A systematic review of global publication trends regarding long-term outcomes of ADHD

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INTRODUCTION
Global interest in attention deficit hyperactivity disorder (ADHD) is on the rise (Hinshaw et al., 2011). ADHD has only been recently recognized on an international scale as a serious medical condition with long-term consequences (Garcia-Jimenez et al., 2005; Wilcox et al., 2007; Curtatolo et al., 2010; Davis et al., 2011; Lecendreux et al., 2011). Historical evidence, however, attests that ADHD symptoms have been described in individuals in many different countries. For example, Jean-Baptiste Poquelin, known as Molière – the French theater author – may have been one of the first people to describe a character with symptoms of ADHD in “L’étourdi ou les contretemps” (translated into English as the scatterbrain or the bungler) in as early as 1653 (Bange and Mouren, 2004). The first diagnostic description of what is now called ADHD occurred in The International Statistical Classification of Diseases Ninth Edition (ICD-9) and The Diagnostic and Statistical Manual of Mental Disorders, Second Edition (DSM-II) in 1965 and

There is increased global recognition of attention deficit hyperactivity disorder (ADHD) as a serious medical condition with long-term consequences. Although originally conceived of as a childhood disorder, ADHD is being increasingly recognized in adults. Individual geographic regions may have specific interests and objectives for the study of ADHD. A systematic review of long-term outcomes (LTOs) in ADHD was conducted to evaluate research on ADHD LTOs on a global scale. Studies that were at least 2 years in duration were examined. A total of 351 studies were identified in the final analysis. We identified nine outcomes of interest and classified studies by specific geographical regions, age groups studied and study design by region and over time. Published studies of LTOs in ADHD have increased in all geographical regions over the past three decades, with a peak number of 42 publications in 2008. This rise in publications on ADHD LTOs may reflect a rise in global interest and recognition of consequences and impairment associated with ADHD. Although many world regions have published on ADHD LTOs, the majority of studies have emerged from the US and Canada, followed by Europe. While investigators in the US and Canada were predominantly interested in drug addiction as a LTO, European researchers were more interested in antisocial behavior, and Eastern Asian investigators focused on both of these LTOs as well as self-esteem. Geographical differences in the focus of ADHD LTO studies may reflect regional variations in cultural values. Proportionally fewer prospective longitudinal studies and proportionally more retrospective and cross-sectional studies have been published in more recent decades. Finally, more studies focusing on ADHD in adolescents and adults have been conducted in recent years, and particularly adolescents in Eastern Asia. These changes in basic study design may reflect an increase in the recognition that ADHD is a lifetime chronic disorder. This systematic review analysis of publication trends in ADHD LTOs reflects geographically based interests that change over time.

Keywords: ADHD, attention deficit, hyperactivity, hyperkinetic, TDAH
ADHD into adulthood makes long-term consequences important. ADHD therefore clearly affects both children and adults, occurring as hyperkinetic disorder or hyperkinetic conduct disorder (Santosh et al., 2010). In reflection of the more stringent ICD-10 criteria, when the MTA combined type ADHD sample reflect comorbid ADHD combined type with conduct disorder or oppositional-defiant disorder. In opposition to the more stringent ICD-10 criteria, which would mainly diagnoses of hyperkinetic conduct disorder, which would mainly be characterized almost exclusively by inattentive symptoms, with minimal hyperactive symptoms (Nigg et al., 2010; APA, 2011).

DSM-IV and ICD-10 have similar criteria for inattentive, hyperactive, and impulsive symptom identification. However, the ICD-10 is stricter than the DSM-IV, with a demand for each symptom to be present across school, home, and other settings in order to be counted (Lange et al., 2010). Unlike the DSM-IV-TR which allows sub-typing based on hyperactive/impulsive or inattentive predominance as well as the combination of both, ICD-10 requires both inattentive and hyperactive/impulsive symptoms for diagnosis (EMEA, 2010). ICD-10 also excludes children with co-occurring conduct disorders (Stubble, 2000) but has a parallel diagnosis of hyperkinetic conduct disorder, which would mainly reflect comorbid ADHD combined type with conduct disorder or oppositional-defiant disorder. In reflection of the more stringent ICD-10 criteria, when the MTA combined type ADHD sample was re-diagnosed by ICD criteria, only 25% met the criteria for hyperkinetic disorder or hyperkinetic conduct disorder (Santosh et al., 2005). In addition, Polanczyk et al. (2007) showed in their meta-regression analysis that ADHD prevalence differs by criteria used (DSM-III, DSM-IV, or ICD-10), and by informant (clinician versus teacher versus parents).

