Defining the Research-Practice Gap in Pediatrics

by

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ABSTRACT

There is a gap between today's scientific advances and their application—between what is known and what is actually being done. This gap occurs because of the process of knowledge translation required to digest research findings for policymakers and practitioners. Studies have repeatedly shown that because of this "know-do" gap, approximately one-half of patients in the United States and Europe are not receiving care according to the most recent scientific evidence. Children are a medically unique and underserved population that stands to be most affected by this gap. Therefore, in this study, the research-practice gap in the pediatric field was calculated and discussed in the context of knowledge brokers, who facilitate opportunities for knowledge translation. Article mentions from the journal Pediatrics were identified in policy documents and analyzed for the years 2010, 2013, and 2016 with the use of the Altmetric platform as a quantitative means of identifying patterns and drawing conclusions about the knowledge translation gap in pediatrics. Altmetric is a bibliometric tool that offers viable insights into the types of impact not covered with traditional methods of citation analysis. The expert policymaking bodies that cited the Pediatrics articles in their policy documents were coded, categorized, and subcategorized to clarify how and where Pediatrics research is ultimately being used to create health policy and to discover whether the gap is similar or different between the various types of policymaking organizations. This allowed the quantitative findings to be nested within a qualitative context. It took a mean of 7.1 years for research to reach the point of policy uptake for practitioners, with a range of 0–32.8 years. There were more international policy mentions than U.S. mentions, but information made its way through the knowledge translation process more quickly in the United States than it did elsewhere. In fact, nearly

40% of articles were cited in policy fewer than five years after original publication. The gap in pediatrics is thus significantly shorter than the 17-year average reported in the literature. However, knowledge brokerage activities performed by technical communicators are continually needed to build links between research, policy applications, and practice.

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CHAPTER 1

INTRODUCTION

In medicine, researchers and practitioners operate in different worlds, with different needs,

goals, cultures, timelines, and rewards (Kothari & Wathen, 2013). The professional, cultural,

and linguistic gap between these two worlds has been well documented (UNICEF, 2008;

World Health Organization, 2004; U.S. Department for Health & Human Services, 2001).

The synthesis of biomedical research findings into practice occurs through the process of

knowledge translation, led by *knowledge brokers,* who tackle the thorny problem of how to use

research to strategically cross disciplinary boundaries (Holmes, McDonald, Jones, &

Graham, 2016).

In medicine, each field of inquiry has complementary—albeit unique—translation goals

(Teachman et al, 2012). Despite many reports in the literature on the research-practice gap in

biomedicine, the gap for individual subspecialties has not been defined to date, to my

knowledge; additionally, I could not find reports of the gap being previously defined in the

field of pediatrics. Because the pediatric population is unique and stands to be greatly

affected by this gap, I chose the field of pediatrics, and the exploration of the specific

research-practice gap within it, as the basis for my study.

The purpose of this thesis was therefore to define the gap between the publication of

original research in the peer-reviewed journal *Pediatrics* and its eventual use in policy and

practice. I sought to elucidate whether there is *(a)* a single, consistent gap, by studying

mentions of *Pediatric* articles in sample years of policy documents generated by a wide variety

of policymaking organizations, or whether *(b)* the gap varies from year to year and according

to policymaking organization types and locations. In this way, I was able to pinpoint what the research-to-practice gap in pediatrics actually looks like, instead of what it may or may not be assumed to be in the broader biomedical literature.

The research questions I investigated were as follows:

What is the specific knowledge translation gap between original research publication in the journal *Pediatrics* and its eventual uptake in policy?

Is this knowledge translation gap the same between sample years of policy, or is it variable?

Are there differences or no differences in this gap among the various policymaking organizations that use *Pediatrics* research evidence?

In my review of the literature, I investigated each interlocking piece of this particular puzzle: the historical "know-do" gap in biomedicine, the knowledge translation process and the role of knowledge brokers within it, the field of pediatrics and why investigating the knowledge translation gap within it is important, the appropriate methods used for determining current research impact, and the crucial role policy plays in the uptake and dissemination of research evidence for practitioners.

