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## An Assessment of Global Research Activities on Children and Adolescent Online Security

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# An Assessment of Global Research Activities on Children and Adolescent Online Security

## Abstract

The use of the Internet among children and adolescents is now a norm in many parts of the world. As the Internet offers a wide range of benefits to these ones, so does it expose them to possible various risks and harm. Researchers in different countries across the world have engaged in the production of relevant research-based knowledge in order to make the virtual world a safe place for the younger ones. However, while studies have been carried out on the subject of Internet risk among children and adolescents, there is a dearth of information on the assessment of research activities across different parts of the world. The present study employed Bibliometric techniques to determine research productivity patterns across the different regions and countries of the world. All relevant publications indexed in Google Scholar were collected between November and December, 2018. The findings of the study reveal that while countries in the American and European regions of the world have been very productive in researching on the subject, the same is not the case with their African counterparts.

## Keywords

Children Internet Security, Adolescent Internet Security, Bibliometric study, Online risk, Online safety

## INTRODUCTION

The changing presence of the Internet from a medium that is majorly used by elites, the selected few, to one in common everyday use (Haythornthwaite & Wellman, 2008) has impacted greatly on different facets of human lives and endeavors. Its wide acceptance and the pervasiveness of its use among children and adolescents have also become highly unprecedented when compared with some earlier technologies. Although previous studies have shown varying degrees of its use among younger generations in developed and developing nations of the world, report of the continuous rise in its adoption and usage among this group is a common phenomenon (The Gallup Organisation, 2008; DeBell and Chapman 2006; Ybarra, Kiwanuka, Emenyonu, Bangsberg, 2006).

Prominent among its use by children and adolescents are for school related purposes, training in the development of critical thinking and argumentation skills, socialisation and entertainment (Pew Research Center, 2010; Espinoza & Juvonen, 2011; Tynes 2007; Fleming, Greentree, Cocotti-Muller, Elias & Morrison, 2006; Holloway, Green, & Livingstone, 2013). As useful as the Internet medium is however, it makes the young ones vulnerable to many security risks such as internet dependence, pornography, violence and racism, illegal downloading, plagiarism, lack of critical sense, potentially harmful chats and contacts, cyber harassment, spam; and sometimes actual experience of attacks in any of these risks, among many others (De Moor et al. (2008) in Valcke, Wever, Van Keer & Schellens, 2011; Espinoza and Juvonen, 2011).

The strangulation and untimely death of a Nigerian girl, Cynthia Osokogu, in 2012 by a man she met through the BlackBerry messenger service and Facebook, who promised to help her with her fashion business (Duthiers, 2012) and the news of a Michigan teen, Katherine Lester, who slipped out of her country to join a would-be husband she had met through the online networking site, MySpace, (Tynes 2007) are only a few among numerous unpleasantness experienced by children and adolescents across the networked globe. Such unpleasant experiences have fueled different reactions from parents and stakeholders. For example, some experts have urged parents to restrain their children from chat rooms and networking sites where Internet predators may lurk, while some parents ensure that their children avoid the cyberspace totally (Tynes 2007), others however, advocated for evidence-based policies that will assist in balancing the goals of maximising opportunities and minimising risks of the Internet (Hasebrink, Livingstone, Haddon, and Ólafsson, 2009; Mascheroni, and Ólafsson, 2014; Espinoza and Juvonen, 2011). Furthermore, in the words of (Haythornthwaite and Wellman, 2008), 'It is time for further analyses on the Internet in everyday life'.

The Internet spans the entire globe and cybercrime does not require any degree of proximity between the attacker and victim before he can inflict harm upon others (Jones, 2007). Cyber criminals can also defy the conventional jurisdictional realms of sovereign nations, hence, efforts towards minimising children and adolescents' harm in the cyber space ought to be of a global concern. This is important because 'insecurity' of any part of the networked world may constitute danger to people in some other 'seemingly secure' parts of the world. The question now is 'How involved are researchers in the different countries of the world in researching on children and adolescents' Internet risks and safety?'

While several studies have been carried out on issues around online risks and safety of children and adolescents (Livingstone, Haddon, Görzig and Ólafsson, 2011; Mascheroni, and Ólafsson, 2014), there is a dearth of information on the assessment of research activities across different parts of the world. The present study seeks to employ Bibliometric techniques to provide information on this identified research gap.

### **Objective of the Study**

The objective of the present study is to assess the extent of research on online safety of children and adolescents across the countries and regions of the world, using Bibliometric techniques. The sub-objectives of the present study entail the assessment of publication outlets, knowledge producers, coverage, patterns and trends in children and adolescents' online safety research. To achieve the objective of the study, the following research questions were addressed.

### **Research Questions**

1. What type of publication outlets are children and adolescent online safety research published in?
2. Which journals are prolific publication outlets for authors publishing on children and adolescents' online safety research?
3. What is the degree of collaboration of children and adolescents' online safety researchers?
4. What is the distribution of research on adolescents' online safety research across the regions of the world?
5. What is the country distribution of research on adolescents' online safety research?
6. What type of institutions mostly research on children and adolescents' online safety?
7. Who are the prolific authors of children and adolescents' online safety researchers?

8. What is the geographical and virtual coverage of research on adolescents'online safety?
9. What is the trend of scientific productivity of children and adolescents'online safety research?
10. How do the trends of scientific productivity of children and adolescents'online safety research vary across the regions of the world?

