Pediatric type 1 diabetes research in the 21st century: A scientometric review

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Abstract

Introduction: Scientometric studies help scientists to identify research gaps and plan future research. There is no scientometric assessment of research on childhood onset type 1 diabetes (T1D), despite an intensive research in this field over the past 2 decades.

Aim of the study: To provide a scientometric assessment of global research output in pediatric T1D.

Material and methods: Publications on pediatric T1D indexed in Scopus database over the 20-year period from 2000 to 2019 were examined. The most productive and impactful countries, organizations and authors, trends in research, the media of publications and characteristics of high cited publications were identified using appropriate bibliographic tools.

Results: Pediatric T1D research registered 7.84% and 79.99% annual and 10-year cumulative growth and averaged 19.35 citations per paper (CPP). The field witnessed an uneven participation of 141 countries, wherein 82.67% of the global research output share came from top 10 countries. USA leads the ranking with 29.76% share, followed by UK (10.56%), Germany, Italy, Sweden and Australia (5.15% to 7.88%), and Poland, Finland, Canada and Denmark (3.04% to 4.24%). Five countries which registered relative citation index (RCI) higher than their group average of 1.63 were Finland (2.30), UK (1.82), Canada (1.77), Denmark and USA (1.74 each). The number of participating organizations and authors was 3627 and 5596 respectively.

Conclusions: The USA and Finland are the most productive and the most impactful countries respectively in global pediatric T1D research. The contribution from developing countries especially from Southeast Asia is meager despite a large disease burden.

Key words: children, scientometrics, type 1 diabetes, bibliometrics, global publications.
**Introduction**

Type 1 diabetes (T1D) is a common endocrine condition in children with a high disease burden worldwide [1]. The annual incidence is estimated to be 98,200 and 128,900 new cases in the under 15 and under 20 year age-groups [1]. An increasing incidence and prevalence is reported from almost all countries (and IDF regions) over the past decades with the most consistent increase seen in the Southeast Asia (SEA) region [1]. The recent estimates suggest that India has surpassed USA in the annual number of incident cases in the 0–14 age group estimated at 15,900 as compared to USA’s 14,700 [1]. Due to the sheer magnitude of disease burden, T1D has been a focus of intensive research globally especially during the last few decades. Despite a large number of publications on pediatric T1D, a precise estimate of global research output is not available in literature. There are several scientometric analyses conducted on diabetes research in countries with high disease burden such as India, China, European and Middle East countries but all of them are focused on Type 2 diabetes (T2D) [2–10]. Only one previous paper has analysed the publication output on T1D from the Middle-East countries [11]. A brief bibliometric assessment of Australian T1D research was reported by the Juvenile Diabetes Research Foundation (JDRF) as part of a report on T1D research agenda for Australia [12]. We therefore planned to undertake the present scientometric study to address the lack of a comprehensive assessment of global research in pediatric T1D.

**Material and methods**

The global research on pediatric T1D was evaluated by applying a combination of quantitative and qualitative indicators on indexed publications in international Scopus database during 2000–2019. Specifically, we evaluated the distribution of publication by publication type and source type, annual and cumulative growth, contribution, impact and share of top 10 countries and their international collaboration, identification of broad subject headings and significant keywords highlighting the trends in research, profiles of its top organizations and authors, media of research communications and identification of most productive and impactful journals and characteristic features of highly cited papers.

The publications on pediatric T1D during 2000–2019 were retrieved from the Scopus database (http://www.scopus.com) by using two combinations of keywords: (“Type 1 Diabet*”) and (Child* or pediatric* or juvenile). As shown below in search strategy, these keywords were searched in “TITLE-ABS-KEY” tag and the search output confined to period “2000–2019” using “date range tag”. This search strategy was subsequently refined by country (including India) to identify top 10 most productive countries. The search strategy yielded 13,193 global publications and these publications were further analyzed by broad subjects, collaborating countries, author-wise, organization-wise and journal-wise etc., by using analytical provisions of Scopus database. Citations to publications were counted from date of their publication till 17 December 2019. TITLE-ABS-KEY (“Type 1 Diabet*” and (Child* or pediat* or juven*)) AND PUBYEAR > 1999 AND PUBYEAR < 2020.

