

Sexual and reproductive health knowledge among young people: a bibliometric analysis (1900 – 2019)

waleed sweileh (✉ waleedsweileh@yahoo.com)

An-Najah National University <https://orcid.org/0000-0002-9460-5144>

Ahmad Mansour

Al-Balqa' Applied University

Research

Keywords: Sexual and reproductive health, Bibliometric, Knowledge, Awareness, Adolescents, Young people

Posted Date: April 3rd, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-20762/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Background: Adolescents and youth (young people) are central to the success of the 2030 agenda. Sexual and reproductive health (SRH) knowledge among young people is critical for their well-being. The objective study was to assess and analyze publications on SHR knowledge among young people.

Method: This study was a bibliometric descriptive one for publications retrieved from Scopus on SHR knowledge among young people. All relevant terms on young people, SHR, and knowledge were implemented to retrieve relevant publications for the study period from 1900 to 2019.

Results: The search found 2544 publications. Publication started on 1951. The number of publications showed two steep phases: one in mid-1980s and one after 2005. Four research themes were identified: human immunodeficiency virus (HIV); human papillomavirus (HPV), condom, and contraception with documents on HPV vaccinations being the most recent. The retrieved publications received an average of 10.9 citations per document and an h-index of 61. The top cited documents published before 2010 focused mainly on HIV, HPV, and condom use while those after 2010 focused on HIV testing technology, HIV prophylaxis and HPV vaccination. The retrieved documents originated mainly from the region of the Americas (n=944). When data were normalized, the South-Eastern Asian region had the highest research activity. At the country level, the USA ranked first (n=701; 27.6%) but when data was normalized, India (91.5 publication per GDP per capita) ranked first followed by Nigeria (53.0) and South Africa (17.9). Journal of Adolescent Health (n=39; 1.5%) ranked first but documents published in AIDS Education and Prevention journal received the highest number of citations per document (34.1). The University of California, San Francisco ranked first (n=33; 1.3%) in this field. The average number of authors per publication was 3.8. Research networking in this field was poor.

Conclusion: This was the first analysis of publications on SRH knowledge among a category of people who are most often neglected in their SRH needs. Research on knowledge and awareness on this subject need to be carried out in all world regions to tailor sex education and health policies to the sociocultural and religious situation in each country.

1.0 Background

The World Health Organization (WHO) defines adolescents as individuals in the 10-19-year age group and “youth” as the 15-24-year age group. These two overlapping age groups are combined in the group “young people”, covering the age range 10-24 years [1]. It is estimated that there are 1.2 billion adolescents and 1.5 billion young people worldwide [2]. According to the *Global Accelerated Action for the Health of Adolescents (AA-HA!)*, health – related issues of adolescents have been little understood or, in some cases, ignored [3]. Sexual and reproductive health (SRH) problems such as unwanted pregnancies, unsafe abortions, unwanted sexually transmitted infections (STDs) such as acquired immunodeficiency syndrome (AIDS) caused by the human immunodeficiency virus (HIV), female genital mutilation/cutting, and teen marriage are major global adolescent health problems [4]. The WHO fact

sheet indicated that at least 10 million unintended pregnancies occur each year among adolescent girls aged 15–19 years in the developing world [5, 6]. Furthermore, of the estimated 5.6 million abortions that occur each year among adolescent girls aged 15–19 years, 3.9 million are unsafe, contributing to maternal mortality, morbidity and lasting health problems. In addition to the negative health effects on the mother, early marriage and/or childbearing also often lead to negative economic and social consequences [7].

Knowledge is an important preventive and protective factor. Despite of globalization and availability of many free web pages, knowledge of adolescents about some essential SRH information are poor [8]. Information and research assessment of SRH knowledge among young people are vital for decision-makers to implement health policies, initiatives, and develop evidence-based effective programs to address adolescents' needs. There are several systematic reviews on adolescents' health in general [9-14]. However, there are no published studies that assessed research activity on SHR knowledge in young people. To fill this gap, the current study was undertaken to assess and analyze research output on knowledge and awareness of young people on SRH. In specific, the global scientific literature on SRH-related knowledge and awareness was retrieved and analyzed for growth pattern, geographic distribution, most important research themes, and citation pattern.

2.0 Materials And Methods

2.1 Database

The current study is a cross sectional descriptive study on scientific literature on SRH knowledge and awareness among adolescents retrieved from SciVerse Scopus database for the study period from 1900 to 2019. The retrieved literature was analyzed using statistical methods, commonly termed bibliometric method.

2.2 Search query

The search query was developed using terms and phrases that were mainly obtained from reviews and published articles [15–17] (Table 1). To increase the accuracy of the results, these terms/phrases were used in the title search since title/abstract search will retrieve many irrelevant documents. The retrieved literature was refined for the following: (1) only documents published in peer-reviewed journals were included; (2) only documents published during the study period from 1900–2019 were included; (3) no language restriction was imposed; and (4) documents containing certain terms such as "parent or parental" were excluded.

Table 1

Keywords and phrases used to retrieve the relevant publications on SRH knowledge and awareness among young people (1900–2019)

1) Adolescents	2) Sexual and reproductive health (SRH)	3) Knowledge
TITLE (youth OR teenager OR teen* OR girl OR adolescent* OR adolescence OR "reproductive age" or pupils OR boys or "10–19 year*" or "young woman" or "young women" or "young female*" or "young male" or "young men" or "young man" or "young people" or "school student*" or "college student*" or "university student*" or girl* OR "age* 10 to 19 year*" or "10–19 year*" or "10–24 year*" or student)	TITLE ("sexual behavior" OR "contraception" OR "contraceptive" OR "condoms" OR "pregnancy" OR "abortion" OR "sexually transmitted infections" OR "venereal diseases" OR sexual OR "reproductive health" OR "early marriage" OR "child marriage" OR "female genital mutilation" OR "female genital cutting" OR "*male circumcision" OR circumcised OR "sexual behavior" OR "sexual experience" OR "sexual activity" OR "early sexual debut" OR "sexual initiation" OR menstruation OR "menstrual hygiene" OR contraception OR "family planning" OR antenatal OR birth OR post-natal OR "sexually transmitted" OR "intercourse" OR "hiv" OR "sex* education" OR reproduction OR "sexual well-being" OR condom OR "human immunodeficiency virus" OR "AIDS" or sex OR "intimate relation*" OR "sexual coercion" OR rape OR "sexual violence" OR "sexual abuse" OR abortion OR "maternal health" OR motherhood OR "forced sex" OR "intimate partner violence" OR "transnational sex" OR "human papillomavirus" OR "HPV" OR "cervical cancer" OR "AIDS" OR "STD" OR "STI" OR "gender inequality" or "dating violence")	TITLE (knowledge OR awareness) OR (TITLE (perception or belief* or attitude* or literacy) AND TITLE-ABS (knowledge OR awareness))
Exclusion: 4) AND NOT TITLE("parent*" OR neuro OR physiolog* OR physician OR pediatrician OR nurse OR "health* provider" OR mind* OR parental OR parents OR father OR mother or "TB" or tuberculosis or adult or media or clinician or office or disclosure or alcohol or "partner* HIV status")		
The asterisk was used as a wild card while the quotation marks were used to limit search for the exact phrase.		
Research query of 1 + 2 + 3 + 4 = SRH knowledge and awareness among young people		
Research query of 2 + 3 + 4 = SRH knowledge and awareness among all age groups		

