

How “global” is research in early intervention for psychosis? A bibliometric analysis

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ABSTRACT

Introduction: Unlike high-income countries (HICs), there are few early intervention services for psychosis in low- and middle-income countries (LAMICs). In HICs, research spurred the growth of such services. Little is known about the state of EIP research in LAMICs, which we address by examining their research output and collaborations vis-à-vis that of HICs.

Methods: We conducted a search in Scopus database for early psychosis publications in scientific journals since 1980. Data from each record, including title, author affiliation, and date, were downloaded. For HIC-LAMIC collaborations, data on first, corresponding and last authors' affiliations, and funding were manually extracted. Descriptive statistics and social network analysis were conducted.

Results: Globally, early psychosis publications increased from 24 in 1980 to 1297 in 2022. Of 16,942 included publications, 16.1 % had LAMIC authors. 71.3 % involved authors from a single country (regardless of income level). 21.9 % were collaborations between HICs, 6.6 % between HICs and LAMICs, and 0.2 % among LAMICs. For research conducted in LAMICs and involving HIC-LAMIC collaborations, the first, last, and corresponding authors were LAMIC-based in 71.8 %, 60.7 %, and 63.0 %, respectively. These positions were dominated (80 %) by authors from four LAMICs. 29.4 % of the HIC-LAMIC subset was funded solely by LAMIC funders, predominantly two LAMICs.

Conclusions: LAMICs are starkly underrepresented in the otherwise flourishing body of early psychosis research. They have far fewer collaborations and less funding than HICs. Closing these gaps in LAMICs where most of the world's youth live is imperative to generate the local knowledge needed to strengthen early psychosis services that are known to improve outcomes.

1. Introduction

Over the past three decades, there has been growth in research and service reform focused on the early stages of psychosis, particularly first-episode psychosis and ultra-high risk/clinical high risk (McGorry et al., 2008). Along with diagnostic criteria, first-episode psychosis has been defined in terms of a first treatment contact; no or less than a pre-defined

period of prior antipsychotic treatment, and/or a pre-defined duration since onset of psychotic symptoms (Breitborde et al., 2009). Ultra-high-risk (clinical high risk) status is inferred from the presence of sub-threshold severity or duration of symptoms or family history of mental illness with/without declining functioning (Yung et al., 1998). Early intervention services for psychosis, comprising developmentally appropriate, phase-specific, high-quality, intensive, recovery-oriented

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care for two to three years, have proven superior to standard care in improving clinical and functional outcomes (Correll et al., 2018). Early intervention services are the standard of care in many high-income countries (HICs) (Csillag et al., 2016, 2018). In low- and middle-income countries (LAMICs), where 80 % of people with psychosis live (World Bank, 2024), their implementation has been slow and fragmented (Brietzke et al., 2011) and their availability remains scanty (Maric et al., 2019). There are calls to implement early psychosis intervention more widely in LAMICs (Farooq et al., 2009).

Along with resource scarcity (Saraceno and Saxena, 2004), a dearth of research impedes the wide implementation of appropriate mental health interventions in LAMICs (Thornicroft et al., 2012; Loch et al., 2023). Knowledge from research is pivotal in planning, implementing and advocating for mental health services and policies (Razzouk et al., 2010), but mental health research production and capacity are scarce in LAMICs (Larivière et al., 2013; Razzouk et al., 2010). Mental health research is underfunded everywhere but especially in LAMICs, which receive ≈ 2.4 % of global mental health research funds (Woelbert et al., 2021). LAMICs also face a paucity of trained personnel and research leaders and unfavorable research environments (Saraceno and Saxena, 2004; Thornicroft et al., 2012).

The growth of early intervention in HICs has been underpinned by research on illness characteristics and course; treatments; outcomes and predictors; pathways to care; and the effectiveness and cost-efficiency of service models (Chen et al., 2019; Howes et al., 2021; Malla et al., 2017; Nordentoft et al., 2015; Rosenheck et al., 2016). Little is known about the state of early psychosis research in LAMICs. Very few studies have examined mental health research capacity in LAMICs (Maj, 2010; Mari et al., 2010), and none have focused on early psychosis. These studies examined the numbers of publications on particular mental health topics in LAMICs (Large et al., 2010). Exploring additional indicators of research capacity could help strengthen early psychosis services and research in LAMICs (Pulford et al., 2020). E.g., although collaborations help advance research and serve as metrics of research capacity (Pulford et al., 2020), no studies have assessed the extent and geographic scope of collaborations in early psychosis research.

This study assesses LAMICs' research capacity in early psychosis by analyzing their research output and collaborations and comparing these with corresponding figures for the field overall and among HICs.

There is growing interest in the equitability of North-South research collaborations, with some studies focusing on LAMIC representation in authorship (Dimitris et al., 2021; Pratt and Hyder, 2018). Our secondary aim was therefore to examine the affiliation (HIC vs LAMIC) of authors in key positions and the funders of HIC-LAMIC collaborations in early psychosis research.

2. Methods

We conducted bibliometric analyses, including social network analysis, of early psychosis research publications after 1980, when literature on early intervention for psychosis began emerging (McGorry, 1993; McGorry et al., 2018; Nelson, 2008).