**Results**

**Publication number and types**

The total publications covered in Scopus database during 2000–2019 were 13,193. The annual output registered 7.84% average growth rate, up from 242 publications in the year 1999 to 957 publications in the year 2019. The 10-year cumulative output registered 79.99% absolute growth, up from 4,712 publications during 2000–2009 to 8,481 publications during 2010–2019. The average citations per paper (CPP) were 19.35 during 2000–2019, which showed a decrease from 38.08 during 2000–2009 to 8.95 CPP during 2010–2019 (Table I). 10,737 (81.38%) publications appeared as original articles, 1,350 (10.23%) as reviews, 260 (1.97%) as letters, 202 (1.53%) as notes, 136 (1.03%) as book chapters and < 1% as others which included editorials (0.50%), erratum and short surveys (0.42% each), books (0.11%), conference reviews (0.02%), retracted (0.01%) and undefined (0.04%).

**Country-wise share of publications**

One hundred and forty one countries participated unevenly in global pediatric T1D research; 65 countries contributed 1–10 papers each, 24 countries 11–30 papers each, 11 countries 31–50 papers each, 10 countries 51–100 papers each, 22 countries 101–500 papers each, 6 countries 501–1000 papers each and 3 countries 1001–3926 papers each. Table II shows the top 10 most productive countries in pediatric T1D research. The share of international collaborative papers of these countries averaged 35.12% (14.26% to 61.35%); the largest share was of Denmark and the least share of Poland. 82.67% of the global research output share and more than 100 citations share come from top 10 countries. USA leads the ranking with global publication share of 29.76% share, followed UK (10.56%), Germany, Italy, Sweden and Australia (from 5.15% to 7.88%), Poland, Finland, Canada and Denmark (from 3.04% to 4.24%).

The publication output increased from 0.15% to 3.87% in 7 countries namely USA, Australia, Denmark, Germany, Sweden, Canada and UK as against a decrease from 1.11% to 0.63% in 3 countries, namely Italy, Finland and Poland during 2000–2009 to 2010–2019. Finland, UK, Canada, Denmark and USA registered relative citation index (RCI) higher than their group average of 1.63 (Table II).

**Subject-wise distribution of research output**

Medicine contributed the largest publication share (88.79%) followed distantly by biochemistry, genetics and molecular biology (29.04%), nursing (11.16%), immunology & microbiology (6.22%), etc. during 2000–2019 (Table 1, supplementary
Table I. Global publication output and citations count in pediatric type 1 diabetes research, 2000–2019

| Year | TP  | TC    | CPP  | Year | TP  | TC    | CPP  |
|------|-----|-------|------|------|-----|-------|------|
| 2000 | 242 | 10,636 | 43.95 | 2010 | 694 | 20,264 | 29.20 |
| 2001 | 325 | 13,441 | 41.36 | 2011 | 730 | 17,84 | 2.44  |
| 2002 | 373 | 15,190 | 40.72 | 2012 | 750 | 16,685 | 22.25 |
| 2003 | 429 | 18,219 | 42.47 | 2013 | 824 | 18,92 | 2.30  |
| 2004 | 486 | 17,643 | 36.30 | 2014 | 832 | 16,57 | 1.99  |
| 2005 | 508 | 22,005 | 43.32 | 2015 | 901 | 12,558 | 13.94 |
| 2006 | 534 | 20,333 | 38.08 | 2016 | 912 | 9,121 | 10.00 |
| 2007 | 559 | 16,527 | 29.57 | 2017 | 907 | 6,934 | 7.64  |
| 2008 | 649 | 25,130 | 38.72 | 2018 | 974 | 4,007 | 4.11  |
| 2009 | 607 | 20,293 | 33.43 | 2019 | 957 | 997   | 1.04  |
| Total| 4712| 179,417 | 38.08 | Total| 8481| 75,899| 8.95  |

TP – total papers; TC – total citations; CPP – citations per paper

Table II. Global publication output and share of top 10 most productive countries in pediatric type 1 diabetes research, 2000–2019