## **LITERATURE REVIEW**

Bibliometrics is a field of research that is devoted to quantitative analysis of written publications such as articles, books, conference proceedings and so on, in order to gain insight into certain phenomenon such as output volume, science quality, interdisciplinarity, networking, amongst others (Grant, 2015; Herubel, 1999 in Jacobs, 2010). Bibliometric study can be carried out at macro level involving country and region comparisons, meso level involving research organisations, universities, and institutes, or micro level such as analysis of programmes, groups or individual researchers (Grant, 2015). It could be descriptive, evaluative or relational. Descriptive Bibliometrics describes the properties of literature and is used to measure research productivity (number of publications) of scientists across geographic areas, time periods and departments and disciplines; Evaluative Bibliometrics use citations as the source of its raw data to assess the scientific value of research, and; Relational Bibliometrics are used to examine relations within scientific research to discover insights into the structure of science research (Jacobs, 2010). Specific examples of Bibliometric research activities might include productivity analyses measuring the output and volume share of a specific actor, such as a country's world share of publications or citations; research impact analysis using citations, and relational indicators studying heterogeneity of collaboration patterns between different actors (Mattison, Laget, Nilsson & Sundberg, 2008; Jacobs, 2010). 3106917913

A search through the literature revealed that Bibliometric analyses have been carried out on some Information and Communication Technology (ICT) related topics. For example, Esfahania, Tavasolia and Jabbarzadeh (2019) used Bibliometric techniques to determine country citation shares of literature on big data and social media. Mahieu, van Eck, van Putten & van den Hoven (2018) carried out a Scientometric analysis to determine the nature, scope and dynamics of the field of digital ethics. Kumar and Garg (2005) compared the research output, research impact and journal country of Chinese and Indian authors in the field of computer science. Mester (2015) used indexes (h-index, h5-index and h5-median) for making the ranking list of the first 12 scientists in robotics and of the list of top 20 publications in the field of Robotics. There is however, no known study on assessment of research efforts on internet safety in general and specifically on

children and adolescents. The present study therefore, seeks to carry out a Bibliometric analysis of literature on children and adolescent internet safety in order to identify the hot and cold spots of research and thereby, create a need to improve on research efforts where necessary.

## **RESEARCH METHODOLOGY**

The present study adopted the Bibliometric method of research to determine the distribution of children and adolescent online safety research efforts and productivity across countries of the world. The population of the study consists of all literature that have been published over the years on children and adolescents' online safety, and which are indexed by Google Scholar. Google Scholar advanced search pane was used, between November and December, 2018, to retrieve literature on children and adolescent online risks and safety. The search strategy used for retrieval was framed as "Internet AND 'adolescen\*' OR 'teenage\*' OR 'child\*' AND [cyberbullying OR cyber-bullying OR bullying OR 'Internet addiction' OR 'unsafe internet use' OR 'Parental control' OR 'contact risk' OR 'content risk' OR 'parenting style' OR 'Teacher control' OR 'safety' OR 'online safety' OR 'internet safety' OR 'online risk' OR 'internet risk' OR 'cyberrisk' OR 'parental mediation' OR 'Risky behaviour' OR 'Risky online behaviours']"

The search strategy retrieved nine hundred and ninety seven (997) documents, all of which were manually reviewed. Five hundred and ninety two (592) documents were excluded from the lot due to duplication and non-relevance to the search topic. Finally, four hundred and five (405) documents were used for the Bibliometric analysis in this study.

### **Data Analysis Tools and Methods**

Microsoft Office Excel 2007 and Orange Text Mining Tool Version 3 were used in analysing the research data. Microsoft Office Excel was used in parsing and preparing the data that was downloaded. The software was also used for descriptive analyses (frequency, percentage and charts) of the data. Orange Text Mining tool Version 3 was used for text mining and visualisation of keywords and age range. Keywords used in describing publications and texts on the ages of studied group were copied into two separate csv files and analysed using Orange data mining tool.

To get the word cloud of the keywords, content of the keyword file was first preprocessed by converting text into lowercase, removing stopwords and punctuations, and tokenizing the content about white space. To get the age cloud of groups already studied, content of the age file was preprocessed by converting (manually) the ages reported in text to numbers. For example, a studied age group that was reported as 'ten to eighteen' was converted to '10 to 18'. The resulting



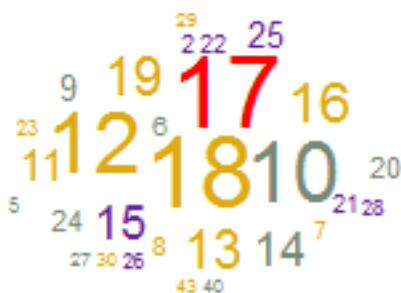


Fig. 2: Age cloud of groups already studied

Fig. 2 shows a cloud of ages of studied groups in the corpus of literature under investigation. The most prominent ages are 17, 18, 10, and 12. Also prominent are 19, 16, 15, 13, and 11. In as much as most studies reported on age ranges of their studied group, it could be inferred that the most studied minimum ages are 10 and 12 while the most studied maximum ages are 17 and 18. Hence, the most studied age range in the previous studies is Age 10 - 18.

## Answers to Research Questions

### Types of Publication Outlets

Categories of publication outlets in which research on children and adolescents have been published are as presented in Fig. 3.

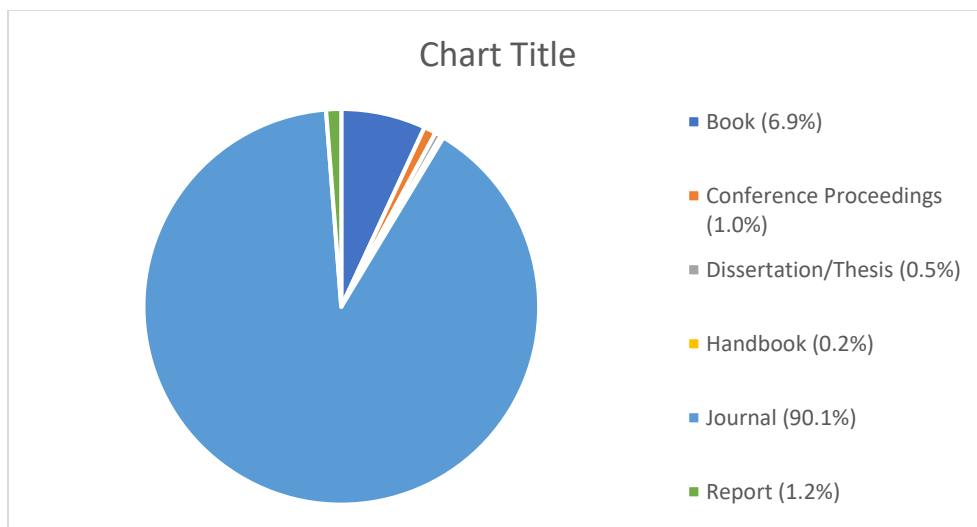


Fig. 3: Publication outlets



As shown in Fig. 3, the highest percentage of research on children and adolescent online risk and safety was published as journal articles (90.1%), followed by books (6.9%) and then reports (1.2%). The least means of publishing research on children and adolescent online risk and safety was as handbooks (0.2%)

### Prolific Journal Outlets

Distribution of the number of published articles in journals and the list of prolific journal outlets are shown in Fig. 4 and Table 1 respectively.