2.1. Search strategy

We searched in the Scopus database using terms such as first-episode psychosis, ultra-high-risk/clinical high risk and early intervention services for psychosis in the title, abstract and keyword sections (see supplement). Scopus was chosen because it registers authors' affiliations, which is necessary for network analysis.

The search was restricted to journal articles published from 1980 to 2022. We excluded conference papers, errata, retracted publications, records without data on authors' affiliations and those outside the early psychosis field. To compare early psychosis research output to that of the wider psychosis field, we searched for records on psychosis and schizophrenia-spectrum disorders more broadly. No language

limitations were implemented. The search was performed on August 2, 2023.

2.2. Procedure

Data on the title, date and author affiliations of included papers were exported to Excel. Country names from authors' institutional affiliations were identified and standardized for each record. These countries were classified by income group and world regions using World Bank (2023) criteria. Multiple affiliations were considered, so records were assigned to more than one country, income group, or world region, when appropriate, e.g., records with authors from an LAMIC and an HIC were assigned to both categories.

For the subset of articles involving HIC-LAMIC collaborations, the funders and countries of the first, last, and corresponding authors were manually identified, considering multiple affiliations for each position. These countries, too, were classified by income group and world region.

2.3. Variables

Research output was the number of records published per country. Research collaboration was analyzed by country using the degree centrality measure, which determines the number of countries directly connected to each country (the number of nodes each network node is connected to). E.g., a country with a degree of 10 would have had publications involving authors from 10 other countries (one paper with authors from 10 countries or multiple papers with multiple authors representing 10 other countries) (Hou et al., 2008).

For studies involving HIC-LAMIC collaborations, we assessed the country of affiliation of the first, last, and corresponding authors separately for studies conducted in LAMICs, HICs and both settings. We defined HIC and LAMIC dominance as all three authorship positions being affiliated to HICs or LAMICs, respectively. Funding sources were categorized as LAMIC funders, HIC funders, international organizations, private donors, pharmaceutical companies and no funding received.

2.4. Statistical analysis

We analyzed research output, research collaborations, co-authorship patterns, and funding with descriptive statistics using STATA 14.2. Collaborative networks and degree estimations were analyzed using Pajek v.3.0.2. In the graphic, thicker lines indicate more collaborative records between countries, while node size correlates with the numbers of records by country.

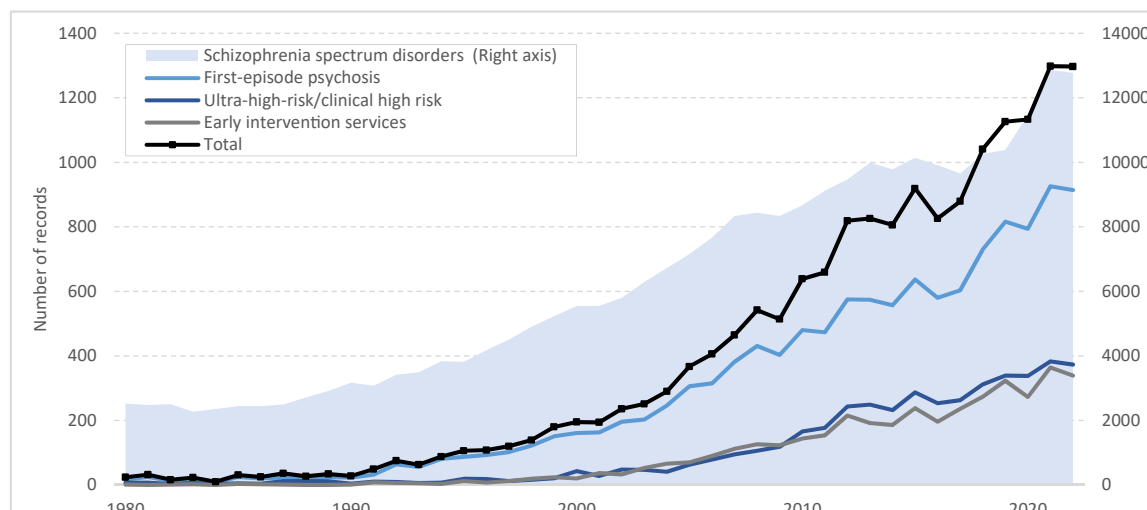
3. Results

We retrieved 17,659 early psychosis research records, of which 717 were excluded for not meeting the inclusion criteria on type of article ($n=414$), relevance to the topic ($n=213$), and incomplete data on authors' affiliation ($n=90$). The supplement contains a PRISMA-type flowchart and countrywide data on degree centrality, leading authorships and funding.