Almost four centuries ago, an ADHD-like pattern of behavior was described in adults by the French author Molière (Bange and Mouren, 2009). Considering more scientific and medical works, it appears that the persistence of ADHD in adulthood was recognized as soon as the beginning of the twentieth century by English (Still, 1902), French (Philippe and Paul-Boncour, 1905), and German (Kraepelin, 1909–1915) authors. Despite these observations, prior to 1972 it was still commonly viewed as a childhood disorder (Arnold et al., 1972). The first clinical trial in adults was conducted by Wender and colleagues in 1976 (Wood et al., 1976). ADHD therefore clearly affects both children and adults, occurring throughout the life-span with a prevalence of 5–10% in childhood, 4% in adults, and about 50–65% persistence (depending on whether ADHD was defined as fully symptomatic or with residual symptoms: Faraone et al., 2006; Kessler et al., 2006; Polanczyk et al., 2007; Kooij et al., 2010; Young and Amarsinghe, 2010). A recent study demonstrated that even older adults (mean age 66 years) suffer from ADHD symptoms and impairments based on measurements of professional, economic, social, and emotional well-being (Brod et al., 2011). The potential persistence of ADHD into adulthood makes long-term consequences important for study, and the global differences that exist in study design are of interest in the interpretation of ADHD long-term outcomes (LTOs). Many studies of ADHD have been conducted in the US, Canada, and Europe. The overall global recognition of the impact of ADHD is increasing, however, with more geographical regions beginning to appreciate the consequences of ADHD on society.

The attention lapses, hyperactivity-impulsiveness, or combination of symptoms caused by ADHD (APA, 2000; WHO, 2010) can lead to wide-ranging negative long-term life consequences (Rasmussen and Gillberg, 2000; Mill et al., 2006). Prior focus for the treatment of ADHD has been on symptomatic control. Patient management has shifted in recent years to include more focus on functional impairment. A negative impact on psycho-social, achievement, and self-evaluation domains has been reported by parents of children with ADHD (Danckaerts et al., 2010). Functional impairment in multiple domains has been measured with tools such as functional magnetic resonance imaging, electrophysiology, and tests of cognitive performance, although these are not currently used as diagnostic tools (EMEA, 2010).

The differences in recognition of ADHD could be one factor that influenced reported prevalence in different world regions. For example, Polanczyk et al. (2007) showed in their meta-regression analysis that prevalence did differ when comparing different world regions. This study showed that the North American rate (6.2%) was only slightly higher than the European rate (4.6%). The highest rates of ADHD diagnosis were observed in Africa (8.5%) and South America (11.8%), but with a wide range of prevalence rates between studies. According to Polanczyk et al. (2007), the overall worldwide prevalence of ADHD is 5.3%. The recent epidemiological studies across the world support the notion that ADHD is a ubiquitous disorder and not merely a Northern American social construct (Moffitt and Melchoir, 2007).

The current systematic review was performed with the goal of: (1) identifying peer-reviewed studies reporting LTOs (two or more years) for people with ADHD published from 1980 through 2010, and (2) to address the following research question via comprehensive analysis of all studies identified; are there differences in outcomes studied by region, either in total or over time?

