Pediatric type 1 diabetes research in the 21st century: a scientometric review
Badania dotyczące cukrzycy typu 1 u dzieci w XXI wieku: przegląd scjentometryczny

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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.

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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 Diabe*") 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 4712 publications during 2000–2009 to 8481 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, 1350 (10.23%) as reviews, 308 (2.33%) as conference papers, 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	20264	29.20
2001	325	13 441	41.36	2011	730	1784	2.44
2002	373	15 190	40.72	2012	750	16685	22.25
2003	429	18 219	42.47	2013	824	1892	2.30
2004	486	17 643	36.30	2014	832	1657	1.99
2005	508	22 005	43.32	2015	901	12558	13.94
2006	534	20 333	38.08	2016	912	9121	10.00
2007	559	16 527	29.57	2017	907	6934	7.64
2008	649	25 130	38.72	2018	974	4007	4.11
2009	607	20 293	33.43	2019	957	997	1.04
Total	4712	179 417	38.08	Total	8481	75899	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		
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	13193	255 316	19.35			

TCP – total cumulative papers; CPP – citations per paper; ICP – international collaborative papers; RCI – relative citation index

file). Based on the activity index, it was observed the research activities have increased in all three subjects, namely psychology (from 95.34 to 102.59), health profession (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 Pittsburg, 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 Pittsburg, USA (41.34 and 2.14) and Stanford University, USA. (41.31 and 2.13).

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), Ilonen (255 papers), Ziegler (203 papers), Ludvigsson (190 papers), Hall (179 papers), Veijola and Revers (159 papers each), Simell (157 papers), Lernmark (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 (53.71 and 2.78), Virtanen (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), Rosenbauer (45.39 and 2.35), Knip (44.08 and 2.28), Hyoty (43.17 and 2.23) and Norris (42.18 and 2.18).

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 17.94 followed by *Journal of Pediatric Endocrinology and Metabolism* (JPEM) ranked 5th with 314 papers and 11.07 CPP and *Pediatric Endocrinology Diabetes and Metabolism* (PEDM) with 104 papers and 3.01 CPP (ranked 16).

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 Pittsburg, USA	235	9715	41.34	47	82 (34.8)	2.14
	8	Lund University, Sweden	233	4827	20.72	37	139 (59.6)	1.07
	9	University of Ulm, Germany	221	6447	29.17	45	143 (64.7)	1.51
	10	National Institute of Health & Welfare, 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; HI – ; 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 Pittsburg, USA (22 each), Hospital for Children & Adolescents, Fin-

land (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 München-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

Table IV. Top 10 most productive and most impactful authors in pediatric type 1 diabetes research during 2000–2019

	S.no.	Author	Author affiliation	TP	TC	CPP	HI	ICP (%)	RCI
Ten most productive authors	1	Knip	University of Helsinki, Finland	280	12 343	44.08	61	117 (41.7)	2.28
	2	Ilonen	University of Turku, Finland	255	10 421	40.87	55	118 (46.2)	2.11
	3	Ziegler	Diabetes Research Institute, Munich, Germany	203	7948	39.15	45	117 (57.6)	2.02
	4	Ludvigsson	University of Linkoping	190	5638	29.67	40	80 (42.1)	1.53
	5	Hall	University of Ulm	179	5098	28.48	40	113 (63.1)	1.47
	6	Veijola	University of Oulu, Finland	159	6151	38.69	39	68 (42.7)	2.00
	7	Revers	University of Colorado, USA	159	8191	51.52	44	79 (49.6)	2.66
	8	Simell	University of Turku, Finland	157	7239	46.11	46	74 (47.1)	2.38
	9	Lernmark	University of Lund, Sweden	148	3922	26.50	36	107 (72.3)	1.37
	10	Bonifacio	Technical University of Dresden, Germany	124	5770	46.53	42	83 (66.9)	2.40
Ten most impactful authors	1	Eisenbarth	University of Colorado, USA	76	6361	83.70	39	39 (51.3)	4.33
	2	Beck	Jaeb Centre for Health Research, USA	91	6263	68.82	40	16 (17.5)	3.56
	3	Dunger	University of Cambridge, U.K.	83	5383	64.86	38	32 (38.5)	3.35
	4	Tamborlane	Yale University, USA	114	7302	64.05	38	10 (8.7)	3.31
	5	Dabelea	University of Colorado, USA	97	5210	53.71	39	10 (10.3)	2.78
	6	Virtanen	University of Tampere, Finland	111	5779	52.06	36	68 (61.2)	2.69
	7	Revers	University of Colorado, USA	159	8191	51.52	44	79 (49.6)	2.66
	8	Bonifacio	Technical University of Dresden, Germany	124	5770	46.53	42	83 (66.9)	2.40
	9	Daneman	Hospital for Sick Children, Toronto University, Canada	78	3624	46.46	28	28 (35.9)	2.40
	10	Simell	University of Turku, Finland	157	7239	46.11	46	74 (47.1)	2.38

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

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

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 organisations 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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