Infodemiology is an emerging field of research, involving the analysis of public inquiry online, to gain insight into societal behavior and to provide information for healthcare-professionals and policymakers. The aim of this infodemiological study was to assess the changes in antibiotic-related Internet queries from Hungary, and to identify the possible association between information seeking behavior for antibiotics and various infectious diseases.

## Materials and methods

Qualitative and quantitative data, and spatio-temporal distribution of queries about antibiotics were extracted from the Google Trends analysis tool for the time-period between 2010.01.01-2020.12.31. In addition, search intensity data were also collected related to the colloquial Hungarian keywords for “flu”, “common cold”, “UTI”, “sore throat”, “cough”, “sinus infection” and “probiotic”. Search intensity was expressed as relative search volume (RSV), a normalized score ranging between 0-100. Parametric tests were performed by IBM SPSS Statistics 22.0.

## Results

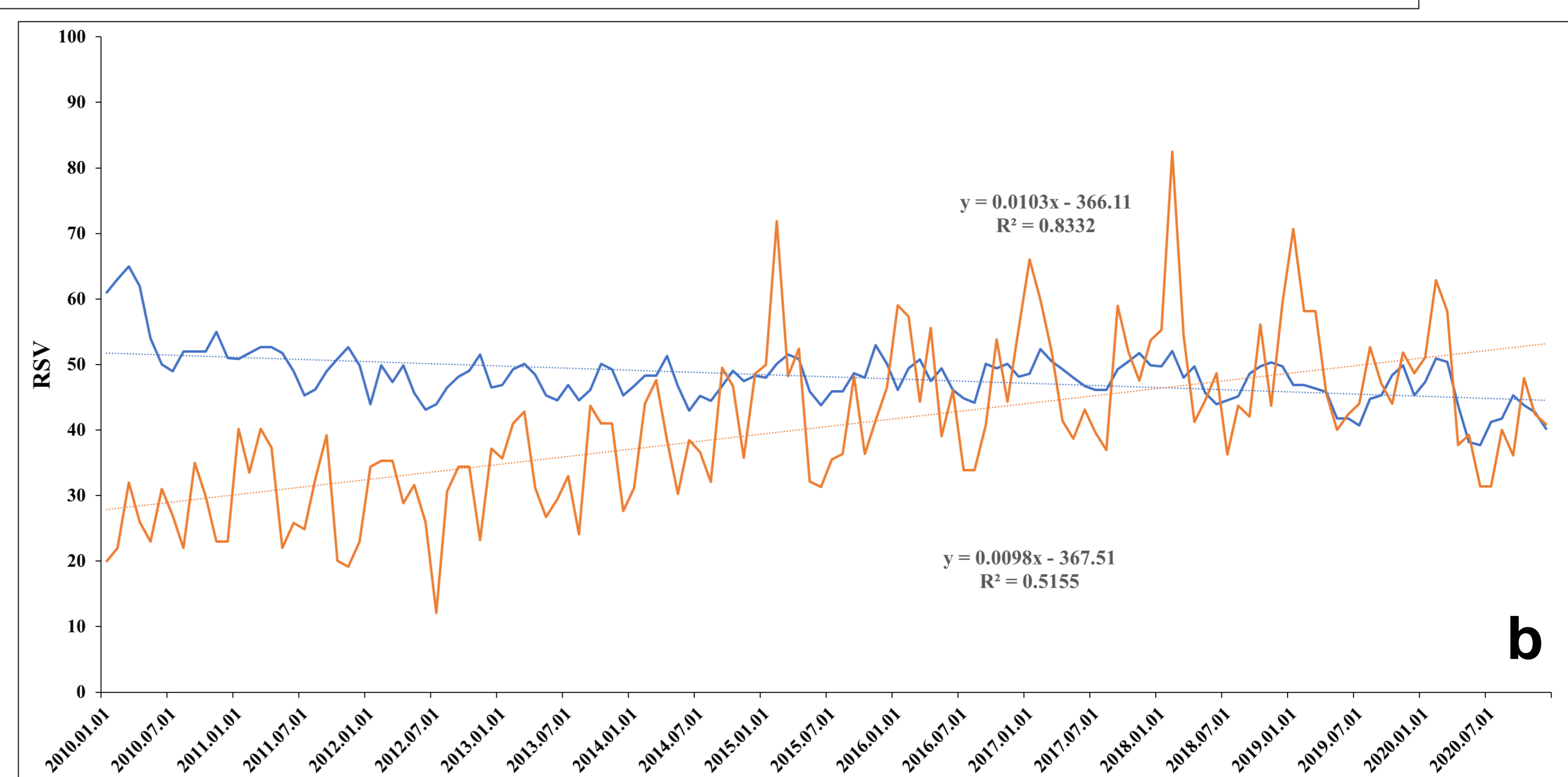
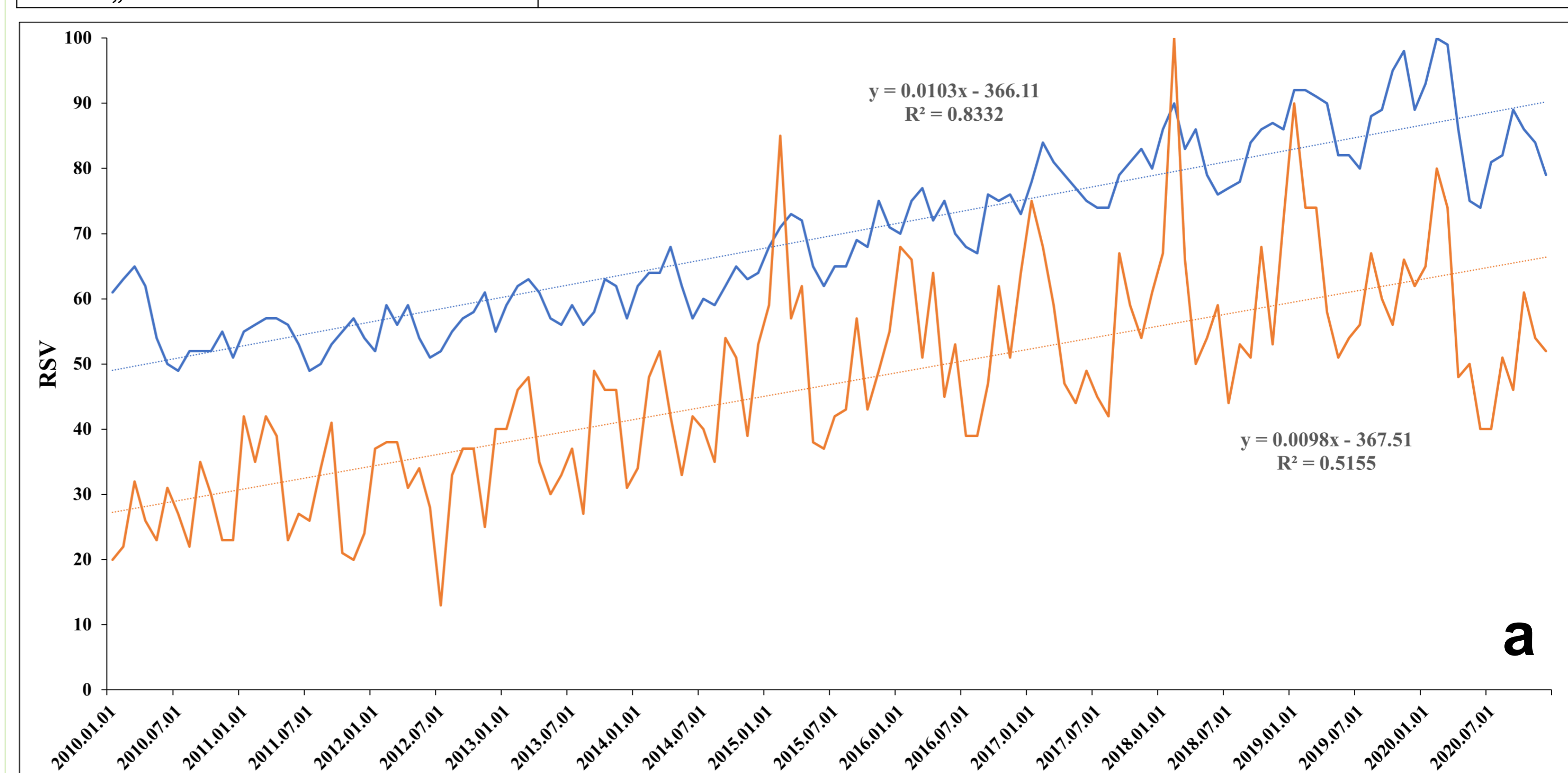
Search intensity for antibiotic-related information (based on the keyword “antibiotikum”) has increased by 211.1% (26.2±4.8 vs. 55.1±12.6) between 2010 and 2020 (**Fig. 1a**); search intensity shows significant growth even when the data was controlled for the increased number of Internet users (26.2±4.8 vs. 43.3±9.9;  $p < 0.001$ ; **Fig. 1b**). The most common related queries were “antibiotic and alcohol” (RSV range: 72-100), “antibiotic and contraceptive” (RSV range: 43-82), “antibiotic side effects” (RSV range: 39-82), “antibiotic diarrhoea” (RSV range: 44-86) and “antibiotic for UTI” (RSV range: 29-100) (**Table 1**).