**MATERIALS AND METHODS**

To systematically identify published studies that examined LTOs (i.e., life consequences) of participants with untreated or treated ADHD, an extensive search of 12 literature databases was performed using a strategy based on the following inclusion and exclusion criteria. Only studies identified in these databases using electronic search engines and this search strategy were included. Studies including a group of participants with ADHD as determined by each study’s authors using any diagnosis criteria were included. To ensure a basic level of study quality, only peer-reviewed studies and only studies utilizing a comparator group (e.g., non-ADHD controls) or comparison measure (e.g., pretreatment baseline) were included. Studies of participants that had received any or no ADHD treatment were included. Longitudinal studies with prospective follow-up or retrospective measures of 2 years or more, cross-sectional studies comparing participants of two ages differing by 2 years or more, or
single cross-sectional studies of participants ≥10-years-old were included. Primary research articles published in English from January 1980–December 2010 inclusive, with available full-text were included. Studies examining symptoms only and not outcomes were excluded. Studies in which ADHD was not a primary condition of the study participants, but was secondary to another condition (e.g., intellectual disabilities or bipolar disorder), were excluded. Animal studies, case studies, and studies including only children younger than 2 years old were excluded. Meta-analyses and literature review studies were also excluded.

The search strategy for study identification was as follows. Inclusionary terms were: (1) names of the condition; ADD (captured all versions of ADHD), hyperkinesis or hyperkinetic, TDHAH (trouble déficit de l’attention/hyperactivité in French or trastorno por déficit de atención con hiperactividad in Spanish), DAH (déficit de l’attention/hyperactivité in French or déficit de atención con hiperactividad in Spanish), DAA (déficit de l’Attention/activité in French or déficit de atención y actividad in Spanish), and (2) LTOs; long-term, longitudinal, education, degree, socioeconomic, salary, divorce, relationship, hobbies, criminality, arrest, incarceration, automobile, car, driving, citation, weight, obesity, suicide, drug abuse, addiction, substance abuse, alcoholism, and (3) comparator condition or group; control, proband, placebo, untreated, no treatment, pre-treatment, comparator, follow-up, normal, compare. Exclusionary terms were: (1) developmental, causal, or symptom terms; neuroanatomy, neuropathology, molecular, gene, development, etiology, preclinical, dose-finding, reaction time, and (2) unsuitable publication types; reprint, review, conference presentation. A more detailed explanation of the search methodology is available upon request. All references retrieved are included in the appendix.

To identify as many studies as possible, the search utilized 12 databases: Academic Search Premier, CINAHL, Cochrane CRCT (including EMBASE), Criminal Justice Abstracts, ERIC, MEDLINE, Military and Government collection, NHS Economic Evaluation database, PsycARTICLES, PsycINFO, SocINDEX, and Teacher Reference Center. Two search engines were used to search MEDLINE. Duplicates were eliminated electronically and manually. Additional unsuitable publication types were eliminated manually, including editorials, comments, reviews, non-peer-reviewed articles, and letters.

Based primarily on title and abstract, remaining studies were manually reviewed and included based on the agreement of two researchers. Each study’s data was extracted into a database; data collected included: (1) study location (country of origin), (2) study sample size, (3) study length, (4) participant’s age range, (5) study support, (6) diagnostic criteria, (7) study type (longitudinal, cross-sectional, prospective, retrospective), (8) outcome measures, (9) outcome results, (10) comparator type, (11) treatment type, and (12) treatment duration. Similar outcome measures were grouped together.

For the purpose of examining studies of ADHD originating in different geographical regions of interest, studies were grouped by location according to the UN Geoscheme (UN, 2011). Major regions included Northern America (United States and Canada excluding Mexico), Europe, Eastern Asia, Western Asia, Oceania (New Zealand and Australia), and Latin America (including Mexico) and the Caribbean. International collaborations were also of interest.

For the purpose of examining studies of ADHD involving participants of different ages, the age range of participants was noted whenever possible and mid-range age was calculated. If the age range was not reported, the mean age was used. The mid-range/mean age was used to group each study into one of three age groups: children were 6- to 12-years-old, adolescents were between 13- and 17-years-old, and adults were above 17 years old. For mid-range ages 18–22, the minimum and maximum ages were also taken into account. If the minimum age was 16 years or younger and the maximum age was below 30 years, then the study was grouped with adolescent studies, rather than adult studies. For further analysis of studies of adults specifically, the age range/mean age was used directly to group studies into three adult groups: transitional adults (18- to 24-years-old), young adults (25- to 44-years-old), and mature adults (45- to 64-years-old).