2.3 Validation

The search query was validated by checking the top active journals and top 200 cited documents. The top active journals and the top 200 cited documents confirmed the validity of the search query for the absence of false-positive documents. The top active journals were in the field of adolescent health or reproductive health or public health which endorse the validity of the search query. Furthermore, the top cited documents included no irrelevant documents which also endorsed the validity of the search query. The validity of the search query for the absence of missing data (false-negative) was confirmed by comparing the numbers of the retrieved documents for each active journal by the actual number of documents published by each journal on the same topic and during the same study period. There was strong correlation between the numbers retrieved and the actual numbers ($p = 0.001$, $r = +0.94$) which

again endorsed the search query for its validity. This validation approach was adopted in previously published bibliometric studies [18].

2.4 Data export

Scopus provides the opportunity to export the retrieved literature into Excel format for further analysis. Scopus allows the export of the following information: number of publications per year, the list of countries, journals, funding agencies, institutions, and authors involved in publishing the retrieved literature, citations received by the retrieved literature, indexed keywords, titles and abstracts of the retrieved documents, the language of the retrieved literature, and the subject areas of the retrieved documents.

2.5 Bibliometric indicators

2.5.1. The results were expressed as top ten active countries, journals, and institutions. Data for top ten active countries was normalized by income and population size measured by Gross Domestic Product (GDP) (nominal) per capita obtained from the latest World Bank data [19].

2.5.2. The geographic distribution of the publications was also presented based on WHO regions: the region of the Americas, the European region, the African region, the Eastern Mediterranean region, the South-Eastern Asian region, and the Western Pacific region.

2.5.3. Research themes were concluded by mapping the most frequently encountered terms in titles/abstracts. VOSviewer maps were presented as network visualization or overlay visualization [20]. The network visualization was used to map research themes while overlay visualization was used to map the time development of research terms.

Citation analysis was expressed as total number of citations received, average number of citations per documents, Hirsh index (h-index) [21], and top ten cited documents which represent the hot topics in the field.

2.5.4. The growth of publications on knowledge of SRH in young people was compared with the growth of publications on SRH in age groups using the same search query after excluding terms related to young age.

3.0 Results

3.1 Volume, types, and languages of the retrieved publications

The research query on young people retrieved 2544 publications. The retrieved documents were mainly research articles (n = 2409; 94.7%), review articles (n = 59; 2.3%), letters (n = 43; 1.7%), and the remaining (n = 33; 1.3%) were notes, editorials, and conference papers. Of the 31 different languages found in the

retrieved literature, English (n = 2266; 89.1%) was the main language followed by Spanish (n = 76; 3.0%), Portuguese (n = 55; 2.2%), French (n = 25; 1.0%), and Chinese (n = 24, 0.9%).

3.2 Subject areas of the retrieved publications

The retrieved documents were mainly in the following subject areas: medicine (n = 1879; 73.9%), social sciences (n = 535; 21.0%), psychology (n = 251; 9.9%), nursing (n = 206; 8.1%), biochemistry (n = 133; 5.2%), immunology/microbiology (n = 81; 3.2%), humanities (n = 76; 3.0%), and pharmacology/toxicology (n = 66; 2.6%).

3.3 Annual growth of publications

The annual number of publications showed a characteristic pattern (Fig. 1). The publications started in early 1950s and remained low (less than 10 publications per year) until mid-1980s. The growth of publications showed a steep increase in mid-1980s and a second steep increase after 2005. Publications present in the steep rise in the mid-1980s were mainly about HIV/AIDS while publications present in the second steep rise after 2005 were diverse but mainly about HPV vaccination and HPV cervical cancer.

3.4 Research themes and research trends

Network visualization of the most frequent terms in titles and abstracts (minimum occurrences of 50 times) showed four clusters representing four research themes in the retrieved publications (Fig. 2): the first cluster was about human papilloma virus (HPV), vaccination, and cancer prevention; the second cluster was about HIV/AIDS; third cluster was about contraception, pregnancy, abortion, and services, the fourth cluster was about condom use and sexually transmitted diseases. The Overlay visualization of the same terms in network visualization map showed that the most recent research topic in the retrieved publications was HPV vaccine/vaccination (Fig. 3).

3.5 Citation analysis and top cited publications

The retrieved publications received 32964 citations, an average of 10.9 citations per document and an h-index of 61. The top cited publications during the period from 1951 to 2009 focused on the following topics [22–31]: HPV, HPV vaccination, HIV/AIDS, condom, and unprotected sex (Table 2). The top cited publications during the period from 2010 to 2019 focused on the following topics [12, 32–40]: HPV vaccination, HIV prophylaxis, HIV testing technology, long acting contraceptives, and sexually transmitted diseases (Table 3).