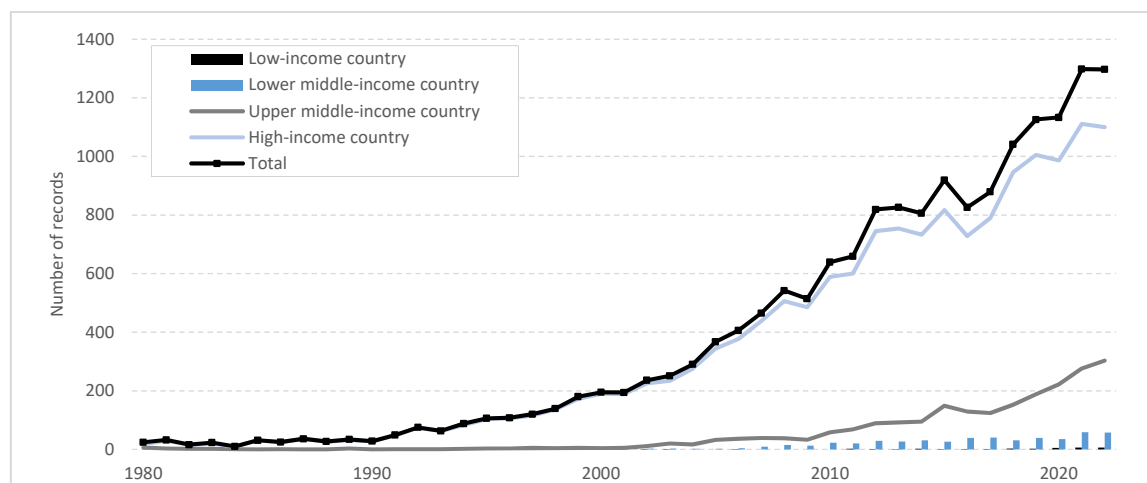
3.1. Research output

We included 16,942 records (91.9 % in English). Publications on early psychosis rose from 24 in 1980 to 1297 in 2022. Early psychosis research accounted for 0.9 % of publications on schizophrenia-spectrum disorders in 1980, rising to 10.2 % by 2022 (Fig. 1a). HICs accounted for 90.5 % of included records and LAMICs for 16.1 % (low-income countries, LICs: 0.2 %; lower middle-income countries, LMICs: 3.1 %; and upper middle-income countries, UMICs: 13.1 %) (Fig. 1b). The regions with the highest early psychosis research output were Europe and Central Asia (54.2 %), North America (35.4 %), and East Asia and the Pacific (24.5 %), followed by Latin America and the Caribbean (3.4 %),

a) Research areas



b) Income groups



c) Number of countries

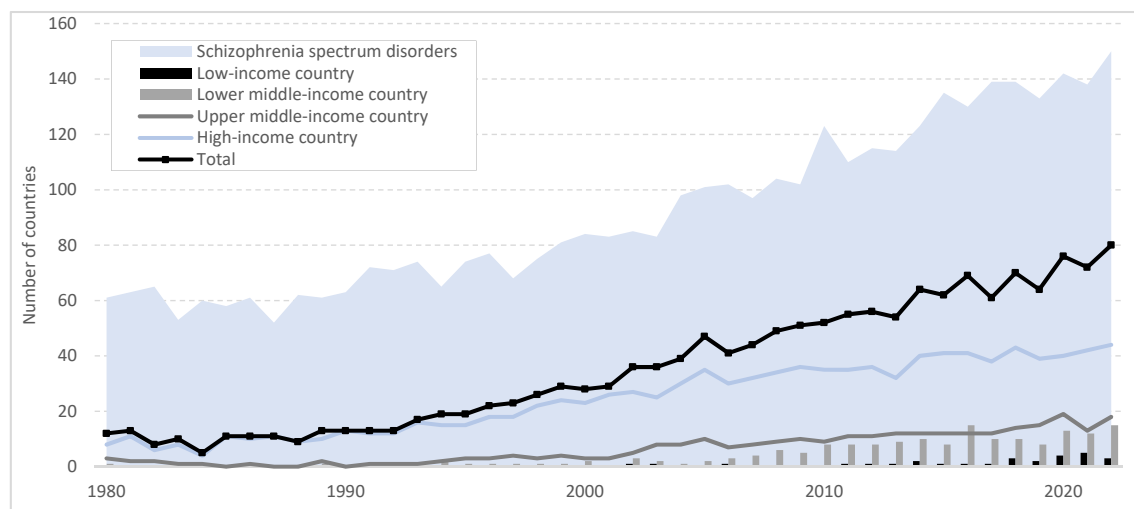


Fig. 1. Scientific output in early intervention in psychosis presented as: a) Number of records by research areas, b) Segmented by income groups, and c) the number of involved countries.

Middle East and North Africa (2.3 %), South Asia (1.6 %), and Sub-Saharan Africa (1.2 %)

Authors hailed from 125 countries, representing 57.3 % of the 218 countries and territories in the World Bank classification. These included 48.2 % of LAMICs (11 of 27 LICs, 40.7 %; 21 of 55 LMICs, 38.2 %; and 24 of 55 UMICs, 61.8 %), and 72.8 % of HICs (59 of 81) (Fig. 1c).

3.2. Research collaborations

The 125 countries that had early psychosis publications had an average degree centrality of 18 (i.e., published with authors from 18 other countries). LAMICs had an average degree of 10.2 (LICs: 2.1, LMICs: 11, UMICs: 12), and HICs an average degree of 27. North America, East Asia and the Pacific, and Europe and Central Asia had average degrees of 69, 27, and 26, respectively, while South Asia, Middle East and North Africa, Latin America and the Caribbean, and Sub-Saharan Africa had average degrees of 16, 10, 9, and 5, respectively.