RESULTS
SEARCH RESULTS
The initial search yielded 7272 citations. Electronic and manual removal of duplicates resulted in removal of 1805 citations. An additional 341 citations were removed according to basic criteria (exclusion of reviews, supplements, case studies, animal studies, editorials, not peer-reviewed articles, not English language) leaving 5126 citations. The titles and abstracts of these 5126 studies were reviewed and 4775 citations were excluded, leaving a total of 351 studies suitable for inclusion according to full inclusion criteria: studies included ADHD participants, reported LTOs or life consequences, and included a comparator measure or group. Study population size ranged from 6 to 1,026,873 participants and longitudinal study duration ranged from 2 to 40 years.

ADHD OUTCOME STUDIES BY GEOGRAPHICAL REGION
Outcome measures were organized into nine main groups based on common outcome characteristics (Table 1).

Studies were grouped according to the major geographical regions described above and on the number of studies that were located in specific geographical regions. The countries of origin (31 total) of all the studies included in the final data set in each major geographical region are presented in Table 2. In Northern America (US and Canada, excluding Mexico) and Europe, there was a steady overall rise in studies of LTOs of ADHD published between 1980 and 2010, with a marked rise in the late 1990s. In Eastern Asia there was a small increase in studies over time also, starting in 2005 (Figure 1). The number of LTO studies published globally peaked in 2008 with 42 studies published that year. The number of studies published in all of the regions shown is continuing to rise in general. Studies involving international collaborations started to be published in 2002.

The interests of specific geographical regions in the nine identified outcome groups were examined (Figure 2). The total number of outcome results was highest for non-medicinal drug use/addictive behavior, followed by academic outcomes, antisocial behavior, social function, occupation, self-esteem, driving, public services use, and obesity. The outcome results reported in the highest proportion of studies from Europe were regarding...
Table 1 | Grouping of outcome results.

| Outcome groups | Outcome result examples |
|----------------|-------------------------|
| Academic       | Achievement test scores, grade point average, failed grades, years of schooling, degrees |
| Antisocial behavior | School expulsion, delinquency, self-reported crimes, arrests, detainment, incarceration, repeat convictions |
| Driving        | Accidents, traffic violations, license suspensions, driving habits and skill, driving record |
| Non-medicinal drug use/addictive behavior | Use, abuse, and dependence on alcohol, cigarettes, marijuana, stimulants, or illicit drugs; age at first use; multiple substance use; gambling |
| Obesity        | Body mass index (BMI), weight |
| Occupation     | Employment, military service, job changes, occupation level, socioeconomic status |
| Public services use | Justice system, emergency health care, financial assistance |
| Self-esteem    | Self-esteem scales, self-perception, suicide ideation, suicide attempts, suicide rate |
| Social function | Relationships, peer nomination scores, marital status, multiple divorces, activities, hobbies |

Table 2 | Study country of origin by world region (UN, 2011).

| Northern America | Canada, United States |
| Europe          | Austria, Belgium, Denmark, European Russia, Finland, France, Germany, Greece, Iceland, Italy, Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom |
| Latin America and Caribbean | Mexico, Puerto Rico, Brazil, Colombia |
| Eastern Asia    | China, Japan, South Korea, Taiwan |
| Western Asia    | Israel, Lebanon, Turkey |
| Oceania         | Australia, New Zealand |

FIGURE 1 | Total number of studies per year by geographical region. There was a marked rise in studies of long-term outcomes of ADHD published worldwide between 1980 and 2010. The number of long-term outcome studies published globally peaked in 2008 with 42 studies published that year. The number of studies published in all of three regions shown appears to be generally continuing to rise. Studies involving international collaborations started being published in 2002.
FIGURE 2 | Interests of specific geographical regions. The total number of outcome results was highest for drug use/addictive behavior, followed by academic outcomes, antisocial behavior, social function, occupation, self-esteem, driving, services use, and obesity. In Europe, the most studies examined antisocial behavior; in Northern America non-medicinal drug use/addictive behavior; and in Eastern Asia self-esteem, non-medicinal drug use/addictive behavior, and antisocial behavior. The highest proportion of studies from all other regions together focused on academic outcomes.