Table 2

Top cited publications during the study period from 1951 to 2009 on SRH knowledge and awareness among young people

Rank*	Title	Number of citations	Year	Journal
1	Adolescents and AIDS: A survey of knowledge, attitudes and beliefs about AIDS in San Francisco	282	1986	American Journal of Public Health
2	Sexual activity, condom use and AIDS awareness among adolescent males	240	1989	Family Planning Perspectives
3	Attitudes about human papillomavirus vaccine in young women	229	2003	International Journal of STD and AIDS
4	Minorities and AIDS: Knowledge, attitudes, and misconceptions among Black and Latino adolescents	227	1988	American Journal of Public Health
5	Sexually active adolescents and condoms: Changes over one year in knowledge, attitudes and use	215	1988	American Journal of Public Health
6	Knowledge and Early Adoption of the HPV Vaccine Among Girls and Young Women: Results of a National Survey	199	2009	Journal of Adolescent Health
7	Knowledge about human papillomavirus among adolescents	162	2000	Obstetrics and Gynecology
8	University students' knowledge and awareness of HPV	162	1999	Preventive Medicine
9	Perceptions of the benefits and costs associated with condom use and unprotected sex among late adolescent college students	140	2000	Journal of Adolescence
9	College students' knowledge and attitudes about AIDS and changes in HIV-preventive behaviors	140	1990	AIDS Education and Prevention
*in ranking, documents with equal citations were given similar ranking and one place in the ranking system was skipped.				

Table 3

Top cited publications during the study period from 2010 to 2019 on SRH knowledge and awareness among young people

Rank	Title	Number of citations	Year	Journal
1	Prep awareness and perceived barriers among single young men who have sex with men	107	2013	Current HIV Research
2	Is use of the human papillomavirus vaccine among female college students related to human papillomavirus knowledge and risk perception?	94	2010	Sexually Transmitted Infections
3	Online social networking technologies, HIV knowledge, and sexual risk and testing behaviors among homeless youth	89	2011	AIDS and Behavior
4	Ethnically diverse female university students' knowledge and attitudes toward human papillomavirus (HPV), HPV vaccination and cervical cancer	76	2010	European Journal of Obstetrics and Gynecology and Reproductive Biology
5	The fertility myth: Israeli students knowledge regarding age-related fertility decline and late pregnancies in an era of assisted reproduction technology	68	2011	Human Reproduction
6	Awareness and knowledge of sexually transmitted diseases (STDs) among school-going adolescents in Europe: A systematic review of published literature	65	2011	BMC Public Health
7	Young women's knowledge, attitudes, and behaviors related to long-acting reversible contraceptives	62	2010	Women's Health Issues
8	Human Papillomavirus awareness, knowledge and vaccine acceptance: A survey among 18-25-year-old male and female vocational school students in Berlin, Germany	59	2012	European Journal of Public Health
9	Human papillomavirus and cervical cancer: Gardasil® vaccination status and knowledge amongst a nationally representative sample of Australian secondary school students	58	2010	Vaccine
10	Femininity ideology and sexual health in young women: A focus on sexual knowledge, embodiment, and agency	56	2011	International Journal of Sexual Health

3.6 Geographic distribution of the publications

The retrieved documents originated mainly from the region of the Americas (n = 944) and the European region (n = 613) (Table 4). However, when data were normalized by the number of publications on SRH knowledge and awareness in all age groups for each particular region, the South-Eastern Asian region had the highest research activity (36.1%).

Table 4

Number of publications stratified by WHO region on SRH knowledge and awareness among young people and among all age groups (1900–2019)

Region	Number of publications on knowledge about SHR		%*
	Adolescents#	All age groups	
African region	382	1286	29.7
The region of the Americas	944	3555	26.6
South-Eastern Asian region	249	689	36.1
European region	613	2100	29.2
Eastern Mediterranean region	145	493	29.4
Western Pacific region	284	941	30.2
#the sum is greater than the total number of retrieved publications because of the overlap			
*the % was calculated by dividing the number of publications in adolescents by the number in all age groups			

3.7 Top ten active countries

The top ten active countries were listed in Table 5. The USA ranked first (n = 701; 27.6%) followed by India (n = 183; 7.2%) and the UK (n = 150; 5.9%). The ten active countries included three in the region of Americas, two in African, two in European, two in Western Pacific, and one in South-Eastern Asian region. When data was normalized by GDP per capita, India (91.5 publication per GDP per capita) ranked first followed by Nigeria (53.0) and South Africa (17.9).

Table 5

Top ten active countries on SRH knowledge and awareness among young people normalized by income and population size

Rank	Country	Number of publications	% N = 2544	Number of publications per GDP/capita
1	United States	701	27.6	11.2
2	India	183	7.2	91.5
3	United Kingdom	150	5.9	3.5
4	South Africa	113	4.4	17.9
5	Nigeria	106	4.2	53.0
6	Turkey	83	3.3	8.9
7	Australia	78	3.1	1.4
8	China	72	2.8	7.3
9	Brazil	71	2.8	8.0
10	Canada	61	2.4	1.3

3.8 Top ten active journals

The top ten active journals were listed in Table 6. Journal of Adolescent Health (n = 39; 1.5%) ranked first followed by BMC Public Health (n = 37; 1.5%) and Asian Pacific Journal of Cancer Prevention (n = 32; 1.3%). The list included two journals specialized in adolescent health, three in reproductive health, two in public health, one in cancer prevention, two in AIDS, and one was multidisciplinary. The active journals were mainly based in Europe and USA. However, three of the active journals were based in Nigeria, India, and Thailand. Documents published in the AIDS Education and Prevention journal received the highest number of citations per document (34.1 citations per document) followed by those published in Journal of Adolescent Health (29.3).

Table 6

Top ten active journals in publishing documents on SRH knowledge and awareness among young people

Rank*	Journal	Number of publications	% N = 2544	Number of citations per document	Country
1	Journal of Adolescent Health	39	1.5	29.3	Netherlands
2	BMC Public Health	37	1.5	17.5	UK
3	Asian Pacific Journal of Cancer Prevention	32	1.3	12.8	Thailand
4	Indian Journal of Public Health Research and Development	26	1.0	0.0	India
4	Plos One	26	1.0	10.8	USA
6	African Journal of Reproductive Health	23	0.9	12.9	Nigeria
7	AIDS Education and Prevention	22	0.9	34.1	USA
7	Journal of Pediatric and Adolescent Gynecology	22	0.9	15.8	Netherlands
7	Reproductive Health	22	0.9	5.8	UK
10	European Journal of Contraception and Reproductive Health Care	18	0.7	24.3	UK
10	International Journal of STD and AIDS	18	0.7	14.2	UK

*in ranking, journals with equal numbers were given similar ranking and one place in the ranking system was skipped.