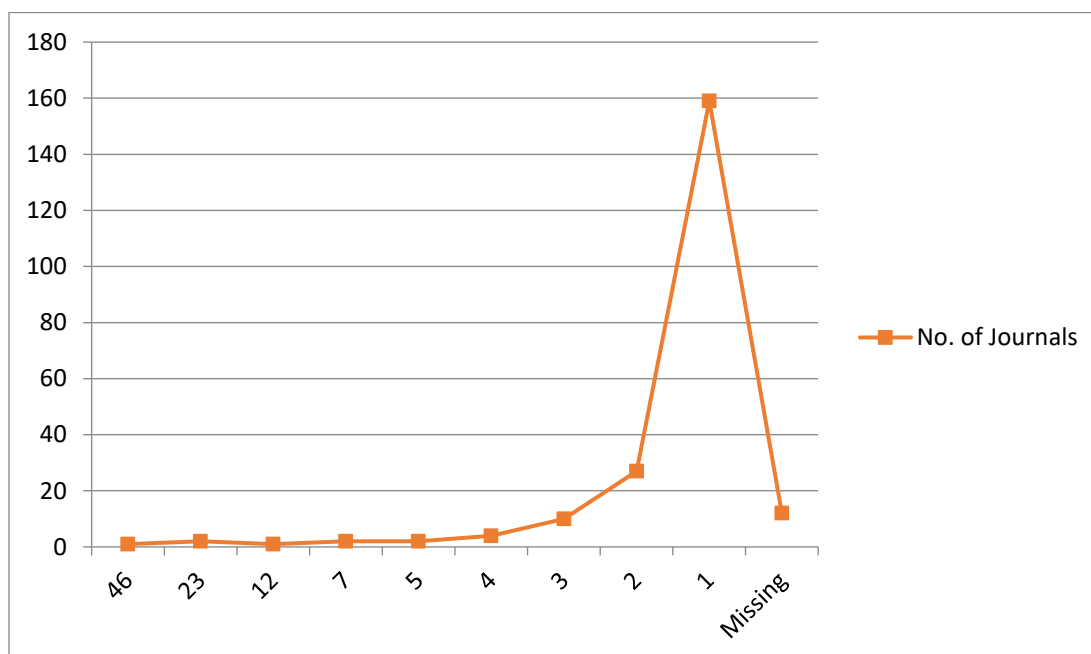


Fig. 4: Distribution of the number of published articles in journals by authors

As shown in Fig. 4, amongst others, only one journal accounted for 46 articles, two journals accounted for 23 articles each, one hundred and fifty-nine journals accounted for only one article each. In the present study, journals having five (5) published articles and above were considered as prolific journal outlets. Table 1 therefore, presents the list of prolific journals publishing on children and adolescent online risk and safety.

S/N	Name of Journal	No. of Articles	Percentage (%)
1	CyberPsychology& Behavior	46	11.5
2	Computers in Human Behavior	23	5.8
3	Journal of Adolescent Health	23	5.8
4	Pediatrics	12	3.0
5	Developmental Psychology	7	1.8
6	New Media & Society	7	1.8
7	Archives of Pediatrics & Adolescent Medicine	5	1.3
8	Journal of Adolescence	5	1.3

*Table 1: Names of Prolific Journal Outlets*

As shown in Table 1, CyberPsychology, Behavior & Social Network ranked first with the highest number of articles (46) published accounting for 11.5% of all articles, this is followed by Computers in Human Behavior and Journal of Adolescent Health journals both of which ranked second with 23 articles (5.8%) each. Pediatrics ranked fourth with 12 (3.0%) articles. The remaining in their descending order of productivity are Developmental Psychology (1.8%) and New Media & Society (1.8%), Archives of Pediatrics & Adolescent Medicine (1.3%) and Journal of Adolescence (1.3%).

### Authors' Degree of Collaboration

The degree of collaboration of authors is as presented in Table 2.

Year	Single authored papers (N <sub>s</sub> )	Multiauthored papers (N <sub>m</sub> )	Degree of Collaboration (C=N <sub>m</sub> /(N <sub>m</sub> +N <sub>s</sub> ))
1993	1	0	0.00
1997	2	0	0.00
1998	1	0	0.00
1999	3	0	0.00
2000	4	4	0.50
2001	3	5	0.63
2002	1	6	0.86
2003	2	7	0.78
2004	4	16	0.80
2005	4	13	0.76
2006	4	9	0.69
2007	7	26	0.79
2008	13	28	0.68
2009	9	22	0.71
2010	6	33	0.85

2011	3	19	0.86
2012	10	48	0.83
2013	5	31	0.86
2014	3	22	0.88
2015	4	13	0.76
2016	0	10	1.00
2017	0	3	1.00
2018	0	1	1.00
Total	89	316	0.78

*Table 2: Degree of Collaboration of Authors*

As shown in Table 2, the degree of collaboration for the entire body of literature in the present study is 0.78. It could be observed that all the publications in the 1990s (1993 - 1999) were single-authored and therefore, had their degrees of collaboration being zero. It could also be observed that the ones published after 2015, that is (2016 - 2018), were all multi-authored and thus had their degrees of collaboration being 1. In between these two extreme values, Year 2014 had the highest degree of collaboration (0.88) while Year 2000 had the lowest degree of collaboration (0.50).