antisocial behavior (28%); from Northern America were regarding non-medicinal drug use/addictive behavior (27%); from Eastern Asia were regarding self-esteem (21%), non-medicinal drug use/addictive behavior (21%), and antisocial behavior (21%); and from all other regions together (“Other”) were regarding academic outcomes (22%).

CHANGES IN STUDY DESIGN OVER TIME
Changes in the broad categories of study design (cross-sectional, longitudinal, prospective, and retrospective) utilized over time by decade (from 1981 to 2010) are shown in Figure 3 (in excluding 1980 only one study was omitted). Proportionally fewer prospective longitudinal studies have been published over time (77, 64, 46% for decades 1981–1990, 1991–2000, and 2001–2010, respectively) and proportionally more retrospective and cross-sectional studies have been published in more recent decades (23, 36, 54% for decades 1981–1990, 1991–2000, and 2001–2010, respectively). No large differences in study design were observed according to geographical region (Northern America, Europe, and all other regions), with longitudinal prospective studies being most prevalent for all regions (52–57%), followed by longitudinal retrospective (21–28%) and cross-sectional (19–21%; data not shown).

CHANGES IN AGE GROUP STUDIED OVER TIME
Figure 4 shows an analysis of subject age by year of the study published. Over time, there has been a clear trend to publish more adolescent and adult studies. In contrast, the number of published studies of children remained relatively stable. For example, in the 3 years 1985–1987, 5 studies of children and 7 of adolescents or adults were published, while in the 3 years 2005–2007, 8 studies of children and 78 studies of adolescents or adults were published.

The full range of ages of participants in all the studies in the present analysis was from 0- to 84-years-old, including ages at entry and follow-up of participants in longitudinal prospective studies. Based directly on the mid-range/mean age of study participants 18 years or older, 81 of 197 (41%) studies were of transitional adults (18–24 years), 92 (47%) were of young adults (25–44), and 24 (12%) were of mature adults (45–64 years). No studies had a mid-range/mean age of participants older than 64 years.

Studies of all three designs have been conducted in adults, including prospective, retrospective, and cross-sectional analyses. As might be expected, of all the retrospective studies, most (72%) have been conducted in adults. Of all the prospective studies, most (49%) have been conducted in adolescents (Table 3).

Finally, the proportion of studies of different age groups in Northern America, Europe, Eastern Asia, and the rest of the world is presented in Figure 5. The proportion of studies of children is highest in Northern America (17%) compared to 8% in “Other” countries around the globe (includes: Mexico, Puerto Rico, Colombia, Brazil, Israel, Lebanon, Turkey, Australia, and New Zealand). The proportion of studies of adults is highest in Northern America (48%) and Europe (50%), while studies from Eastern Asia and “Other” countries include a large proportion of studies of adolescents (60 and 58%, respectively).
We considered two possible explanations for the greater proportion of studies of adolescents in East Asia and “Other” countries; neither of which appear to account for the trend upon examination of the studies in the database, as follows: the large proportion of studies of adolescents in Eastern Asia and “Other” countries was not due to a larger proportion of these studies being prospective longitudinal studies, as might be inferred from data presented in Table 3. The proportion of different study designs of adolescent studies from these regions was very similar to the proportion of different study designs found in all world regions (50% prospective longitudinal, 25% retrospective longitudinal, and 25% cross-sectional). Nor does it appear to be due to an artifact of longitudinal prospective studies ending with participants at different ages at follow-up in East Asia and “Other” countries versus Northern America and Europe. The mean mid-range/mean age at follow-up for East Asia and “Other” countries was 16.9 years, not substantially different than that for Northern America and Europe, which was 17.9 years.