12,087 records (71.3 %) involved authors from single countries. The remainder (28.7 %) represented collaborations, with 3708 publications involving HIC-HIC collaborations (21.9 %); 28 involving inter-LAMIC collaborations (0.2 %); 1119 involving HIC-LAMIC collaborations (6.6 %) (Table 1).

Network analysis (Fig. 2) showed that the core of the collaboration network comprised a few HICs with notable scientific output (large nodes), varied connections (high degree), and strong collaborations (thicker lines). Other HICs and the BRICS (Brazil, Russia, India, China, and South Africa) subgroup of LAMICs, exhibited scientific output but at a lower level with fewer connections and lighter collaborations. The outer region includes most LMICs and LICs, and a few HICs, with limited publications and collaborations.

3.3. Co-authorship in HIC-LAMIC collaborations

In the 1119 papers involving HIC-LAMIC collaboration, 152 first authors (13.6 %), 93 last authors (8.3 %), and 184 corresponding authors (16.4 %) were affiliated with both HICs and LAMICs. 634 records (56.7 %) pertained to studies in LAMICs; 233 (20.8 %) in HICs; and 84 (7.5 %) in both settings. The remaining records were unclassified (145 records, 13.0 %; e.g., reviews, letters to editors) or included no information on study setting (23 records, 2.1 %). For studies in LAMICs,

71.8 % of first, 60.7 % of last, and 63.0 % of corresponding authors were from LAMICs. For studies done in HICs, 75.9 % of first, 84.1 % of last, and 83.1 % of corresponding authors were from HICs. Studies conducted in both HICs and LAMICs, and unclassifiable studies, predominantly had first, last, and corresponding authors from HICs (Fig. 3a-c).

Of the 1119 publications involving HIC-LAMIC collaborations, LAMIC dominance occurred in 322 (28.8 %) and HIC dominance in 298 records (26.6 %). Their first authors came from 74 countries (41 LAMICs); last authors from 67 countries (32 LAMICs); and corresponding authors from 65 countries (31 LAMICs). 80 % of articles with a LAMIC first, last or corresponding author were published by China, Brazil, South Africa, and India (Fig. 4).

3.4. Funding of HIC-LAMIC collaborations

In the HIC-LAMIC subset, 145 records (12.9 %) lacked funding details, 107 (9.6 %) reported receiving no funding for research, and 867 (77.5 %) disclosed funding sources (see Table 2). Research for 29.4 % of these papers was funded solely by LAMIC funders. With non-LAMIC funders (e.g., HICs, international organizations), LAMIC funders co-funded an additional 17.7 % of HIC-LAMIC projects.

Research for 45.1 % of the studies conducted in LAMICs (286/634) was funded exclusively by LAMIC funders. Alone and with other funders, HIC funders supported the research for 60.7 % of HIC-dominant and 22.0 % of LAMIC-dominant publications. LAMIC funders funded research for 11.1 % and 79.2 % of HIC- and LAMIC-dominant papers, respectively.

International organizations, global pharmaceutical companies, private donors, and funders from 30 HICs and 22 LAMICs supported research in the 867 HIC-LAMIC publications. Among these, China funded research for 368 papers, Brazil for 78 papers, and both countries jointly for four papers. Their combined contribution represents 84 % of the records (442/526) with some LAMIC funding.

4. Discussion

The significant growth in early psychosis research from 1980 to 2022 has been very uneven, with HICs exhibiting much higher scientific output than LICs. This aligns with the notion of the “10/90 gap” which posits that < 10 % of research resources are in countries facing 90 % of global health problems (Global Forum for Health Research and WHO, 1999, Razzouk et al., 2008). This gulf partly reflects the correlation between countries’ economic wealth and output in global health research (Cash-Gibson et al., 2018; Dimitris et al., 2021). However, research output cannot be tied only to income levels. Not all HICs have high research productivity and capacity (e.g., the Gulf states). Conversely, LAMICs like China and Brazil have higher research outputs than some HICs (Nature editorial, 2021). Nonetheless, comparing early psychosis research outputs across countries of different income levels can reveal associations between economic factors and service accessibility and quality. In LAMICs, for instance, durations of untreated psychosis are associated with gross domestic product purchasing power parity (Large et al., 2008).

Although collaboration is thought to enhance research capacity in LAMICs (da Silva et al., 2019), we found that just over a fourth of psychosis papers involved multi-country collaborations. Most early psychosis research involved single HICs with a fraction thereof representing inter-HIC collaborations, as in most research (Adams and Gurney, 2018). Little early psychosis research involves LAMIC-HIC collaborations and even less involves inter-LAMIC collaborations. LAMIC researchers, facing scarce local funding, may seek collaborations with HICs (rather than other LAMICs) to access more research enablers like funding, resources, capacity-building, research culture, and high-impact journal publications (fearing possibly higher rejection rates for LAMIC-only publications) (Patel and Kim, 2007). This is regrettable because inter-LAMIC collaborations can generate more locally relevant

Table 1
Scientific collaboration by income group of authors’ country of affiliation (n=16,942).