The altmetrics ("alternative metrics") approach was identified as a research vehicle appropriate for use in this study because it offers readily available insights into types of

impact not achievable with traditional methods. While altmetrics has been employed to study a number of individual biomedical subspecialties previously, including emergency medicine (Barbic, Tubman, Lam, & Barbic, 2016; Trueger et al, 2015) and orthopedics (Scarlat, Mavrogenis, Pecina, & Niculescu, 2015), I was not able to identify studies involving its use in pediatrics—or its application in exploring the know-do gap within any individual biomedical subspecialty. I therefore saw an opportunity to build upon the existing literature, while describing something previously unknown in this particular sector of technical communications.

The results I was able to generate with the Altmetric platform allowed me to define and characterize the research-practice gap in pediatrics, both qualitatively and quantitatively. They also enabled me to consider what my findings within the field of pediatrics represent in the greater context of biomedical reporting, how they relate to what has been reported previously in the literature, and what they add to the existing technical communications knowledge base.

The goal of this research was therefore to use the altmetrics method to define the knowledge translation gap between original research published in the journal *Pediatrics* and the eventual use of this research to enact health care policy for pediatricians and other practitioners. By defining the gap in this critical field of medicine, my findings not only supplement our working knowledge as technical communicators and knowledge brokers, but they may help to transform the way we approach knowledge brokering as communications experts in science.

CHAPTER 2

LITERATURE REVIEW

In laying the groundwork for answering my research questions, an in-depth review of the literature was required for the following individual pieces: the "know-do" gap in biomedicine, the knowledge translation process and the role of knowledge brokers within it, the field of pediatrics and why investigating the knowledge translation gap within it matters, the appropriate methods used to determine current research impact, and the vital role policy plays in the uptake and dissemination of research evidence for practitioners. Herein, I've summarized the literature for each piece.

The "Know-Do" Gap

The Disconnect Between Science and Its Application

Researchers advance science by adding to the knowledge base—they produce *evidence,* which policymakers and practitioners use for decision making. The goals of researchers are therefore "publications, patents, and professorships" (Pang, 2003). However, because researchers tend to be less interested in the big-picture policy or practice aspects of their work, their findings often require "translation" before they can be understood and used by policymakers and practitioners (UNICEF, 2008). Indeed, it has been said that researchers and policymakers do not speak the same language; researchers are from Mars, and policymakers are from Venus (Feldman, Nadash, & Gursen, 2001).

Practitioners and policymakers, on the other hand, are interested in solutions that can be applied to a broad swathe of people and issues (Choi et al, 2005). Medical practitioners work

in many contexts, including clinical, regulatory, administrative, community, and educational environments (World Health Organization, 2004). Policymakers are a heterogeneous group of individuals with varying levels of experience and expertise—including legislators (generalists who make decisions about funding), administrators (specialists with strong research backgrounds), and other representatives tasked with solving problems. The targets in this world are "policy, practice, and people" (Pang, 2003).

From policymakers' and practitioners' perspectives, most research is pointless and has no real-world value—a view that has been substantiated by a number of reports in the literature (Ioannidis, 2016; MacLeod et al, 2014). Information in research publications tends to be dense, with the findings buried in the text. Policymakers want a "bottom line," but researchers are often uncomfortable providing one, since they tend to focus on issues not directly related to policy or practice applications. This creates significant challenges in bridging the divide between knowledge and action.

The processes through which knowledge is exchanged, translated, and synthesized are complex. In the world of policy and practice, research knowledge must often compete with factors such as cultures, habits, traditions, political considerations, personal interests, beliefs, intuition, and superstitions (World Health Organization, 2004). Research can improve the robustness of decision-making; the scientific literature helps to widen the sphere of influence on policy. The trick is therefore to *connect* science with policy (Choi et al, 2005). However, science can be a slow-moving process, since it builds upon previous research findings. Dramatic breakthroughs are rare; as a rule, good science is cumulative and generalizable (Huston, 2008). For this reason, it can be relatively unhelpful from a policy perspective.