3.9 Top ten active institutions

The list of active institutions was listed in Table 7. Of the ten active institutions, nine were academic institution and one was a research institution. Seven of the active institutions were based in the USA, one in Nigeria, one in South Africa, and one in Sweden. The University of California, San Francisco ranked first (n = 33; 1.3%) followed by the University of KwaZulu-Natal (n = 25; 1.0%).

Table 7

Top ten active institutions involved in publishing documents on SRH knowledge and awareness among young people

Rank*	Institution	Number of publications	% N = 2544	Country
1	University of California, San Francisco	33	1.3	USA
2	University of KwaZulu-Natal	25	1.0	South Africa
3	University of Ibadan	21	0.8	Nigeria
4	Columbia University in the City of New York	19	0.7	USA
5	The University of North Carolina at Chapel Hill	17	0.7	USA
5	Emory University	17	0.7	USA
7	Uppsala Universitet	15	0.6	Sweden
7	Centers for Disease Control and Prevention	15	0.6	USA
9	University of Pennsylvania	14	0.6	USA
9	University of Washington, Seattle	14	0.6	USA

*in ranking, institutions with equal numbers were given similar ranking and one place in the ranking system was skipped.

3.10 Authorship analysis

A total of 9565 authors participated in publishing the retrieved documents; an average of 3.8 authors per document. A total of 286 (11.2%) publications were single authored and 509 (20.0%) were double-authored. Network visualization of top 20 active authors showed that most active authors do not exist within research networks (Fig. 4).

3.11 Funding

Of the total retrieved documents, 489 (19.2%) were funded projects. The main funding agency was the American National Institute of Health (n = 94; 3.7%).

4.0 Discussion

The current study aimed to assess and analyze literature on SRH knowledge and awareness among young people. The current study showed that the growth of publications has witnessed two steep increase in the number of publications. The first increase is mostly due to the spread of HIV/AIDS while the second increase was mostly due to the HPV and the development of HPV vaccine. The retrieved publications received relatively lesser number of citations than publications in other topics. For example, the h-index of the retrieved publications was lower than that for publications on AIDS-related stigma [41], carbapenem resistance [42], depression in diabetic patients [43], but higher than that on female genital mutilation [44]. The relatively low h-index and the relatively fixed growth of publications are indicative of poor or inadequate interest in adolescent health. This conclusion was also endorsed by previous publications [45].

The current study indicated that there were four major research themes. Sexually transmitted diseases/infections, particularly HIV and HPV, were central themes in the retrieved documents. The WHO list of global health threats published in 2019 included two items that were indirectly related to adolescent health [46]. HIV and vaccination hesitancy especially for HPV. It is estimated that in 2016, approximately 2.1 million adolescents were living with HIV. Adolescents get the HIV either from their mothers (vertical transmission) or during their unprotected sexual practices at adolescence. Of the estimated 2.1 million adolescents with HIV in 2016, 71% lived in nine countries in sub-Saharan Africa and India [47, 48]. This might explain the relatively high research productivity per capita from India and other African countries such as Nigeria. It is believed that unprotected sex is the most common route of HIV infection among adolescents and that low sexual health knowledge is a key barrier to reducing HIV infections among adolescents [49, 50]. The second major theme in the retrieved literature was HPV. Vaccines have been proven to prevent HPV infection and reduce incidence of cervical cancer [51]. However, there is increased resistance and hesitancy among parents to uptake HPV vaccines for their adolescent children for various medical and non-medical reasons [52–54] Studies have also shown that numbers of parents who declined vaccination have quadrupled from 4.4–16.4% between the years 2014 and 2017 [51]. No wonder that HPV vaccine hesitancy articles were visualized as the most recent hot topic on SRH knowledge and awareness among young people.

The current study showed that condom use, contraceptive pills, pregnancy, and abortion were also major themes in the retrieved publications. Studies have shown that adolescents and young people had limited access to SRH services and limited or incomplete information about contraception and abortion obtained from peers or other unreliable resources [55–58]. Another problem is child marriage is a global issue but highest rates take place in rural sub-Saharan Africa and South Asia [59]. India has the most child marriages and in 47% of all marriages in India the bride is a child.

The current study showed the African and South-Eastern Asian regions have the highest relative research activity in this field. At the country level, India and Nigeria have the highest normalized research output. South Asia has more adolescents – nearly 350 million – than any other region while adolescents in the sub-Saharan Africa make up the greatest proportion of the population, with fully 23 per cent of the region's population aged 10–19 [2].

In absolute numbers, the USA, the UK, Australia, and Canada ranked among the top active countries. This was expected given that these countries showed leading research role in various medical subjects [60–62]. Adolescents in developed countries have better access to SRH services than their peers in low- and middle-income countries [63]. Adolescents in developed countries seem to have better school services and parental education about SRH [64]. For example, a study in the USA found that in 2015–2017, 89% of females and 94% of males aged 15–19 reported that they or their partner had used contraceptives the last time they had sexual intercourse [65]. The condom is the contraceptive method most commonly used among adolescents in the USA. In 2015–2017, 63% of females and 82% of males aged 15–19 in the USA reported having used a condom the first time they had sexual intercourse [65].

The current study is the first bibliometric investigation of the global research on SRH knowledge in adolescents. However, the current study has a few limitations. The terms used to retrieve the relevant documents were based on terms used in previously published studies. The author did his best to include all possible relevant terms. However, some terms might be missed. Publications in this field that have been published in local or regional journals that are un-indexed in Scopus were also missed. Therefore, publications in un-indexed journals in Africa, Asia, Latin America, and other parts of the world were missed.

5.0 Conclusion

The growth of global adolescent and young population and the increasing number of health challenges they face need to be transformed into research that increases adolescents' health and wellbeing in different parts of the world. The current study showed that the number of publications on SRH knowledge and awareness among young people was affected by the Sexually transmitted infections and contraception were the major research themes global emergence of HIV/AIDS in the 1980s and by the development of HPV vaccinations in 2004. In absolute numbers, the region of the Americas and the European region were most active. However, relative to research in all age groups, the South-Eastern Asian region was most active. The new generations of young people across the globe need to be educated regarding their SRH at school level or through trusted web pages to avoid misinformation or incomplete knowledge that might cause harm to their life. This cannot be achieved without rigorous research on the level of knowledge taking into consideration the socio-cultural and religious variations in different world regions.