### **Author's Distribution across World Regions**

Table 3 presents the distribution of authors who have published their research on adolescents' online safety research across the regions of the world.

<b>Rank</b>	<b>Country Region</b>	<b>No. of Authors</b>	<b>Percentage (%)</b>
1	Americas	558	46.2
2	Europe	393	32.6
3	Asia	124	10.3
4	Oceania	77	6.4
5	Africa	1	0.1
6	Missing Value	54	4.5
	Total	1207	100.0

*Table 3: Author distribution across world regions*

As shown in Table 3, one thousand, two hundred and seven (1,207) authors were responsible for publishing the four hundred and five (405) publications being analysed in the present study. Out of these 1,207 authors, over forty-six percent (46.2%) of authors are from the American region, followed by Europe (32.6%), Asia (10.3%), Oceania (6.4%) and Africa (0.1%).

### Author's Distribution across Countries

Table 4 presents the distribution of authors who have published their research on children and adolescents' online safety research across the countries of the world.

S/No.	Country of Affiliation	No. of Authors	Country Percentage (%)	S/No.	Country of Affiliation	No. of Authors	Country Percentage (%)
1	USA	491	42.7	24	Brasil	5	0.4
2	UK	101	8.8	25	Iceland	5	0.4
3	Canada	65	5.6	26	Ireland	5	0.4
4	Australia	61	5.3	27	Estonia	4	0.3
5	Belgium	41	3.6	28	Malaysia	4	0.3
6	Netherland	40	3.5	29	Singapore	4	0.3
7	Greece	36	3.1	30	Thailand	4	0.3
8	Germany	34	2.9	31	Denmark	3	0.3
9	Spain	32	2.8	32	France	3	0.3
10	Taiwan	28	2.4	33	Luxembourg	3	0.3
11	China	25	2.2	34	Slovenia	3	0.3
12	Israel	16	1.4	35	Hong Kong	2	0.2
13	New Zealand	15	1.3	36	Hungary	2	0.2
14	Turkey	15	1.3	37	Lithuania	2	0.2
15	Italy	15	1.3	38	Poland	2	0.2
16	Sweden	14	1.2	39	Czech Republic	1	0.1
17	Korea	13	1.1	40	England	1	0.1
18	Finland	12	1.0	41	Japan	1	0.1
19	Switzerland	11	1.0	42	Lebanon	1	0.1
20	Austria	9	0.8	43	Nigeria	1	0.1
21	Portugal	8	0.7	44	Norway	1	0.1
22	India	6	0.5	45	Philippines	1	0.1
23	Romania	6	0.5	46	United Arab Emirates	1	0.1

Table 4: Distribution of authors across countries

As presented in Table 4, out of forty six countries whose authors have published on children and adolescent online safety, USA accounted for the highest percentage (42.7%) followed by UK (8.8%), Canada (5.6%), Australia (5.3%) amongst other countries.

### Types of Authors' Institutions

Based on the number of published authors, the categories of institutions that have publications in the literature on children and adolescent online risk and security are as presented in Table 5.

Type of Institution	No of Published authors	Percentage of published authors
University	919	76.14
Research Institute/Centre	91	7.54
Hospital	63	5.22
College	50	4.14
Medical Centre	18	1.49
Law Enforcement Agency	3	0.25
Non-Governmental Organisation	3	0.25
Agency	2	0.17
Task Force	2	0.17
International Organization	1	0.08
Professional Association	1	0.08
Missing	54	4.5
Total	1207	100

*Table 5: Types of Institutional Affiliation of Authors*

As shown in Table 5, apart from the authors whose institutional types could not be determined because their institutional affiliations were not specified, eleven types of institutions could be identified as sources of research on children and adolescent online risk and safety. These categories of institution are universities, colleges, research institutes/centres, hospitals, medical centres, task-forces, non-governmental organisations, agencies, law enforcement agents, international organisations and professional associations.

Out of the eleven institutional types, universities accounted for the highest percentage (76%) of published authors. This was followed by research institutes/centres (8%) and hospitals (5%). International organisations and professional associations accounted for only one published author each.

### Prolific Authors and Their Institutions of Affiliation

Distribution of number of published articles by authors and the list of prolific authors are shown in Fig. 5 and Table 6 respectively.

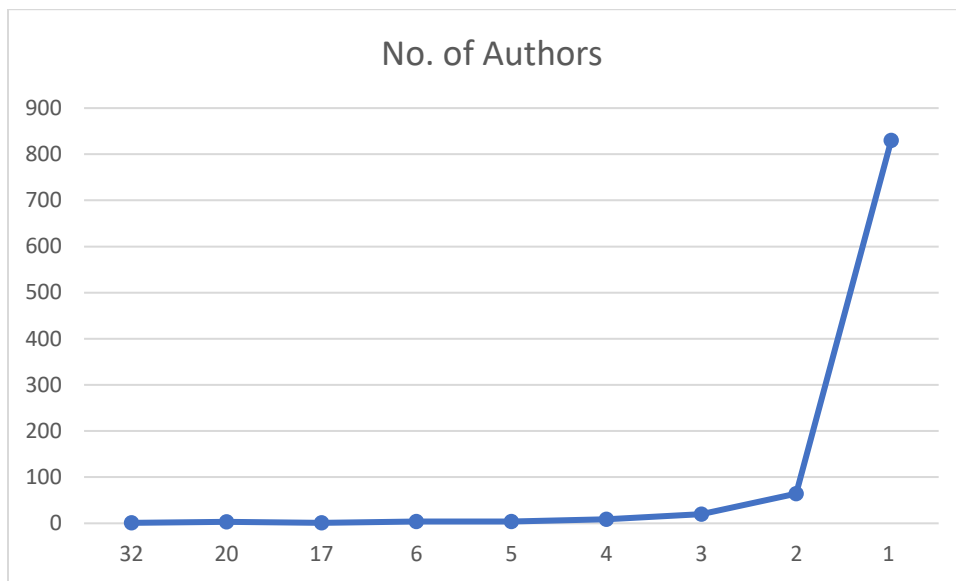


Fig. 5: Distribution of number of published articles by authors

As shown in Fig. 5, amongst others, only one author accounted for 32 articles, three authors accounted for 20 articles each, one author accounted for seventeen articles, four authors accounted for 6 and 5 articles each, nine authors accounted for 4 articles, twenty authors accounted for 3 articles each, sixty-four authors accounted for 2 articles while eight hundred and thirty authors accounted for 1 article each. In the present study, authors having five (5) published articles and above were considered as prolific authors. Table 5 therefore, presents the list of prolific authors that have published on children and adolescent online risk and safety.