Authors affiliated with institutions from:	n	%
Only one country	12,087	71.3
HIC	10,507	62.0
UMIC	1257	7.4
LMIC	305	1.8
LIC	18	0.1
Two or more countries (same country income group)	3719	22.0
HICs	3708	21.9
UMICs	9	0.1
LMICs	2	0.0
Two or more countries (between HIC and LAMICs)	1119	6.6
HIC+UMIC	906	5.3
HIC+LMIC	171	1.0
HIC+LIC	5	0.0
HIC+UMIC+LMIC	28	0.2
HIC+UMIC+LIC	7	0.0
HIC+LMIC+LIC	2	0.0
Two or more countries (between LAMICs)	17	0.1
UMIC+LMIC	15	0.1
UMIC+LIC	1	0.0
LMIC+LIC	1	0.0

HIC: High-income country, LAMIC: Low- and middle-income country, UMIC: Upper middle-income country, LMIC: Lower middle-income country, LIC: Low-income country.

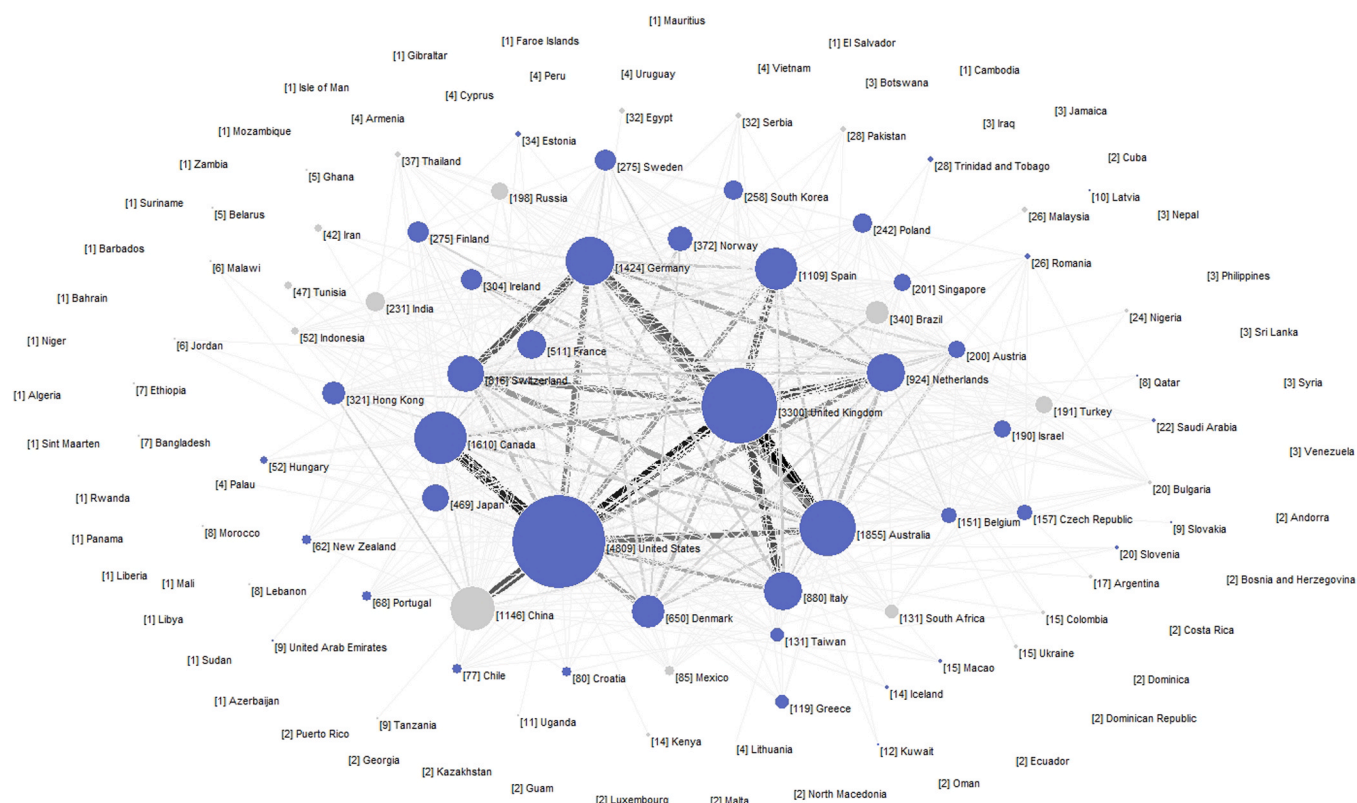


Fig. 2. Collaboration network in global early intervention in psychosis research by income groups of authors' country of affiliation (1980–2020). Color of nodes varies by country income groups (Gray: Low- and middle- income countries, and blue: high-income countries). Collaborations between two countries with more than two studies in common are shown.

and transferable solutions; reduce global knowledge inequities; and help LAMIC researchers cooperate and advocate for more funding and better policies (Nature editorial, 2023).