Abbreviations

SRH: Sexual and reproductive health

WHO: World Health Organization

Declarations

- Ethics approval and consent to participate: Not Applicable
- Consent for publication: Not Applicable
- Availability of data and materials: Not applicable
- Competing interests: None
- Funding: None
- Authors' contributions: W.S design and manuscript writing. A. M: data analysis and interpretation.
- Acknowledgements: None

References

1. World Health Organization (WHO): **The Health of Youth**. In: *document A42/Technical Discussions/2*. Geneva; 1989.
2. UNICEF: **Adolescent demographics** [<https://data.unicef.org/topic/adolescents/demographics/>]
3. World Health Organization (WHO): **Global accelerated action for the health of adolescents (AA-HA!): guidance to support country implementation**. 2017.
4. World Health Organization (WHO): **Orientation Programme on Adolescent Health for Health-care Providers**. In. Geneva; 2019.
5. World Health Organization (WHO): **Adolescent Pregnancy** [<https://www.who.int/news-room/fact-sheets/detail/adolescent-pregnancy>]
6. Darroch JE, Woog V, Bankole A, Ashford LS, Points K: **Costs and benefits of meeting the contraceptive needs of adolescents**. *Guttmacher Institute* 2016.
7. Raj A, Boehmer U: **Girl child marriage and its association with national rates of HIV, maternal health, and infant mortality across 97 countries**. *Violence against women* 2013, **19**(4):536-551.
8. AlQuaiz AM, Kazi A, Al Muneef M: **Determinants of sexual health knowledge in adolescent girls in schools of Riyadh-Saudi Arabia: a cross sectional study**. *BMC women's health* 2013, **13**:19.
9. Coast E, Lattof SR, Strong J: **Puberty and menstruation knowledge among young adolescents in low- and middle-income countries: a scoping review**. *International Journal of Public Health* 2019, **64**(2):293-304.
10. Guo S, Yang Y, Liu F, Li F: **The awareness rate of mental health knowledge among Chinese adolescent: A systematic review and meta-analysis**. *Medicine (United States)* 2020, **99**(7).
11. Munakampe MN, Zulu JM, Michelo C: **Contraception and abortion knowledge, attitudes and practices among adolescents from low and middle-income countries: A systematic review**. *BMC Health Services Research* 2018, **18**(1).
12. Samkange-Zeeb FN, Spallek L, Zeeb H: **Awareness and knowledge of sexually transmitted diseases (STDs) among school-going adolescents in Europe: A systematic review of published literature**. *BMC Public Health* 2011, **11**.

13. Singh S, Zaki RA, Farid NDN: **A systematic review of depression literacy: Knowledge, help-seeking and stigmatising attitudes among adolescents.** *Journal of Adolescence* 2019, **74**:154-172.
14. Tallon JM, Saavedra Dias R, Costa AM, Leitão JC, Barros A, Rodrigues V, Monteiro MJ, Almeida A, Narciso J, Silva AJ: **Impact of Technology and School-Based Nutrition Education Programs on Nutrition Knowledge and Behavior During Adolescence—A Systematic Review.** *Scandinavian Journal of Educational Research* 2019.
15. Yi S, Tuot S, Mwai GW, Ngin C, Chhim K, Pal K, Igbiniedion E, Holland P, Choub SC, Mburu G: **Awareness and willingness to use HIV pre-exposure prophylaxis among men who have sex with men in low- and middle-income countries: A systematic review and meta-analysis: A.** *Journal of the International AIDS Society* 2017, **20**(1).
16. Farih M, Freeth D, Khan K, Meads C: **Sexual and reproductive health knowledge and information-seeking behavior among middle eastern female university students: a systematic review.** *International Journal of Sexual Health* 2015, **27**(4):383-395.
17. Ivanova O, Rai M, Kemigisha E: **A systematic review of sexual and reproductive health knowledge, experiences and access to services among refugee, migrant and displaced girls and young women in Africa.** *International Journal of Environmental Research and Public Health* 2018, **15**(8).
18. Sweileh WM, Wickramage K, Pottie K, Hui C, Roberts B, Sawalha AF, Zyoud SH: **Bibliometric analysis of global migration health research in peer-reviewed literature (2000-2016).** *BMC Public Health* 2018, **18**(1):777.
19. World Bank: **List of Countries by GDP (nominal) per capita**
[<http://statisticstimes.com/economy/countries-by-gdp-capita.php>]
20. Van Eck NJ, Waltman L: **Text mining and visualization using VOSviewer.** In.: Centre for Science and Technology Studies, Leiden University, The Netherlands 2011.
21. Hirsch JE: **An index to quantify an individual's scientific research output.** *Proceedings of the National academy of Sciences* 2005, **102**(46):16569-16572.
22. Caskey R, Lindau ST, Alexander GC: **Knowledge and Early Adoption of the HPV Vaccine Among Girls and Young Women: Results of a National Survey.** *J Adolesc Health* 2009, **45**(5):453-462.
23. Dell DL, Chen H, Ahmad F, Stewart DE: **Knowledge about human papillomavirus among adolescents.** *Obstet Gynecol* 2000, **96**(5):653-656.
24. DiClemente RJ, Boyer CB, Morales ES: **Minorities and AIDS: Knowledge, attitudes, and misconceptions among Black and Latino adolescents.** *American Journal of Public Health* 1988, **78**(1):55-57.
25. DiClemente RJ, Forrest KA, Mickler S: **College students' knowledge and attitudes about AIDS and changes in HIV-preventive behaviors.** *AIDS EDUC PREV* 1990, **2**(3):201-212.
26. DiClemente RJ, Zorn J, Temoshok L: **Adolescents and AIDS: A survey of knowledge, attitudes and beliefs about AIDS in San Francisco.** *American Journal of Public Health* 1986, **76**(12):1443-1445.
27. Kahn JA, Rosenthal SL, Hamann T, Bernstein DI: **Attitudes about human papillomavirus vaccine in young women.** *International Journal of STD and AIDS* 2003, **14**(5):300-306.

