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Tattoo side effects worldwide: a Google Trends–based time series analysis

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Abstract

Introduction: It is not known whether tattoo-related complications are becoming more frequent and, if so, how quickly.
Methods: Data generated through Google Trends (GT) worldwide, from January 1st, 2004 to December 31st, 2018, were analyzed for the search volume indexes (SVIs) of selected symptoms ("swollen tattoo," "raised tattoo," "tattoo bumps," "itchy tattoo," "tattoo fading"), diagnosis ("infected tattoo," "tattoo allergy"), and control terms ("tattoo care," "tattoo healing").
Results: For 2004–2018, the mean SVIs for symptoms were: "itchy tattoo" (41) › "tattoo bumps" (31) › "raised tattoos" (30) › "tattoo fading" (24) › "swollen tattoo" (22). The mean SVIs by 5-year periods showed a regular and constant increase for "itchy tattoo." The search for "infected tattoo" saw a slight but progressive increase, whereas the search for "tattoo allergy" remained stable between 2004 and 2018.
Conclusions: Analysis of GT shows an increased search for symptoms such as itching, bumps, and induration on tattoos. However, it cannot be confirmed whether this rise points to a *real* increase of side effects, or to the popularity of tattoos and generalization of internet use as a tool to obtain information. GT could be of interest for detecting and following trends related to tattoo complications. Use of informal terms rather than medical terms is warranted.

Keywords: epidemiology, internet, itch, Google Trends, infodemiology, population, search analysis, tattoo, tattoo complication

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Introduction

The prevalence of tattoo complications varies widely according to studies, up to 27% for minor complaints (1–3). It is not known whether complications are becoming more frequent and, if so, how quickly. Google Trends (GT) is a useful website that provides data on the relative search volume of queries and topics over time and across geographical areas (worldwide, country, and city). It allows seasonal and long-term assessment of trends of public interest. A user can compare up to five terms or topics simultaneously. GT was used to estimate the search volumes of several symptoms and diagnostics associated with tattoos.

Methods

Data generated through GT for relative search volumes of the following symptom-related terms were analyzed: "swollen tattoo," "raised tattoo," "tattoo bumps," "itchy tattoo," and "tattoo fading," and diagnostic-related terms: "infected tattoo" and "tattoo allergy." The terms "tattoo care" and "tattoo healing" were used as control terms. For each given term, GT provides an additional list of associated searches. Thus, it could be verified that each term selected for this study was used adequately. For example, "painful tattoo" and "tattoo pain" were excluded because both were mostly associated with enquiries about how painful the tattooing procedure was or could be.

To compare whether the results would be similar in non-English speaking countries, an additional analysis was performed in French. The following symptom-related terms were used: *tatouage gonflé* "swollen tattoo", *tatouage en relief* "raised tattoo", and *tatouage qui gratte* "itchy tattoo". For diagnosis, *tatouage infecté* "infected tattoo" and *tatouage allergie* "tattoo allergy" were used. For "tattoo healing" and "tattoo care," only one term was chosen: *cicatrisation tatouage* "tattoo healing". It was not possible to find reliable equivalents for "tattoo bumps," "tattoo fading," or "tattoo care," and so they were omitted.

Analysis was performed worldwide from January 1st, 2004 to December 31st, 2018. Results are displayed as a set of time series. The values are not the actual search counts but percentages relative to the total searches across the specified geography and time period. The resulting numbers are then scaled from 0 to 100 based on the proportion of all searches on all topics. All data used in this study are publicly available, anonymous, and cannot be traced back to identifiable individuals. The study did not require ethical approval by an institutional review board.

Results

Because of the use of English terms, the results are mainly limited to North America (the United States and Canada), the United Kingdom, Australia, and sometimes South Africa. Between 2004 and 2018, search volumes indexes (SVIs) rose for all the symptom-associated terms, and mainly for "itchy tattoos" (data not shown). Mean SVIs for 2004–2018 are as follows: "itchy tattoo" (41 ± 29), "tattoo bumps" (31 ± 21), "raised tattoos" (30 ± 20), "tattoo fading" (24 ± 13), and "swollen tattoo" (22 ± 14). Comparison of the mean SVIs by 5-year periods shows a regular and constant increase for "itchy tattoo": 11 ± 11 (2004–2008), 41 ± 18 (2009–2013), and 72 ± 14 (2014–2018). Searches for "tattoo bumps" and "raised tattoos" also increased, whereas those for "tattoo fading" remained rather stable (Fig. 1).