Encouragingly, we did not find great imbalances in the authorship of papers from HIC-LAMIC collaborative early psychosis research conducted in LAMICs. For comparison, only 52.9 % of papers on infectious diseases research done in Africa had an African first author and 33 % of LAMIC-based RCTs in adolescent mental health research had a LAMIC-affiliated author (Hedt-Gauthier et al., 2019; Osborn et al., 2020). Four BRICS countries accounted for 80 % of the LAMIC-affiliated first, last and corresponding authorships on collaborative publications. This aligns with BRICS countries' high output across mental health and other sciences (Larivière et al., 2013; "Nature Index," 2024). Overall, LAMIC researchers have few to no first, last or corresponding authorships in early psychosis research.

China and Brazil funded the research for four of the five publications involving LAMIC-funded HIC-LAMIC collaborations. This is consistent with these countries' record of funding mental health research in LAMICs (Pollitt et al., 2016). It also underscores how limited funding is in other LAMICs. We also confirmed the influence of funding source on co-authorship patterns (Schneider and Maleka, 2018). Research funded by HIC and LMIC bodies respectively yielded HIC-dominated and LAMIC-dominated authorships. International organizations supported HIC-dominant and not LAMIC-dominant research, possibly because of being based in HICs or driven by HIC priorities. This trend is evident across mental health research (Woelbert et al., 2021).

4.1. Implications

Within the larger global health goal of strengthening LAMICs' research capacity, emphasis must be placed on research into early interventions for serious mental illnesses, which is woefully scarce in

LAMICs. This is imperative if early psychosis services and policies in LAMICs are to be guided by culturally and contextually relevant knowledge, rather than knowledge transposed from HICs (Singh et al., 2020).

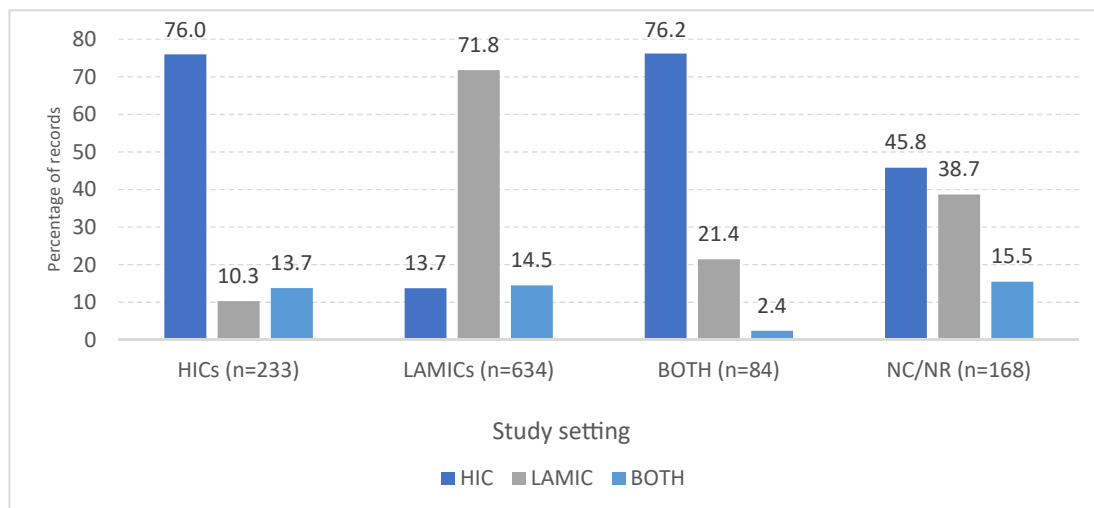
Developing early psychosis research capacity in LAMICs requires sustained funding and policy commitment. We acknowledge that many LAMICs have limited means due to many historical factors (Charani et al., 2022; OECD Data, 2024). Still, LAMICs that can do so must invest more in mental health research to center the needs and priorities of their patients, practitioners, and policymakers and to mitigate power imbalances.

We also urge international funders to boost funding for mental health and early psychosis research and implement mechanisms to address global inequities in knowledge production, use, circulation, and leadership (e.g., by directly funding LAMIC researchers and projects).