28. Kegeles SM, Adler NE, Irwin Jr CE: **Sexually active adolescents and condoms: Changes over one year in knowledge, attitudes and use.** *American Journal of Public Health* 1988, **78**(4):460-461.
29. Parsons JT, Halkitis PN, Bimbi D, Borkowski T: **Perceptions of the benefits and costs associated with condom use and unprotected sex among late adolescent college students.** *Journal of Adolescence* 2000, **23**(4):377-391.
30. Sonenstein FL, Pleck JH, Ku LC: **Sexual activity, condom use and AIDS awareness among adolescent males.** *Family Planning Perspectives* 1989, **21**(4):152-158.
31. Yacobi E, Tennant C, Ferrante J, Pal N, Roetzheim R: **University students' knowledge and awareness of HPV.** *Prev Med* 1999, **28**(6):535-541.
32. Agius PA, Pitts MK, Smith AMA, Mitchell A: **Human papillomavirus and cervical cancer: Gardasil® vaccination status and knowledge amongst a nationally representative sample of Australian secondary school students.** *Vaccine* 2010, **28**(27):4416-4422.
33. Bauermeister JA, Meanley S, Pingel E, Soler JH, Harper GW: **Prep awareness and perceived barriers among single young men who have sex with men.** *Current HIV Research* 2013, **11**(7):520-527.
34. Blödt S, Holmberg C, Müller-Nordhorn J, Rieckmann N: **Human Papillomavirus awareness, knowledge and vaccine acceptance: A survey among 18-25 year old male and female vocational school students in Berlin, Germany.** *European Journal of Public Health* 2012, **22**(6):808-813.
35. Curtin N, Ward LM, Merriwether A, Caruthers A: **Femininity ideology and sexual health in young women: A focus on sexual knowledge, embodiment, and agency.** *International Journal of Sexual Health* 2011, **23**(1):48-62.
36. Hashiloni-Dolev Y, Kaplan A, Shkedi-Rafid S: **The fertility myth: Israeli students knowledge regarding age-related fertility decline and late pregnancies in an era of assisted reproduction technology.** *Human Reproduction* 2011, **26**(11):3045-3053.
37. Licht AS, Murphy JM, Hyland AJ, Fix BV, Hawk LW, Mahoney MC: **Is use of the human papillomavirus vaccine among female college students related to human papillomavirus knowledge and risk perception?** *Sexually Transmitted Infections* 2010, **86**(1):74-78.
38. Spies EL, Askelson NM, Gelman E, Losch M: **Young women's knowledge, attitudes, and behaviors related to long-acting reversible contraceptives.** *Women's Health Issues* 2010, **20**(6):394-399.
39. Wong LP, Sam IC: **Ethnically diverse female university students' knowledge and attitudes toward human papillomavirus (HPV), HPV vaccination and cervical cancer.** *European Journal of Obstetrics and Gynecology and Reproductive Biology* 2010, **148**(1):90-95.
40. Young SD, Rice E: **Online social networking technologies, HIV knowledge, and sexual risk and testing behaviors among homeless youth.** *AIDS and Behavior* 2011, **15**(2):253-260.
41. Sweileh WM: **Bibliometric analysis of literature in AIDS-related stigma and discrimination.** *Translational behavioral medicine* 2019, **9**(4):617-628.
42. Sweileh WM, Shraim NY, Al-Jabi SW, Sawalha AF, AbuTaha AS, Zyoud SH: **Bibliometric analysis of global scientific research on carbapenem resistance (1986-2015).** *Ann Clin Microbiol Antimicrob* 2016, **15**(1):56.

43. Sweileh WM: **Analysis of global research output on diabetes depression and suicide.** *Annals of general psychiatry* 2018, **17**:44.
44. Sweileh WM: **Bibliometric analysis of literature on female genital mutilation: (1930 - 2015).** *Reproductive health* 2016, **13**(1):130.
45. Azzopardi PS, Hearps SJ, Francis KL, Kennedy EC, Mokdad AH, Kassebaum NJ, Lim S, Irvine CM, Vos T, Brown AD: **Progress in adolescent health and wellbeing: tracking 12 headline indicators for 195 countries and territories, 1990–2016.** *The Lancet* 2019, **393**(10176):1101-1118.
46. World Health Organization (WHO): **Ten threats to global health in 2019** [<https://www.who.int/emergencies/ten-threats-to-global-health-in-2019>]
47. UNAIDS: **Global AIDS Update 2016.** [<http://www.unaids.org/en/resources/documents/2016/Global-AIDS-update-2016>.]
48. Slogrove AL, Sohn AH: **The global epidemiology of adolescents living with HIV: time for more granular data to improve adolescent health outcomes.** *Current opinion in HIV and AIDS* 2018, **13**(3):170-178.
49. World Health Organization: **HIV/AIDS fact sheet** [<http://www.who.int/mediacentre/factsheets/fs360/en/>]
50. AVERT: **Global information and education on HIV and AIDS. YOUNG PEOPLE, HIV AND AIDS** [<https://www.avert.org/professionals/hiv-social-issues/key-affected-populations/young-people>]
51. Goncalves AK, Cobucci RN, Rodrigues HM, de Melo AG, Giraldo PC: **Safety, tolerability and side effects of human papillomavirus vaccines: a systematic quantitative review.** *The Brazilian journal of infectious diseases : an official publication of the Brazilian Society of Infectious Diseases* 2014, **18**(6):651-659.
52. Guzman-Holst A, DeAntonio R, Prado-Cohrs D, Juliao P: **Barriers to vaccination in Latin America: A systematic literature review.** *Vaccine* 2020, **38**(3):470-481.
53. Facciola A, Visalli G, Orlando A, Bertuccio MP, Spataro P, Squeri R, Picerno I, Di Pietro A: **Vaccine hesitancy: An overview on parents' opinions about vaccination and possible reasons of vaccine refusal.** *Journal of public health research* 2019, **8**(1):1436.
54. Callaghan T, Motta M, Sylvester S, Lunz Trujillo K, Blackburn CC: **Parent psychology and the decision to delay childhood vaccination.** *Social science & medicine (1982)* 2019, **238**:112407.
55. Munakampe MN, Zulu JM, Michelo C: **Contraception and abortion knowledge, attitudes and practices among adolescents from low and middle-income countries: a systematic review.** *BMC Health Serv Res* 2018, **18**(1):909.
56. Kennedy E, Gray N, Azzopardi P, Creati M: **Adolescent fertility and family planning in East Asia and the Pacific: a review of DHS reports.** *Reproductive health* 2011, **8**:11.
57. Chandra-Mouli V, McCarraher DR, Phillips SJ, Williamson NE, Hainsworth G: **Contraception for adolescents in low and middle income countries: needs, barriers, and access.** *Reproductive health* 2014, **11**(1):1.