Mean SVIs for diagnostic-associated terms for 2004–2018 are: "tattoo care" (64 ± 14), "tattoo healing" (26 ± 12), "infected tattoo" (14 ± 9), and "tattoo allergy" (3 ± 1). The search for "infected tattoo"

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saw a slight but progressive increase, whereas the search for "tattoo allergy" remained stable between 2004 and 2018. SVIs for "tattoo care" were always the highest, and "tattoo healing" followed the SVI trend for "infected tattoo" (Fig. 2).

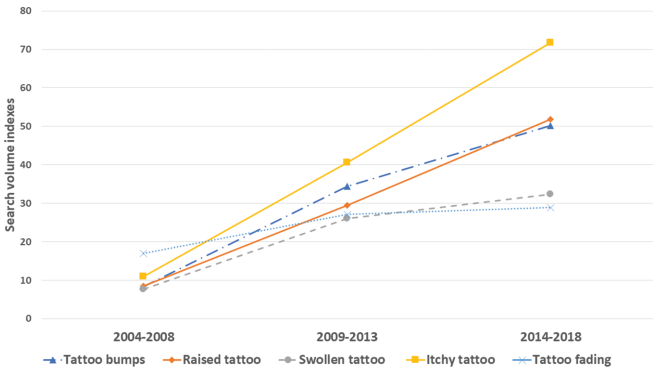

Figure 1 | Mean values for search volumes indexes on Google Trends for "tattoo bumps," "raised tattoo," "swollen tattoo," "itchy tattoo," and "tattoo fading," worldwide, between 2004 and 2018, by 5-year periods.

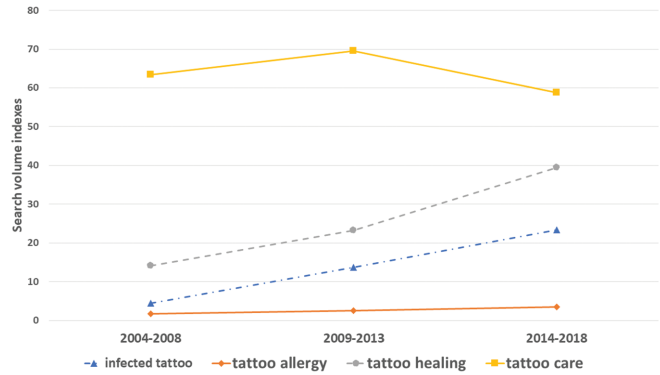

Figure 2 | Mean values for search volumes indexes on Google Trends for "tattoo allergy," "infected tattoo," "tattoo healing," and "tattoo care," worldwide, between 2004 and 2018, by 5-year periods.

For French terms, the mean SVIs for 2004–2018 are as follows: *tatouage qui gratte* "itchy tattoo" (23 ± 24), *tatouage en relief* "raised tattoo" (19 ± 19), and *tatouage gonflé* "swollen tattoo" (12 ± 15). Comparison of the mean SVIs by 5-year periods also shows an increase for all terms, led by "itchy tattoo" (Fig. 3). Mean SVIs for diagnostic-associated terms for 2004–2018 are: *cicatrisation tatouage* "tattoo healing" (35 ± 24), *tatouage allergie* "tattoo allergy" (9 ± 7), and *tatouage infecté* "infected tattoos" (6 ± 6).

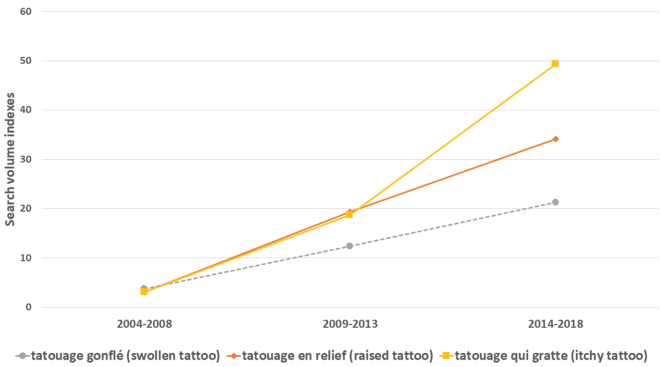

Figure 3 | Mean values for search volumes indexes on Google Trends for *tatouage induré* "raised tattoo," *tatouage gonflé* "swollen tattoo," and *tatouage qui gratte* "itchy tattoo," France, between 2004 and 2018, by 5-year periods.