| S.no. | Country | Number (% share) of papers | TCP | CPP | ICP | %ICP | RCI |
|-------|---------|----------------------------|-----|-----|-----|------|-----|
|       |         | 2000–2009 | 2010–2019 | 2000–2019 | 2000–2019 | 2000–2019 | 2000–2019 |
| 1     | USA     | 1285 (27.2) | 2641 (31.1) | 3926 (29.7) | 131,852 | 33.58 | 1084 | 27.61 | 1.74 |
| 2     | UK      | 493 (10.4)  | 900 (10.6)  | 1393 (10.5) | 49,029  | 35.20 | 655  | 47.02 | 1.82 |
| 3     | Germany | 357 (7.5)   | 683 (8.0)   | 1040 (7.8)  | 32,719  | 31.46 | 524  | 50.38 | 1.63 |
| 4     | Italy   | 355 (7.5)   | 545 (6.4)   | 900 (6.8)   | 22,133  | 24.59 | 302  | 33.56 | 1.27 |
| 5     | Sweden  | 281 (5.9)   | 542 (6.3)   | 823 (6.2)   | 23,680  | 28.77 | 160  | 19.44 | 1.49 |
| 6     | Australia| 200 (4.2)  | 480 (5.6)   | 680 (5.1)   | 18,004  | 26.48 | 283  | 41.62 | 1.37 |
| 7     | Poland  | 237 (5.0)   | 373 (4.4)   | 610 (4.6)   | 7439    | 12.20 | 87   | 14.26 | 0.63 |
| 8     | Finland | 244 (5.1)   | 357 (4.2)   | 601 (4.5)   | 26,766  | 44.54 | 331  | 55.07 | 2.30 |
| 9     | Canada  | 180 (3.8)   | 353 (4.1)   | 533 (4.0)   | 18,206  | 34.16 | 264  | 49.53 | 1.77 |
| 10    | Denmark | 115 (2.4)   | 286 (3.3)   | 401 (3.0)   | 13,490  | 33.64 | 246  | 61.35 | 1.74 |
| Total |         | 3747 (79.5) | 7160 (84.4) | 10,907 (82.4) | 343,318 | 31.48 | 3936 | 36.09 | 1.63 |
| World |         | 4712        | 8481        | 13,193      | 255,316 | 19.35 |      |      |      |

TCP – total cumulative papers; CPP – citations per paper; ICP – international collaborative papers; RCI – relative citation index
Based on the activity index, it was observed that research activities have increased in all three subjects, namely psychology (from 95.34 to 102.59), health professions (62.89 to 120.62) and agricultural and biological sciences (54.78 to 125.12). Immunology and microbiology recorded the highest citation impact per paper of 14.717, followed by medicine (7.40) and biochemistry, genetics and molecular biology (5.94). The overlap in the coverage of literature under the three subjects i.e. pharmacology, toxicology and pharmaceutics probably contributed to their increased activity index (82.43 to 109.76), as against a decrease noted in other subjects, namely medicine (102.37 to 98.68), biochemistry, genetics and molecular biology (103.85 to 97.86), nursing (from 109.75 to 94.58), immunology and microbiology (122.58 to 87.45) and neuroscience (131.53 to 82.48).

**Significant keywords**

We identified 74 keywords (assumed to be significant) from the literature which throw light on the research trends and factors involved in global pediatric T1D research. These keywords are listed in Table 2 (supplementary file) in the decreasing order of the frequency of their occurrence in the literature during 2000–2019.

**Top most productive organizations**

There was uneven participation by 3627 organizations in pediatric T1D research; 2120 organizations published 1–10 papers each, 650 organizations 11–20 papers each, 342 organizations 21–30 papers each, 210 organizations 31–40 papers each, 136 organizations 41–50 papers each, 106 organizations 51–100 papers each, 51 organizations 101–200 papers each and 12 organizations 201–516 papers each. Eight organizations registered their publication output above the most productive group average of 223.54; University of Colorado, USA (684 papers), University of Helsinki, Finland (372 papers), University of Turku, Finland (318 papers), University Hospital of Tampere, Finland (304 papers), University of Washington, Seattle, USA (303 papers), Yale University, USA (285 papers), University of Pittsburgh, USA (235 papers) and Lund University, Sweden (233 papers) (Table III). Similarly, 16 organizations registered their CPP and RCI above the group average of 40.14 and 2.07 respectively. These were National Institute of Health and Welfare, Finland (61.07 and 3.16), Joslin Diabetes Centre, Tampa, USA (56.82 and 2.94), Jaeb Center for Health Research, USA (52.61 and 2.72), University of Washington, Seattle, USA (50.06 and 2.59), University of Tampere, Finland (49.07 and 2.54), Yale University, USA (48.48 and 2.51), Hospital for Children & Adolescents, Finland (48.21 and 2.49), University of Cambridge, U.K. (46.15 and 2.38), University of Oulu, Finland (46.04 and 2.38), Harvard Medical School, USA (45.73 and 2.36), University of Colorado, USA (43.73 and 2.26), Hospital for Sick Children, University of Toronto, Canada (43.66 and 2.26), University Hospital of Tampere, Finland (42.97 and 2.22), University of Toronto, Canada (41.92 and 2.17), University of Pittsburgh, USA (41.34 and 2.14) and Stanford University, USA. (41.31 and 2.13).