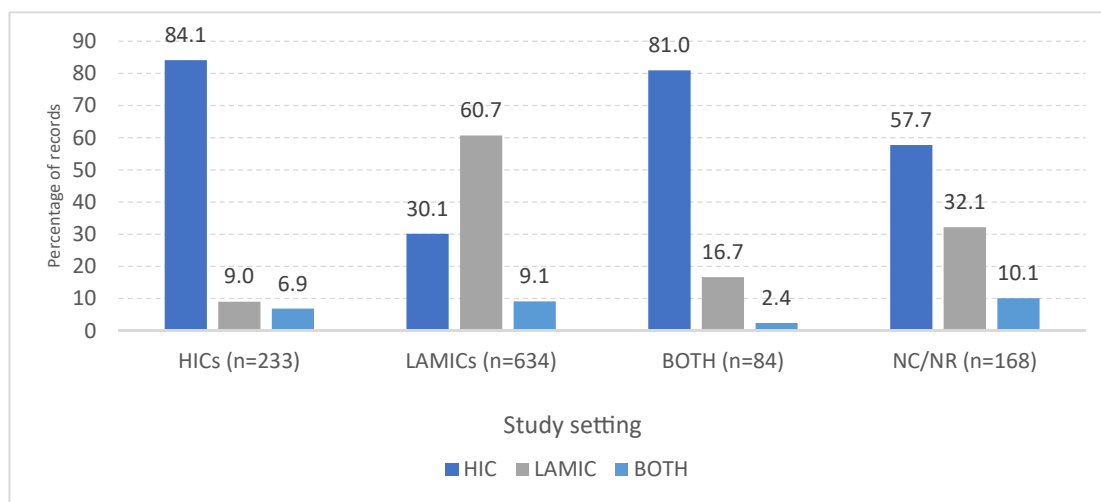
Research capacity in LAMICs could benefit from more and stronger collaborations between HICs and LAMICs and among LAMICs. Well-known HIC-LAMIC collaborations that have supported early psychosis services development and research in LAMICs include the India-Canada partnership funded by the US National Institutes of Health (Iyer et al., 2010; Malla et al., 2020) and the Warwick-India-Canada project funded by the British National Institutes of Health Research (Singh et al., 2021). Research collaborations can also be promoted or coordinated by governments, funders and international organizations (Charani et al., 2022).

Beyond providing project-by-project funding, grants should advance capacity and leadership in LAMICs (e.g., by training LAMIC-based PhDs; supporting networks in and across LAMICs; helping sustain and scale up research endeavours/innovations, etc.) (da Silva et al., 2019). Enhancing local capacity may also help stem brain drain, which widens human resources gaps in LAMICs. Projects should follow equity-aligned global health research principles (Canadian Association for Global

a) First authorship



b) Last authorship



c) Corresponding authorship*

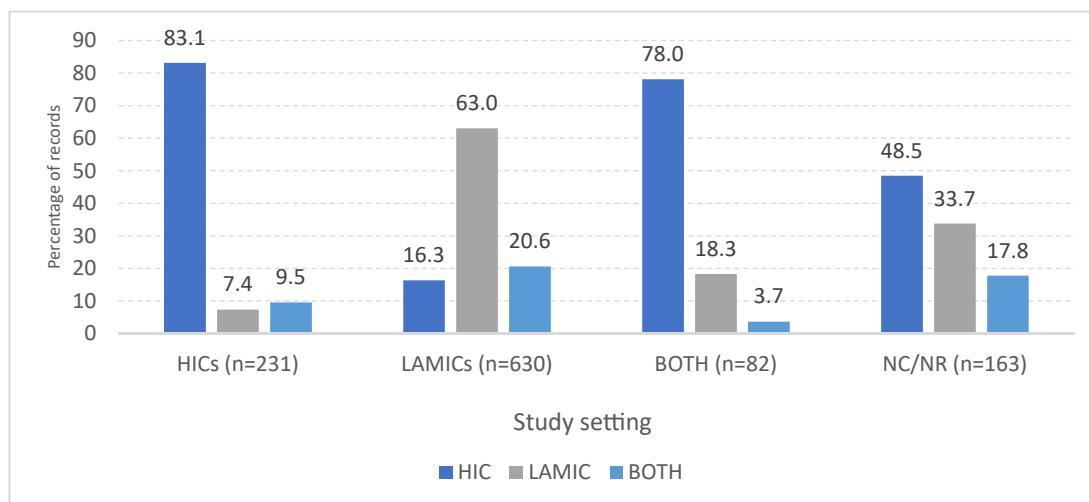


Fig. 3. Distribution of a) first, b) last, and c) corresponding authorship by study setting (n=1119). HIC: High-income country, LAMIC: Low- and middle-income country, NC: Not classified, NR: Not reported. *13 records did not report data on corresponding author.

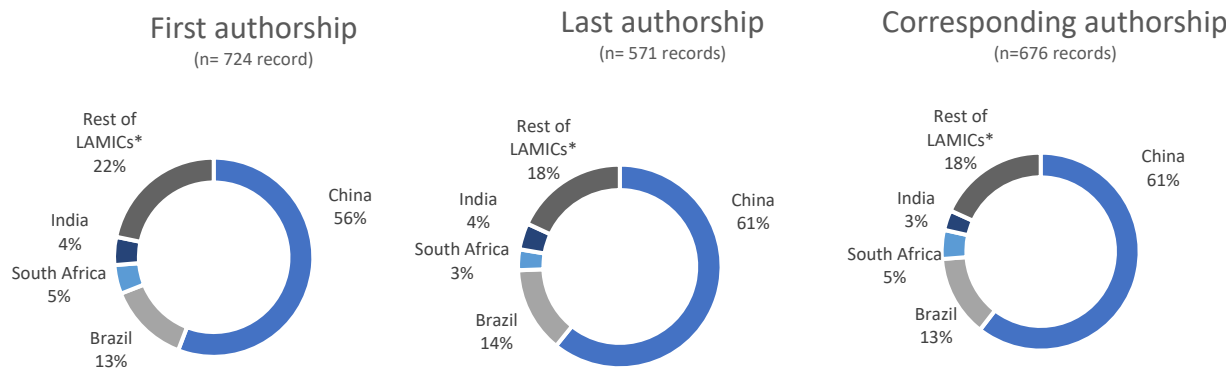


Fig. 4. LAMICs that most frequently held the first, last, and corresponding authorship positions in records from collaborations between HICs and LAMICs (1980–2022). *Includes 37, 28 and 27 LAMICs in the first, last and corresponding authorship positions, respectively.