S/No.	Name of Authors	Institutional Affiliation	No. of contributions
1	KJ Mitchell	University of New Hampshire	32
2	D Finkelhor	University of New Hampshire	20
3	S Livingstone	London School of Economics and Political Science	20
4	ML Ybarra	Internet solution for kids, Inc/Center for Innovative Public Health Research	20
5	J Wolak	University of New Hampshire	17
6	F Mishna	University of Toronto	6
7	MD Griffiths	Nottingham Trent University	6
8	PM Valkenburg	University of Amsterdam	6
9	KS Young	University of Pittsburgh & St. Bonaventure University & Center for Internet Addiction and Recovery	6

10	J Peter	University of Amsterdam	5
11	K Olafsson	University of Akureyri	5
12	MA Moreno	University of Washington & Seattle Children's Research Institute	5
13	PK Smith	University of London	5

*Table 6: Names of Prolific Authors and their institutional affiliation*

As shown in Table 6, the most prolific author is K. J. Mitchell of University of New Hampshire with 32 articles on internet safety. The second most prolific authors are D. Finkelhor from University of New Hampshire, S. Livingstone from London School of Economics and Political Science, and M. L. Ybarra from Internet solution for kids, Inc/Center for Innovative Public Health Research with 20 articles each. These were followed by J. Wolak from University of New Hampshire with 17 articles. F. Mishna from University of Toronto, K. S. Young from University of Pittsburgh & St. Bonaventure University & Center for Internet Addiction and Recovery, M. D. Griffiths from Nottingham Trent University and P. M. Valkenburg from University of Amsterdam had 6 articles each. Other prolific authors each of whom has five publications are J. Peter from University of Amsterdam, K. Olafsson from University of Akureyri, M. A. Moreno from University of Washington & Seattle Children's Research Institute and P. K. Smith from University of London with 5 articles each.

### **Coverage of Research on Children and Adolescents' Online Safety**

To determine the coverage of previous research on children and adolescents' online safety, research outputs under investigation in the present study have been categorized into three. These are those that studied physical location(s) within a single country, those that studied physical locations within multiple countries and those that studied online (virtual) environments. It was observed that articles in the first two categories are mostly empirical while those in the third categories are mostly reviews of related topics. The distribution of research on adolescents' online safety (based on these three categories) are as presented in Tables 7a – 7c.

S/No.	Research Country	No. of Article	Percentage(%)	S/No.	Research Country	No. of Article	Percentage(%)
1	USA	136	45.8	18	India	2	0.7
2	UK	26	8.8	19	Singapore	2	0.7
3	Australia	15	5.1	20	Sweden	2	0.7
4	Canada	14	4.7	21	Switzerland	2	0.7
5	Netherlands	12	4.0	22	Austria	1	0.3
6	China	10	3.4	23	Brasil	1	0.3
7	Belgium	9	3.0	24	Denmark	1	0.3
8	Germany	8	2.7	25	Italy	1	0.3
9	Greece	8	2.7	26	Luxembourg	1	0.3
10	Spain	8	2.7	27	Mexico	1	0.3
11	Turkey	8	2.7	28	Nigeria	1	0.3

12	Taiwan	7	2.4	29	Poland	1	0.3
13	Korea	5	1.7	30	Portugal	1	0.3
14	Israel	3	1.0	31	Romania	1	0.3
15	New Zealand	3	1.0	32	Slovenia	1	0.3
16	Finland	2	0.7	33	South Africa	1	0.3
17	Hong Kong	2	0.7	34	Thailand	1	0.3

*Table 7a: Distribution of research carried out on physical location(s) within a single country*

As shown in Table 7a, physical locations within thirty-four countries have been studied and reported on in the literature analysed in the present study. Articles reporting studies on USA catered for the highest percentage (45.8%) of all article that reported on physical location(s) in single countries. This is followed by UK, Australia, Canada, Netherlands and china catering for 8.8%, 5.1%, 4.7%, 4.0% and 3.4% respectively. Out of the remaining twenty-eight countries, a country has 3.0%, four countries have 2.7%, one has 2.4%, one has 1.7%, two has 1.0%, six have 0.7%, while thirteen countries have 0.3% of articles reporting on children and adolescent online safety.

Research Country	No. of Article	Percentage(%)
EU Countries	7	33.3
USA & UK	2	9.5
Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece	1	4.8
Austria, Estonia, France, Germany, Hungary, Ireland, Israel, Italy, Romania, Slovenia and Spain	1	4.8
Belgium, France, & Netherlands	1	4.8
China, Japan, South Korea, Malaysia and Philippines	1	4.8
Denmark, Iceland, Ireland, Norway and Sweden	1	4.8
Greece, Spain, Poland, Germany, Romania, the Netherlands, and Iceland	1	4.8
Portugal & Brasil	1	4.8
UK, Netherlands, Italy, & Ireland	1	4.8
USA & Canada	1	4.8
USA & New Zealand	1	4.8
USA, Canada, & Mexico	1	4.8
USA, UK, Australia, & Canada	1	4.8

*Table 7b: Distribution of research carried on physical locations within multiple countries*

As shown in Table 7b, some studies reported on multiple countries that were researched on together. Studies on European countries (all inclusive) take the lead with 33.3% of articles in this category reporting on them. It could be observed that USA is the country that has been most jointly studies with some other countries such as UK, Canada, New Zealand, Mexico and Australia. It could also be observed that in most cases, countries that were jointly reported on are mostly from the same world region.