DISCUSSION
STUDIES OF ADHD LTOs OVER TIME
This analysis clearly shows that numerous studies of LTOs in ADHD already exist, and that studies of this topic have increased steadily from 1980 to the present time, with a peak increase in studies published in 2008. When published studies are considered by geographical regions, a similar pattern in terms of peak publication is observed, although most studies have been conducted in Northern America. As detailed in the introduction, the prevalence of ADHD has been estimated by a research group from Brazil, who found ADHD present in all nations (Polanczyk et al., 2007). Thus, these results may be due to greater acceptance of ADHD as a disorder for study in the US and Canada or perhaps greater availability for funding for ADHD-related studies specifically. These results may also reflect a general larger proportion of biomedical research studies coming from the US in all therapeutic fields.

The incidence of reported ADHD, more recently including adult ADHD, has increased in the US over time, undoubtedly spurring the interest in study of ADHD (Boyle et al., 2011; Montejano et al., 2011). Interestingly, even within the US itself ethnic differences in ADHD diagnosis exist, with more ADHD diagnoses in White American youths versus Hispanic American youths (Stevens et al., 2004). A recent report described higher incidence in non-Hispanic white children versus non-Hispanic black children and lower incidence in Mexican children versus other groups (Akinbami et al., 2011).
When we examined the focus of interest for specific geographic regions, we observed that in Europe, antisocial behavior was of the highest interest. The largest amount of research in the US was concerning non-medicinal drug use/addictive behavior. In Eastern Asia there appeared to be a balance of research in antisocial behavior, non-medicinal drug use/addictive behavior, and self-esteem. Other regions had the greatest research in academic outcomes. These “other” countries included those in Western Asia (Lebanon, Israel, Turkey), Oceania (Australia, New Zealand), and Latin America and the Caribbean (Puerto Rico, Mexico, Colombia, Brazil). The differences in study emphasis observed may have to do with geographic variations in the cultural expectations of children and adults with ADHD, but may also reflect the emphasis of government policies and attempts at cost reduction in specific sectors of society (such as in the prison system; Young et al., 2011a). One can additionally speculate about the types of studies that have been included overall. For example, the rather low number of driving studies was included because this is more likely to be studied in short-term than long-term studies. The high number of studies on non-medicinal drug-use/addictive behavior may be due to fears of stimulant abuse.

### Age-Related Focus of ADHD LTO Studies

The present results indicate that there has been a general shift in interest to the effects of ADHD in transitional and young adults. There were limited studies (24 total) in adults aged 45 and older, however, a recent study of ADHD in adults with a mean age of 66 demonstrated life burden of decreased finances, increased illness, lower educational, and job status as well as being socially isolated (Brod et al., 2011). Current data indicates responsiveness of this population to treatment that is similar to younger populations (Manor et al., 2011). Interest in adult ADHD has risen; no doubt due to the impact of ADHD on work, daily living, family living, and relationships (Young et al., 2003; Rosler et al., 2010).

The present results also indicate that over time there has been a shift in study design from prospective longitudinal studies to retrospective longitudinal studies. This may be explained by the analysis described in Figure 4, which shows the increasing interest in the effects of ADHD in adults and Table 3, which shows that studies of ADHD in adults are largely retrospective studies. Studies of ADHD in adults often necessarily utilize a retrospective design, particularly if ADHD is identified when the participants are adults, or if symptoms that existed in childhood are evaluated retrospectively in adults looking back on their childhood.