**Medium of research communication**

Of the total world output in pediatric T1D research, 97.32% (12840) appeared in journals, 1.11% (146) in books, 0.92% (121) as book series, 0.45% (60) in conference proceedings, 0.08% (11) in trade publications and 0.11% (15) as undefined. Of the 1078 journals which reported 5614 articles, 880 published 1–5 papers each, 135 published 6–10 papers each, 86 published 11–50 papers each, 30 published 51–971 papers each. The top 30 most productive journals accounted for 43.72% share of total research output that appeared in journal medium, which decreased from 46.67% during 2000-09 to 42.20% during 2010-2019. The top most productive and impactful journals are shown in Table III (supplementary file). Amongst pediatric endocrinology journals, Pediatric Diabetes was the most productive (overall rank 1) having published 971 papers with average CPP of 41.26 and 2.13 respectively; GS Eisenbarth (83.70 and 4.33), Beck (68.82 and 3.56), Dunger (64.86 and 3.35), Tamborlane (64.05 and 3.31), Dabelea (52.06 and 2.69), Revers (51.52 and 2.66), Bonifacio (46.53 and 2.40), Daneman (46.46 and 2.40), Simell (46.11 and 2.38), Rosenauer (45.39 and 2.35), Knip (44.08 and 2.28), Hyoty (43.17 and 2.23) and Norris (42.18 and 2.18).

**Top authors**

Table IV shows the top most productive and impactful authors. 5596 authors unevenly participated in T1D research; 2862 authors published 1 papers each, 1461 authors 2–5 papers each, 715 authors 6–10 papers each, 472 authors 11–50 papers each, 74 authors 51–100 papers each, 10 authors 101–200 papers each and 2 authors 201–276 papers each. The research productivity of top 50 most productive authors varied from 76 to 280 publications per author. Together they contributed 3664 (27.77%) publications and 151 189 (59.22%) citations. Ten authors registered their publications output above the most productive group average of 122.13; Knip (280 papers), Ionen (255 papers), Ziegler (203 papers), Ludvigsson (190 papers), Hall (179 papers), Veijola and Revers (159 papers each), Simell (157 papers), Lenmark (148 papers) and Bonifacio (124 papers). 14 authors registered their CPP and RCI above the group average of 41.26 and 2.13 respectively; GS Eisenbarth (83.70 and 4.33), Beck (68.82 and 3.56), Dunger (64.86 and 3.35), Tamborlane (64.05 and 3.31), Dabelea (52.06 and 2.69), Revers (51.52 and 2.66), Bonifacio (46.53 and 2.40), Daneman (46.46 and 2.40), Simell (46.11 and 2.38), Rosenauer (45.39 and 2.35), Knip (44.08 and 2.28), Hyoty (43.17 and 2.23) and Norris (42.18 and 2.18).

**Highly cited papers**

Of the 13193 global publications, only 541 (4.10%) publications registered 100 to 1636 CPP (assumed highly cited) and they together received a total of 111673 citations since their publication, averaging 206.23 CPP. The distribution of 541 highly cited papers was highly skewed; 369 papers each registered citations in the range of 100–199, 88 papers 201–300, 40 papers 301–400, 19 papers 401–500, 20 papers 501–1000, 3 papers 1001–1500 and 2 papers 1501–1636. Among 541 highly cited papers, USA contributed the highest number of papers (275), followed by UK (114), Germany (65), Finland (55), Sweden (47), Italy (40), Canada (39), Denmark (29), Australia (28).
Table III. Most productive and most impactful organizations in pediatric type 1 diabetes research during 2000–2019