Virtual Environment	No. of articles	Percentage(%)
Online bibliographic databases (such as PsycINFO, PubMed, MEDLINE, EMBASE, DARE, ASSIA, Scopus, Ovid, Web of Science, Eric, The Cochrane Library, PsycNet, PsychSpider/ZPID, PSYINDEX, Google Scholar)	8	47.1
Social Media (MySpace, Twitter, and Facebook)	7	41.2
Online study resources (ChildData, TeenHealthFX)	2	11.8

Table 7c: Distribution of research carried out on Virtual Environment

As shown in Table 7c, eight articles centered on online bibliographic databases such as PsycINFO, PubMed, MEDLINE, EMBASE, DARE. Seven focused on social media and two on online study websites.

### Productivity Trend of Children and Adolescents' Online Safety Research

The trend of research productivity of children and adolescent internet safety publications indexed in Google Scholar database is as shown in Fig. 6.

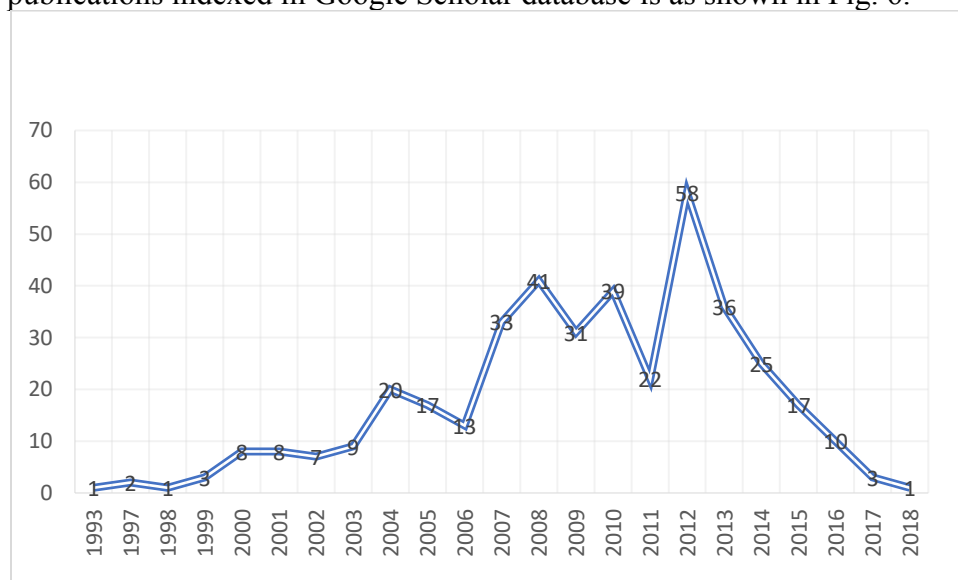


Fig. 6: Pattern of productivity of research on children and adolescents' online safety

As shown in Fig. 6, the highest number of publications (58) were published in the year 2012, while the lowest number (1 only) were published in 1993, 1998 and 2018. There was however, no publication between 1994 and 1997.

### Comparison of Research Productivity Trends across World Regions

The research productivity trends of world regions together with that of the globe are as presented in Fig. 7.

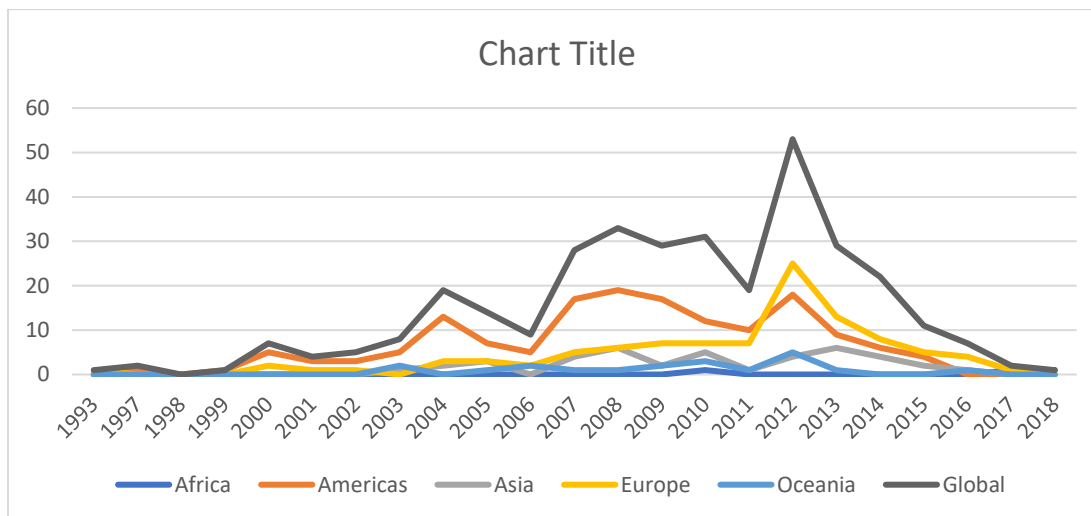


Fig. 7: Research productivity trends comparison

As shown in Fig. 4, the global trend appears to mimic, first that of the American region and secondly, that of the European region. It could also be observed that three regions (Americas, Europe and Oceania) and the globe have their highest productivity in the Year 2012. Asia has its highest productivity in Years 2008 and 2013. Although, Africa has the lowest productivity trend, it is the only region with productivity in the Year 2018.

## DISCUSSION OF FINDINGS AND CONCLUSION

### Discussion of Findings

#### Publication Outlets

The largest percentage (90.1%) of literature on children and adolescent online safety are published in journals. This result is similar to previous studies (Adesina and Opesade, 2018). This shows that authors prefer to publish their research findings in journals when compared with other means of publication. This might not have been unconnected with the fact that academic journals being the 'gold standard', despite the academic rigor required from authors to maintain high level of quality, still attract authors more than other outlets for the publication of their research.