### Table 3 | Number of studies of different design by different age groups.

| Age Group         | Longitudinal, prospective | Longitudinal, retrospective | Cross-sectional |
|-------------------|----------------------------|----------------------------|-----------------|
| Adults (18–84 years) | 51                        | 89                        | 41              |
| Adolescents (13–17 years) | 91                         | 20                        | 20              |
| Children (6–12 years) | 43                        | 7                         | 6               |

![Figure 5](https://www.frontiersin.org)  
**FIGURE 5 | Participant ages by region.** The proportion of studies of different age groups is similar between Northern America and Europe, but studies from Eastern Asia and “Other” countries around the globe include a large proportion of adolescents and fewer children and adults.
Finally, we found that in Northern America and Europe, the bulk of studies have been conducted in adult populations; then adolescents followed by children, whereas in Eastern Asia and all other regions, most studies have been conducted in adolescent populations (Figure 5). This trend may reflect the interests of specific countries, however, the reasons for this trend are not clear. This may reflect differences in service provision, with more adult services being available/set up in western countries. It may be due to the availability of sources of data in specific regions and the need for immediately publishable results. Specific regions of the world may be just starting to understand ADHD and in other countries across the world, the trend has been to start off with study of ADHD in children and then gradually move to study of ADHD in adults.

CONSIDERATION OF POSSIBLE BIASES AND LIMITATIONS

Biases and limitations need to be evaluated regarding the studies included. Naturally, compiling studies with different designs has benefits and limitations. When reviewing this analysis, it is important to consider that the studies extracted have different geographical populations, different numbers of subjects, different investigators, and numerous other different characteristics in terms of their design. Although the compilation of studies must be viewed with appropriate caveats regarding differences between study designs, there is value in being able to view a comprehensive body of literature together in one place; hence our rationale for conducting this analysis and presenting the results graphically rather than only descriptively.

Publication and cultural bias may have resulted from evaluating only studies published in English. Also, the analysis excluded unpublished conference presentations. Search engine and literature database bias may have occurred, since only studies included unpublished conference presentations. Search engine and literature database bias may have occurred, since only studies included in databases were included. We reduced this bias through extensive searching of a total of 12 databases. In addition, our search relied on search engines for “peer-reviewed” articles, which may have erroneously excluded some studies that were, in fact, peer-reviewed. All the studies included in the present analysis were confirmed to be peer-reviewed.

FUTURE DIRECTIONS

This analysis examined geographical publication trends for studies of LTOs in ADHD. It supports a trend for increased study over time of this topic across all regions, differences in the focus of specific geographical regions, a shift to a focus on effects of ADHD in adults and more retrospective studies being conducted. Further analyses of this database is appropriate to address pertinent research questions such as the impact of pharmacological and/or psychological treatment on ADHD LTOs, and whether specific LTOs are more or less responsive to treatment. Further analysis may include comparisons of outcomes of participants who have been treated with drugs with different mechanisms of action, for example.

It is encouraging that research is now taking a life-span perspective. With studies starting to report ADHD outcomes in older adults, future research should focus on longer-term outcomes and, in particular, treatment of ADHD in the longer-term. However, the life-span perspective of research has not been directly paralleled with service provision. Mechanisms that translate research findings into evolving clinical practice, and service provisions that meet the needs of patients who must transition between services need to be better established (Young et al., 2011b) as this seems to be the current challenge faced by practitioners in the field.

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Finally, we found that in Northern America and Europe, the bulk of studies have been conducted in adult populations; then adolescents followed by children, whereas in Eastern Asia and all other regions, most studies have been conducted in adolescent populations (Figure 5). This trend may reflect the interests of specific countries, however, the reasons for this trend are not clear. This may reflect differences in service provision, with more adult services being available/set up in western countries. It may be due to the availability of sources of data in specific regions and the need for immediately publishable results. Specific regions of the world may be just starting to understand ADHD and in other countries across the world, the trend has been to start off with study of ADHD in children and then gradually move to study of ADHD in adults.
Hodgkins et al. ADHD long-term outcomes publication trends

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For example, one reference is from Frankel et al. (1999), which discusses the long-term outcomes of ADHD intervention and treatment, highlighting the importance of early identification and intervention. Another is from Friedman et al. (1998), which explores the relationship between ADHD and adolescent substance use, suggesting that early intervention can mitigate these risks.

The text is structured in a list format, with each reference including the authors' names, the title of the work, the publication details (journal, volume, issue, year), and the DOI or URL if available. The references are cited in a standard academic format, ensuring that the source material is accurately and legally used.

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