58. Williamson LM, Parkes A, Wight D, Petticrew M, Hart GJ: **Limits to modern contraceptive use among young women in developing countries: a systematic review of qualitative research.** *Reproductive health* 2009, **6**:3.
59. World Health Organization (WHO): **Child Marriages**
[https://www.who.int/mediacentre/news/releases/2013/child_marriage_20130307/en/]
60. Sweileh WM, Al-Jabi SW, AbuTaha AS, Zyoud SH, Anayah FMA, Sawalha AF: **Bibliometric analysis of worldwide scientific literature in mobile - health: 2006-2016.** *BMC medical informatics and decision making* 2017, **17**(1):72.
61. Sweileh WM: **Global research output on HIV/AIDS-related medication adherence from 1980 to 2017.** *BMC Health Serv Res* 2018, **18**(1):765.
62. Sweileh WM: **Global research trends of World Health Organization's top eight emerging pathogens.** *Globalization and health* 2017, **13**(1):9.
63. Centers for Disease Control and Prevention (CDC): **Adolescent Health**
[<https://www.cdc.gov/nchs/fastats/adolescent-health.htm>]
64. Maughan ED, Bergren MD: **School Health Services to Meet Adolescent Needs in the USA.** In: *International Handbook on Adolescent Health and Development.* edn.: Springer; 2017: 511-523.
65. Guttmacher Institute: **Adolescent Sexual and Reproductive Health in the United States** [Adolescent Sexual and Reproductive Health in the United States]

Figures

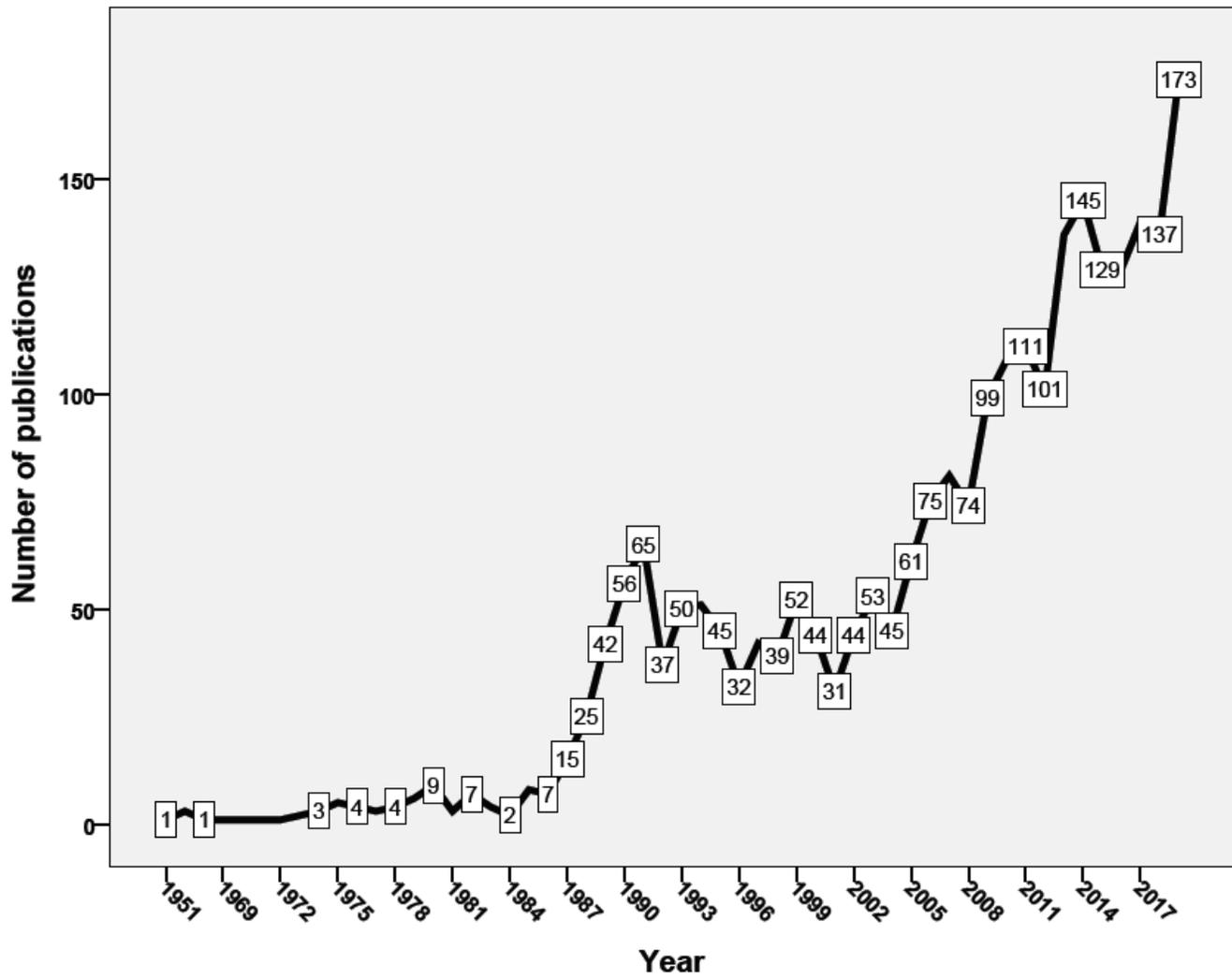


Figure 1

Annual growth of publications on SRH Knowledge among young people (1900 – 2019).