### **Prolific Journal Outlets**

CyberPsychology, Behavior & Social Network ranked first, followed by Computers in Human Behavior and Journal of Adolescent Health journals. Pediatrics ranked fourth followed by Developmental Psychology, and New Media & Society, Archives of Pediatrics & Adolescent Medicine and then Journal of Adolescence. It is worthy to note that Cyberpsychology, Behavior, and Social Networking and New Media & Society were among the specialist journals established in the late 1990s partly in response to the subject of considerable public concern on online and mobile risks among adolescent and children while Computers in Human Behavior was one of the older journals that turned their attention to online risks of children (Livingstone and Smith, 2014). These journals still maintain their leadership role as publishers of articles on the subject. The high performance of health related journals such Journal of Adolescent Health, Pediatrics and also Archives of Pediatrics & Adolescent Medicine is also worthy of note. This might not have been unconnected with health implications of internet risk on children and adolescents.

### **Degree of Collaboration of Children and Adolescents' Online Safety Researchers**

The degree of collaboration for the entire body of literature in the present study is 0.78. While publications in the 1990s were all single-authored and research published between Year 2000 and 2014 were a mixture of single and multi-authored papers, all research published after 2015 were multi-authored. As revealed in this finding, there appears to be a gradual movement from totally single-authorship to totally multi-authorship in the publication of children and adolescents' online safety literature. This corroborates the assertion of Woods, Youn and Johanson (2010). According to them, co-authored and multiple-authored articles have become the norm in recent years, cutting across different disciplines despite the fact that faculty and administrators believed that the amount of credit one receives for publishing should diminish with the addition of more and more authors. The possible reason for the trend towards more than one author per published article might be a need for scientists who are specialists in different areas to work together in order to address the problems using different scientific techniques, approaches, and ideas; need to access resources and research funding from Governmental and non-Governmental organizations; or the demand for higher levels of scientific inquiry, among others (Katz and Martin (1995) in Woods, Youn and Johanson, 2010).

### **Producers of Knowledge: Regional Distribution**

More than forty-six percent (46.2%) of authors that have published on adolescents' online safety are from Americas, followed by Europe (32.6%), Asia (10.3%), Oceania (6.4%) and Africa (0.1%). From this result, it is evident that Americas is the most prolific region while Africa is the least prolific region of the world in terms of regional distribution of author's affiliation.

This finding corroborates the report of Veugelers and Baltensperger (2019) that Europe and the United States have traditionally led in science and technology (S&T) development, and that new S&T powerhouses, the most notable new power in the world S&T landscape being China, have emerged. This assertion can easily be confirmed by the relative performance of each of the five regions where research productivity was led by the Americas, Europe and then Asia. The performance of the African region is however, very poor with a regional score of 0.1%.

Could Africa's lack of publications on this topic be a reflection of the lack of Internet usage and pervasiveness across the region compared to other regions of the world? Africa is the second most populous continent in the world, the region, though having the least Internet penetration (39.6%), has the greatest Internet growth in the World (11,481 %) between the Years 2000 and 2019 (Internet World Stats, 2020). Also, taking the case of Nigeria, the most populous African country, for an example. Nigeria has an enormous internet growth; with the number of Internet users growing from 28 million in 2012 to 103 million in May 2018 (Premium Times, 2018). The Internet has also become increasingly accessible to young people, especially children, both at home and in schools (Nigeria Internet Registration Association, 2016). In spite of increased exposure to the networked world and the fact that the country has gained a level of notoriety for young people committing online fraud, and for children being harmed by strangers they have met online, very little attention is being paid in Nigeria to the issue of digital safety for children (Parenting for a digital future, 2018). The lack of research therefore, might not necessarily be as a result of lack of use or pervasiveness of the Internet in the region. It might probably be due to low priority given to Research and Development and low public funding in Science and Technology in the African region compared to the other regions of the world. It might also be that researchers in Africa have not discovered a need to research on the topic of children and adolescent internet safety as much as expected.

### **Producers of Knowledge: Institutional Types**

Out of the eleven categories of institution from which research on children and adolescent internet safety have been published, universities accounted for the highest percentage of publications and authors. Seventy-six percent of published authors were affiliated to universities while the remaining 24% of authors were distributed across the other ten types of institutions namely colleges, research institutes/centres, hospitals, medical centres, task-forces, non-governmental organisations, agencies, law enforcement agents, international organisations and professional associations. This finding further reaffirms the political and economic importance of universities as institutions that produce and transfer knowledge (Opesade, Famurewa and Igwe, 2017). It also emphasises the position of universities as locus of knowledge production and the role of universities across the world as the most significant producers of new knowledge through research (Anyago & Mabawonku, 2014, Godin and Gingras (2000; Cloete and Bunting (2013b).

### **Producers of Knowledge: Prolific Authors**

As revealed in the study, only one author accounted for 32 articles, three authors accounted for 20 articles each, one author accounted for seventeen articles, four authors accounted for 6 and 5 articles each, nine authors accounted for 4 articles, twenty authors accounted for 3 articles each, sixty-four authors accounted for 2 articles while eight hundred and thirty authors accounted for 1 article each. This pattern supports the assertion of Lotka's power law which affirms that there is an inverse relation between the number of publications and the number of authors producing them. (Adigwe, 2016; Maz-Machado, José, Jiménez-Fanjul, León-Mantero, 2017).

The most prolific author in the present study is K. J. Mitchell followed by D. Finkelhor, both of whom are affiliated to University of New Hampshire. S. Livingstone and M. L. Ybarra affiliated to London School of Economics and Political Science, and Internet solution for kids, Inc/Center for Innovative Public Health Research respectively came next. These are followed J. Wolak from University of New Hampshire, F. Mishna from University of Toronto, K. S. Young University of Pittsburgh, M. D. Griffiths from Nottingham Trent University and then P. M. Valkenburg from University of Amsterdam. These prolific authors are affiliated to institutions that are based in USA, Europe and Canada. Three of these prolific authors are from the same university, University of New Hampshire.