Educational campaigns (EAAD and WAAW) seemingly **had no effect** on the intensity of antibiotic-related searches (before: 66.59±15.49 vs. after: 67.91±14.07;  $p > 0.05$ ). Strong positive correlations were found between antibiotic-related online queries and searches related to the **colloquial Hungarian keywords** for flu ( $r = 0.594$ ), sore throat ( $r = 0.644$ ), cough ( $r = 0.707$ ) and probiotics ( $r = 0.812$ ), while moderately strong for the common cold ( $r = 0.465$ ); in every case,  $p$  values  $< 0.001$  were recorded.

## Results

**Table 1.** Related search terms used in Google searches from Hungary, associated with the search key „antibiotic” (between 2010 and 2020, translated)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
„alcohol”	100	100	100	100	100	100	91	95	100	100	72
„birth control”	43			72	62			52	82		
„side effects”	43	75	70	25	13	41	52	39	82		
„during pregnancy”	43					27	24		24		
„augmentin”			93		38						
„medication”			92	77	38	82	100	48		22	
„natural antibiotic”			61	33	19	36	38	14			
„sumetrolim”			39		50			38	47		
„tonsillitis”			39								
„zinnat”			34		38			57	35		29
„antibiotic effects”				78	88	82	63	100	65		71
„diarrhoea”				61	44	50	57	86		44	86
„without prescription”				50			53	38	47		
„adverse events”				33			58	24	59		
„aktil duo”					25			19			
„antibiotic types”					19	14					
„klion”					13						
„quinsy”					12						
„for urinary infection”						50	58	29	53	33	100
„probiotic”						36			23		
„sumamed”						27					
„augmentin duo”							29				
„together with antibiotics”											71
„antibiotic resistance”											43



**Figure 1.** Secular trends observed in antibiotic-related queries in the Google search engine from Hungary (orange) and globally (blue) between 2010 and 2020; a:

Owing to its quick and easy accessibility, the Internet has become an important source of health-related information for the public. Analysis of antibiotic-related Internet queries may be a valuable source of information of collective health utilization trends. Noteworthy associations were seen between information-seeking behavior on commonly occurring infectious ailments.

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