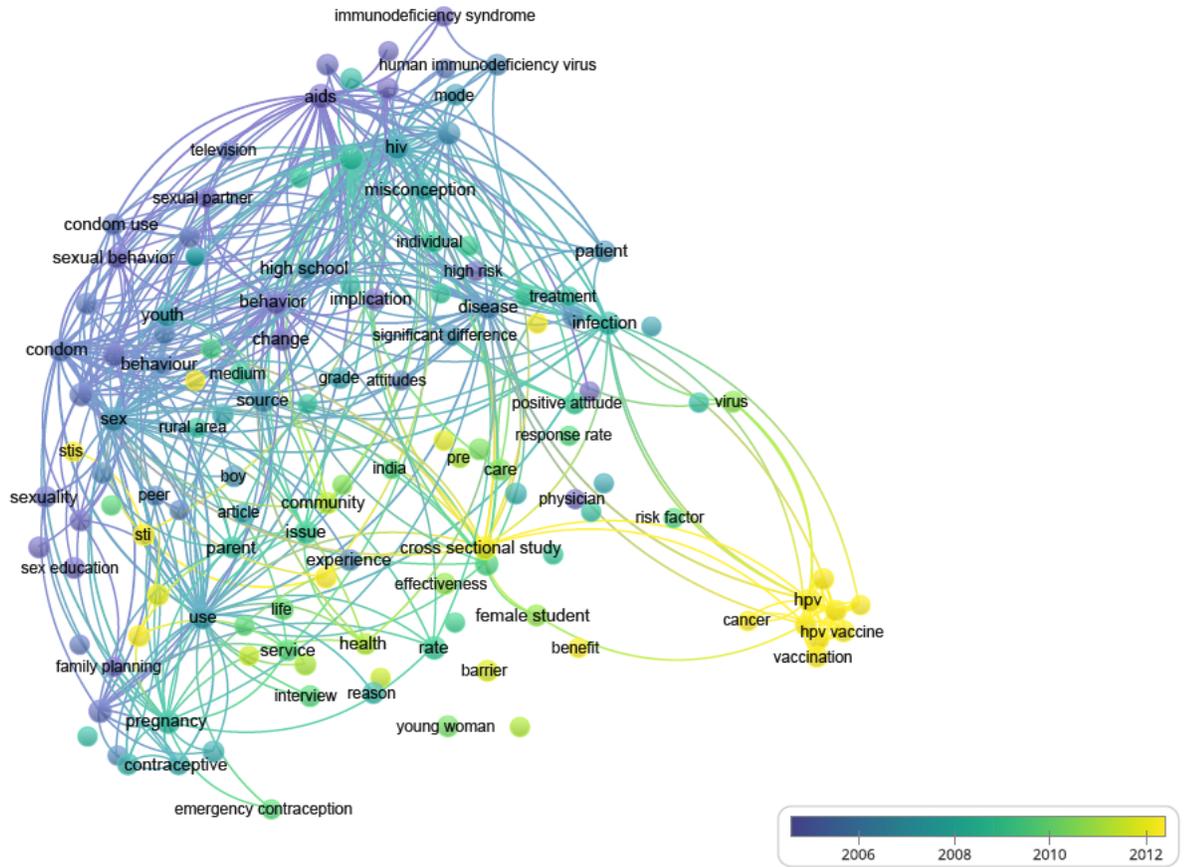


Figure 3

Overlay visualization map of most frequent terms in titles/abstracts of the retrieved publication. Most recent terms have a yellow color.

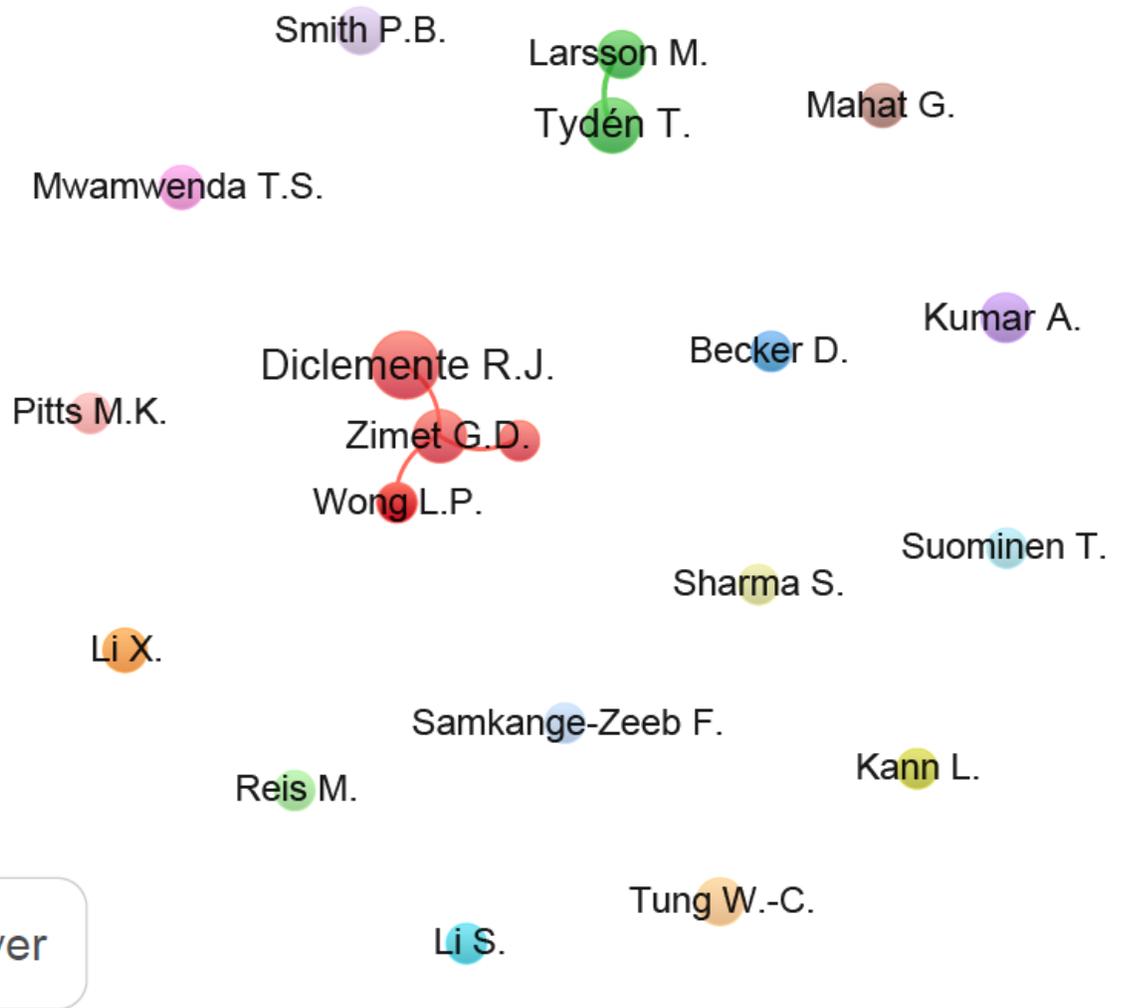


Figure 4

Network visualization map of top 20 active authors. Limited number of research networks were seen in the map.