| S.no. | Name of the Organization | TP | TC   | CPP | HI  | ICP (%) | RCI  |
|------|--------------------------|----|------|-----|-----|---------|------|
|      | **Ten Most Productive Organizations** |    |      |     |     |         |      |
| 1    | University of Colorado, USA | 684 | 29914 | 43.73 | 89 | 245 (35.8) | 2.26 |
| 2    | University of Helsinki, Finland | 372 | 14557 | 39.13 | 66 | 166 (44.6) | 2.02 |
| 3    | University of Turku, Finland | 318 | 12684 | 39.89 | 59 | 168 (52.8) | 2.06 |
| 4    | University Hospital of Tampere, Finland | 304 | 13063 | 42.97 | 58 | 140 (46.0) | 2.22 |
| 5    | University of Washington, Seattle, USA | 303 | 15167 | 50.06 | 62 | 115 (37.9) | 2.59 |
| 6    | Yale University, USA | 285 | 13817 | 48.48 | 58 | 49 (17.1) | 2.51 |
| 7    | University of Pittsburgh, USA | 235 | 9715 | 41.34 | 47 | 82 (34.8) | 2.24 |
| 8    | University of Washington, Seattle, USA | 233 | 4827 | 20.72 | 37 | 139 (59.6) | 2.14 |
| 9    | University of Ulm, Germany | 221 | 6447 | 29.17 | 45 | 143 (64.7) | 1.51 |
| 10   | University of Helsinki, Finland | 221 | 13497 | 61.07 | 56 | 136 (61.5) | 3.16 |
|      | **Ten Most Impactful Organizations** |    |      |     |     |         |      |
| 1    | National Institute of Health & Welfare, Finland | 221 | 13497 | 61.07 | 56 | 136 (61.5) | 3.16 |
| 2    | Joslin Diabetes Centre, Tampa, USA | 191 | 10852 | 56.82 | 51 | 36 (18.8) | 2.94 |
| 3    | Jaeb Center for Health Research, USA | 156 | 8207 | 52.61 | 47 | 36 (23.0) | 2.72 |
| 4    | University of Washington, Seattle, USA | 303 | 15167 | 50.06 | 62 | 115 (37.9) | 2.59 |
| 5    | University of Tampere, Finland | 209 | 10256 | 49.07 | 50 | 110 (52.6) | 2.54 |
| 6    | Yale University, USA | 285 | 13817 | 48.48 | 58 | 49 (17.1) | 2.51 |
| 7    | Hospital for Children & Adolescents, Finland | 183 | 8823 | 48.21 | 56 | 71 (38.8) | 2.49 |
| 8    | University of Cambridge, UK | 191 | 8814 | 46.15 | 46 | 109 (57.0) | 2.38 |
| 9    | University of Oulu, Finland | 201 | 9255 | 46.04 | 48 | 74 (36.8) | 2.38 |
| 10   | Harvard Medical School, USA | 167 | 7637 | 45.73 | 46 | 51 (30.5) | 2.36 |

TP – total publications; TC – total citations; CPP – citations per paper; ICP – international collaborative papers; RCI – relative citation index

Austria (25), Netherlands (24), France and Norway (20 each), Spain (19), Belgium (17), Switzerland (11), Israel (10), Japan (9), Hungary and Poland (8 each), New Zealand (5), India (4), China, Czech Republic and Turkey (3 each), Saudi Arabia and Taiwan (2 each). Among the participating organizations in high-cited papers, University of Colorado, USA contributed the largest number (74) of papers, followed by University of Washington, Seattle, USA (36), University of Helsinki, Finland (33), University of Turku, Finland (30), University Hospital of Tampere, Finland (29), National Institute of Health & Welfare, Finland, Yale University, USA and University of Cambridge, UK (27 each), University of Tampere, Finland (25), Joslin Diabetes Centre, Tampa, USA (23), Harvard Medical School, USA and University of Pittsburgh, USA (22 each), Hospital for Children & Adolescents, Finland (21), Jaeb Center for Health Research, USA and University of Oulu, Finland (20 each), University of Toronto, Canada and Stanford University (17 each), Cincinnati Children Hospital Medical Center, USA and Hospital for Sick Children, University of Toronto, Canada (14 papers each), University of Ulm, Germany (13 papers), University of South Florida, Tampa, USA (12 papers), Diabetes Research Institute, Hospital Münchener-Schwabing, Munich, Germany (11 papers), Helmholtz Center Munich German Research Center for Environmental Health, Germany (10 papers) etc. Among the authors in high-cited papers, Knip contributed the largest number of papers (29), followed by Ilonen (27 papers), Revers (22), Dunger (19 papers), Dabelea, Eisenbarth and Ziegler (18 papers each), Bonifacio and Simell (17 papers each), Beck (15 papers), Orchard and
Veijola (13 papers each), Hyoty and Virtanen (12 papers each), Danne and Ludvigsson (11 papers each), and Hall (10 papers) etc. The distribution of high-cited papers in different journals is as follows: *Diabetes Care* (119 papers), *Diabetes* (44 papers), *Diabetologia* (37 papers), *Diabetic Medicine* (16 papers), *Journal of Pediatrics* (15 papers), *Pediatrics Diabetes* (14 papers), *Journal of Clinical Endocrinology and Metabolism* (11 papers), *Diabetic Technology and Therapeutics* and *Journal of Pediatric Psychology* (8 papers each), *Archives of Disease in Childhood* (6 papers), *Diabetes Metabolism Research and Reviews* (5 papers), *Journal of Diabetes Science and Technology* (4 papers), *Diabetes Research and Clinical Practice*, *Journal of Diabetes and Its Complications*, *European Journal of Pediatrics and Current Diabetes Reports* (3 papers) etc.