### **Coverage of Research on Children and Adolescents' Online Safety**

Physical locations within thirty-four countries have been studied and reported on in the literature analysed in the present study. Articles reporting studies on USA catered for the highest percentage of all articles that reported on physical location(s) in single countries. This is followed by UK, Australia, Canada, Netherlands and China. This finding corroborates the fact that United States is the most prolific publisher of high-quality science in the world as reported in Nature Index (2016) and Nature Index (2019). It could also be observed that all these highly productive countries (except Netherlands) are in the list of the largest contributors to papers published in the 82 leading journals in Year 2018 and among the top 10 countries for scientific research in 2018 tracked by the Nature Index (Nature Index, 2019). European Union (EU) countries as a bloc took the lead among countries that were studied together. This is in line with the EU strategy to be a global centre for excellent research and to be positioned as world-leader in critical technological fields. The EU and its Framework Programme has been charged to support further integration of the intra-EU excellent research pole among others (Veugelers and Baltensperger, 2019).

### **Patterns of Research Productivity**

The research productivity trend of children and adolescent online safety reveals very low productivity in the 1990s and a gradual and continuous increase from the Year 2000 until Year 2012 after which a gradual decline in productivity begins to set in. This trend might be because researchers might not have seen a need to research on the subject as at 1990s due to the fact that the Internet was still at its infancy stage and its adoption was not so pervasive among children and adolescent to warrant exposure to internet risks. However, as the Internet became more accessible to the younger generation and there arose increased exposure to internet risks, then researchers in different parts of the world began to get interested in the subject. The gradual decline in the amount of research output from Year 2012 until Year 2018, when only one output was found, appear to be a remarkable trend. Could it be that researchers have become less interested in studying the problem or that previous research efforts have helped to mitigate effect of online risks among young ones and there is actually no need for so much more research in the field?

This trend appears to be a reflection of perceived need for research on the subject, particularly in some developed countries of the world as could be inferred from the submission of Livingstone and Smith (2014) in their review of research of harms experienced by child users (under 18 years old) of online and mobile technologies mostly concentrated in Europe, North America and Australia. According to them considerable public concern among parents, educators and clinicians, as amplified by the mass media on online and mobile risks among

adolescent and children led to a new and multidisciplinary field of research which has emerged in the late 1990s. However, in their study which was conducted about two decades later it was reported that although sexual and aggressive risks of cyberbullying, contact with strangers, sexual messaging ('sexting') and pornography vary in prevalence, they do not appear to be rising substantially with increasing access to mobile and online technologies, possibly because these technologies pose no additional risk to offline behaviour, or because any risks are offset by a commensurate growth in safety awareness and initiatives. Furthermore, as stated by them,

Since the present climate in many developed countries favours evidence-based policy making, it is constructive that the past decade has seen an escalation in researchers from multiple disciplines combining forces to raise awareness, produce research evidence, and initiate multi-stakeholder efforts to mitigate harm.

Could it then be that research tempo in the developed countries might have been reduced based on the present state of security as revealed by evidence-based research? While children and adolescents in the developed parts of the world might have been helped due to safety awareness and initiatives, those in the developing countries, particularly, Africa have been under-researched. Without adequate research, their level of vulnerability or propensity to constitute threat to others would remain unknown.

## **Conclusion**

The results generated from the present study show that journals are the most preferred means of publishing research on children and adolescent online safety. The most prolific journals in the research field are CyberPsychology, Behavior & Social Network, Computers in Human Behavior, Journal of Adolescent Health, Pediatrics, Developmental Psychology, New Media & Society, Archives of Pediatrics & Adolescent Medicine and Journal of Adolescence. Authors have gradually moved from absolute single authorship to absolute multi-authorship of research publication. Distribution of research on children and adolescent online safety is highest in the American region followed by the European, Asian, Oceania and African regions. United States of America top the list of countries that have been researched and that have published on the subject.

A remarkable percentage of authors that have published on children and adolescent online safety are affiliated to universities. The most prolific authors are K. J. Mitchell from University of New Hampshire, D. Finkelhor from University of New Hampshire, S. Livingstone from London School of Economics and Political Science, and M. L. Ybarra from Internet solution for kids, Inc/Center for Innovative

Public Health Research, J. Wolak from University of New Hampshire, F. Mishna from University of Toronto, K. S. Young from University of Pittsburgh & St. Bonaventure University & Center for Internet Addiction and Recovery, M. D. Griffiths from Nottingham Trent University and P. M. Valkenburg from University of Amsterdam.

While little was done in the 1990s, there was a gradual and continuous increase from the Year 2000 until Year 2012 after which there is a gradual decline in productivity. Comparison of research trend across the regions of the world revealed that this trend is driven by the developed regions of the world, particularly America and then Europe.

## **Recommendations**

Based on the findings of this study, the following recommendation are made:

1. Researchers in the developing countries, especially African countries should take interest in researching on children and adolescents' internet safety.
2. Government of African countries should support researchers to engage in research on children and adolescents' internet safety.
3. Funding agencies should assist African researchers to carry out evidence-based evidences on the state of children and adolescents' internet safety.
4. Researchers in the well-researched parts of the world should never relent in their initiative to make the Internet a safe place for their children and adolescents.

## **Suggestions for Further Studies**

The main objective of the present study is to assess, based on bibliographic analysis of publications indexed in Google Scholar, patterns in research activities across different parts of the world. The findings have however, necessitated a need for further studies in order to provide answers to some further questions emanating from the present study. We hereby provide the following suggestions for further studies:

1. Investigation of factors responsible for a decline in the number of publications on children and adolescent online safety from 2012 to 2018 as indexed in Google Scholar database.
2. Investigation of factors responsible for Africa's low productivity in research on children and adolescent internet safety.
3. Investigation of law enforcement agencies' interest in children and adolescent online safety research in the different parts of the world.



4. Determination of prominent topics that have been studied in existing literature on children and adolescent online safety.

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