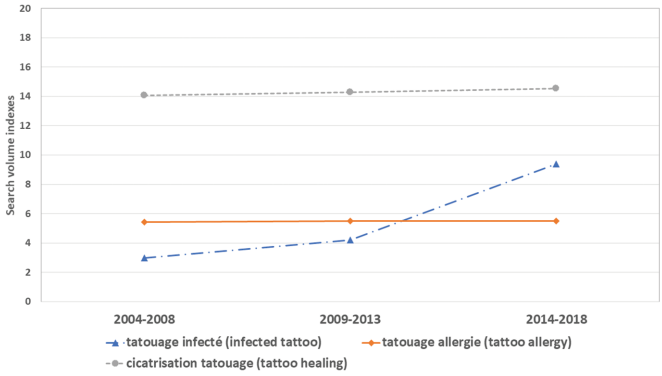

Figure 4 | Mean values for search volumes indexes on Google Trends for *tatouage allergie* "tattoo allergy," *tatouage infecté* "infected tattoo," and *cicatrisation* tatouage "tattoo healing," France, between 2004 and 2018, by 5-year periods.

Discussion

The results reveal that SVIs regarding tattoo-associated symptoms, mainly itching, bumps, and raised tattoos, have increased since 2004. Allergic reactions manifest clinically with infiltrated papules, nodules, or plaques restricted to a color within a tattoo. Itching can be severe, with an impact on quality of life (4). Bumps and raised tattoos are not exclusively associated with allergy. Other entities can manifest with bumps and induration/infiltration, such as granulomatous foreign-body reaction or sarcoidosis (5–7). Tattoos are itchy during the healing phase, and itching can occur from time to time on healed tattoos with minimal discomfort (2). Therefore, it is not possible to identify the reasons for "itchy tattoo." Searches for "infected tattoo" have also increased since 2004. However, a local infection is most likely to be the first complication that anyone suspects, irrespective of the symptoms and delay of onset. SVIs for "infected tattoo" may include infections on a tattoo, but most likely also acute complications after tattooing in general. This hypothesis is supported by SVI trends for "tattoo healing" that closely follow those for "infected tattoo." Tattooed individuals experiencing healing problems on a recent tattoo may look for answers on the internet. "Infected tattoo" and "tattoo healing" are likely to be associated searches. On the other hand, the term "tattoo allergy" was seldom used. The first and simplest explanation would be that "tattoo allergy" is not as common as expected, and its frequency remains low and stable over time. Another explanation is that individuals do not casually use this expression. The term "tattoo ink allergy" was even less frequently used on Google trends. However, symptoms such as raised tattoos or itchy bumps on tattoos point to a possible tattoo ink allergy. It is hypothesized that the term "tattoo allergy" may not be popular enough among the population. Moreover, infection or healing problems may come to mind first for tattooed individuals with symptoms on their tattoos. Direct SVI comparison between countries is meaningless. However, the 2004–2018 search trends were similar between French- and English-speaking countries regarding both the increase in volume searches and the distribution of symptoms/diagnoses researched.

The limitations of this study are numerous. First, GT is not a real epidemiological instrument. Only individuals with access to the internet can be accounted for. However, tattooed individuals are rather young, between 20 and 40 years old, and therefore

rather accustomed to using the internet daily. Despite working on worldwide data, the use of English terms mainly restricted the results to English-speaking countries. According to the World Bank (8), the proportion of the general population using the internet in those countries ranged from 76% (United States) to 94.8% (United Kingdom). As mentioned above, the reasons why these terms were searched for is not known. Searches could have been for other reasons, such as curiosity or interest, or because of media articles on the topic. Finally, terms such as "infected tattoo" may be misused for a symptom and not an infection.

Conclusions

Acknowledging the limitations of this study, the analysis of GT shows that there is an increased search for tattoo complications manifesting with itching, bumps, and induration on tattoos. Similar results were found using English and French terms. However, it cannot be confirmed whether this rise points to a *real* increase in side effects, or to the popularity of tattoos and generalization of internet use as a tool to obtain information. Even though it is not a perfect tool, GT can be of interest for detecting and following trends related to tattoo complications. Informal terms describing symptoms and conditions may be more sensitive for detecting tattoo side effects on GT than complicated medical terms.

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