Table 2
Funding agencies that support EIP records conducted between HICs and LAMICs (1980–2022).

Funding agencies	All records (N=1119)		HIC dominance (N=298)		LAMIC dominance (N=322)	
	n	%	n	%	n	%
LAMIC	329	29.4*	5	1.7	190	59.0
HIC	229	20.5#	132	44.3	14	4.3
HIC+LAMIC	159	14.2@	11	3.7	57	17.7
HIC+IO	31	2.8	25	8.4	0	0.0
PH	28	2.5	10	3.4	3	0.9
IO	26	2.3	21	7.0	2	0.6
HIC+PH	14	1.3	7	2.3	0	0.0
LAMIC+IO	14	1.3@	12	4.0	0	0.0
PD	8	0.7	6	2.0	0	0.0
LAMIC+PH	8	0.7@	0	0.0	4	1.2
HIC+LAMIC+IO	7	0.6@	4	1.3	0	0.0
LAMIC+IO+PH	4	0.4@	0	0.0	4	1.2
IO+PH	3	0.3	2	0.7	0	0.0
HIC+LAMIC+PH	3	0.3@	0	0.0	0	0.0
HIC+PD	1	0.1	1	0.3	0	0.0
HIC+IO+PH	1	0.1	0	0.0	0	0.0
HIC+LAMIC+IO+PH	1	0.1@	0	0.0	0	0.0
HIC+LAMIC+IO+PH+PD	1	0.1@	1	0.3	0	0.0
No funding	107	9.6	27	9.1	21	6.5
No information on funding	145	13.0	34	11.4	27	8.4

HIC: High-income country, LAMIC: Low- and middle-income country, IO: International organization, PH: Pharma company, PD: Private donor. International organizations: European Union, New Partnership for Africa's Development, World Health Organization, etc.
* Included in calculating total for exclusively LAMIC-funded; # Included in calculating total for exclusively HIC-funded; @ Included in totals for some LAMIC funds received but not exclusively LAMIC-funded * Included in totals for some HIC funds received but not exclusively HIC-funded

Health, 2024; Collins, 2020) and avoid exacerbating epistemic injustices (e.g., involving LAMIC collaborators only in data collection and not conception; not valuing non-academic LAMIC partners; etc.) (Bhakuni and Abimbola, 2021). International associations also have a responsibility to highlight and reduce global health inequities. The World Psychiatry Association's early intervention LAMICs initiative is noteworthy (Singh et al., 2023).

4.2. Limitations

Our analysis potentially overlooked studies in non-Scopus-indexed journals. However, Scopus is widely used in bibliometric analyses, covers all world regions, and includes papers in some 40 non-English languages (Elseviere, 2024). Numbers for some types of collaborations might have been inflated by instances of researchers with institutional

affiliations in more than one country.
Manually reviewing all included records was not feasible given the volume retrieved, but this is not required in standard bibliometric analyses. Still, we rigorously evaluated the subset of HIC-LAMIC collaboration records, manually extracting authorship and funding information. Country-level statistics may not disclose within-country disparities. In every LAMIC where early psychosis research is done, it is usually in one or a few institutions. Similar but smaller internal disparities also exist in HICs (Petersen, 2021; UK research and Innovation, 2021). Our paper is the first to map the state of early psychosis research in LAMICs and associated LAMIC-HIC inequities. The methodological constraints of bibliometric analyses precluded investigations of the structural and geopolitical determinants of these inequities. Nonetheless, this study is robust because of its well-developed search strategy, its extensive period of focus, and its use of multiple indicators and analyses.

4.3. Conclusion

LAMICs have had a negligible share of worldwide early psychosis research, which has rapidly expanded since 1980. They also have far fewer collaborations in and far less funding for early psychosis research than HICs. Closing these gaps is imperative because it is in LAMICs that most of the world's people live; the bulk of global disease burden occurs; and mental health services and resources are scarcest. More research in LAMICs is also needed to further strengthen with local knowledge the early intervention services that are known to improve psychosis outcomes.
More fundamentally, underfunded mental health services and research—realities even in HICs—reflect the low priority societies accord to mental health. Change in this regard cannot be driven solely by research. It requires social and political advocacy rooted in locally relevant knowledge.

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Disclosure

The authors have no disclosures to report.

CRediT authorship contribution statement

Ruben Valle: Writing – original draft, Validation, Methodology, Formal analysis, Data curation, Conceptualization. **Srividya N. Iyer:** Writing – review & editing, Visualization, Validation, Supervision, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Swaran P. Singh:** Writing – review & editing, Visualization, Validation. **Alexandre Andrade Loch:** Writing – review & editing, Visualization, Validation.

Declaration of Competing Interest

None.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.ajp.2024.104128](https://doi.org/10.1016/j.ajp.2024.104128).

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