**Discussion**

A tremendous progress in research in the past few decades has allowed T1D patients to achieve near normal glycemic control and lead lives almost like their peers [13]. This seemingly impossible scenario at one time has been achieved through a targeted and sustained investment in T1D research. Several advancements such as semi-invasive blood glucose monitor...
testing, insulin delivery methods, strategies to restore β-cell function, elucidation of etiopathogenesis of T1D, artificial pancreas technologies, new therapies for diabetic complications and preventing or delaying T1D in at risk individuals have been made with the ultimate aim of achieving a cure for T1D [13]. The T1D research activities appear to be focussed in the developed countries. Although the incidence and prevalence of childhood onset T1D is almost similar in developed countries as compared to developing countries especially those of SEA region, the research contribution from the developing countries has been meagre with no developing country figuring in the top 10 countries. A possible explanation is the requirement of large investments and national governmental support for such highly organized activity [14]. While the governments and several organizations in the developed countries appear to have funded research in T1D, such support is lacking in the developing countries [13, 14]. Nevertheless, some of the less resourceful countries in the SEA region have shown improvement in pediatric T1D research in the recent times [15]. In particular, India which is currently placed 17th in the global T1D research ranking is likely to improve its ranking due to a sustained focus on pediatric T1D research during the past decade [15]. Several groups of researchers who are engaged in pediatric T1D research in India over the past two decades will likely contribute to an improved publication output [16–21].

All the top productive and top impactful organisations and authors belong to some of the most resourceful countries of the world. A major factor for this is the availability of several funding resources in these countries. In USA alone, the Special Statutory Funding Program for T1D Research has provided nearly $2.5 billion for research into the prevention, cure, and treatment of T1D since 1998 [22]. Several other organisations such as the International Society for Pediatric and Adolescent Diabetes, JDRF, International Diabetes Foundation, American Diabetes Association have pledged funding to support their declared T1D research missions [22]. Such funding and the researchers’ devotion of time are instrumental to generate impactful publications from developed countries as compared to developing countries where T1D is often given less priority for research [14, 15].

Amongst the speciality journals that published pediatric T1D research, Pediatric Diabetes was understandably ranked first as it exclusively publishes articles in childhood diabetes. The JPEM was the only other speciality journal amongst the top 10 impactful journals. Although PEDM has published some well cited articles on T1D, its overall ranking has remained low [23–26]. With the recent focus to raise the journal’s scientific level, the journal is likely to move up in the rankings in terms of T1D publication output [27].

The high cited papers were highly likely to be published in top ranking journals with Diabetes Care publishing almost 3-fold the publication numbers as compared to the second ranked Diabetes. Most of these papers were published by the most impactful authors and organizations and were more likely to be international collaborative. None of the speciality journals other than Pediatric Diabetes published any high cited papers in pediatric T1D.

The current scientometric analysis has some limitations. Despite using the standardized names of the authors to avoid spelling errors in names and initials, and resolving the issue of synonyms or homonyms in authors’ names by using other specific fields such as affiliations, we probably were still unable to capture all the data. It is suggested that performing a simultaneous search using the major biomedical scientific databases such as Scopus, PubMed and web of science may retrieve additional data [28]. But the citation counts and accuracy of citations may still differ considerably [29]. Although scopus is considered to provide better citation accuracy and is updated more frequently as compared to other databases, there may still be a wide gap in the citation counts [29, 30]. Despite these limitations, the current analysis provides a framework for focusing on research activities by countries, organizations and authors which are lagging behind others quantitatively and qualitatively in pediatric T1D research.

In conclusion, the most impactful research in pediatric T1D has been conducted by developed countries such as USA and Finland. The contribution from developing countries to global pediatric T1D research lags in quality as well as quantity despite having a disease burden similar to the developed countries.

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