Policymakers have very little time to consider original scientific publications—and yet, the policies, guidelines, and regulations they create have a profound effect on our daily lives and health status (Brownson, Royer, Ewing, & McBride, 2006).

The Gap Affects Patient Care

If research findings are not effectively "translated" for use in policy and practice, there can be a wide gulf between what is known from research evidence and what is actually done in practice (Davis et al, 2003). Because of this gulf, effective drugs, services, and programs often do not reach the patients who need them; healthcare systems can incur unnecessary expenditures; and patients can be exposed to unnecessary harms (Grimshaw et al, 2012). For example, there has been widespread variation in the use of aspirin, ß-blockers, anti-ischemic drugs, and calcium antagonists in the United States, Europe, and Canada, despite good evidence on their best use (Davis et al, 2003).

Multiple studies have shown that patients receive a dismal 55% of recommended care because they are not benefiting from recent advances, and the quality of their treatment varies (McGlynn et al, 2003; Novak et al, 2011; U.S. Department for Health & Human Services, 2001). Additionally, 20% to 30% of patients may receive treatment that is not needed or is potentially harmful (Grimshaw et al, 2012; Novak et al, 2011). Novak et al (2011) point out that while health professionals ideologically support evidence-based practice, this does not necessarily translate into the provision of patient care. Ward et al (2009) argue that in healthcare, failing to translate research evidence into action contributes to health inequities and causes costly and time-consuming research to be wasted.

Research Versus Real-World Concerns

With so much valuable medical research available today, what causes it to go unused? For one thing, research favors the generation of *new* knowledge, over the assimilation of *what is already known.* Additionally, many features of academic culture can render the information produced by researchers unsuitable for use in policymaking and practice. Practitioners complain that researchers are not creating interventions that they can apply effectively (Teachman et al, 2012). Lewis (2007) maintains that "A great deal of scientific inquiry and reporting has little or no concern for indirect effects or the context within which phenomena occur." Researchers write for other researchers (Feldman, Nadash, & Gursen, 2001); for uptake by practitioners, however, research findings must be distilled into policy-relevant terms or otherwise disseminated more widely—but there can be few resources available to do this. Relying on journals and guidelines for dissemination places the responsibility on the practitioner to read, accurately interpret, and effectively apply the findings in his or her own setting (Olswang & Prelock, 2015), which can lead to wide variation in interpretations and applications.

Many researchers lack the specific skills and tools required for knowledge translation and may need significant support to make their work more readily available to policymakers and practitioners (Feldman, Nadash, & Gursen, 2001). Indeed, some practitioners have concerns about whether researchers are even receptive to research about clinical outcomes (Teachman et al 2012). Practitioners describe problems they've encountered in implementing empirically supported treatments, because most treatment research samples do not reflect the

demographics or clinical presentation of the general population (Dingfelder & Mandell, 2011). DeAngelis (2010) bemoans the "cherry picking" of patients for research purposes, which does not always translate to the "messy, real-world" of patients seen in clinical practice. As Lewis (2007) points out, "The randomized controlled trial is an artifice; it does not occur in nature." There is a general feeling discussed by Chambless and Ollendick (2001) that intervention studies can be categorically ignored by practitioners, because research reflects the singular interests of a few biased researchers and does not translate into "real-world practice."

A tenet that is often overlooked in the pursuit of research evidence is that knowledge depends as much on the *evaluation* of existing research as it does on the *generation* of new research. In the past, this neglect has led to inefficient use of limited resources for research and missed opportunities for achieving gains in health (World Health Organization, 2004). Brownson et al (2006) argue that researchers are obligated not only to discover new knowledge, but also to ensure that current discoveries are applied to improve patient health and well-being. New research should build on existing knowledge, and health decision makers should use research syntheses to inform policy and practice; failure to do so may result in serious consequences for patients and inefficient expenditure of limited healthcare resources (World Health Organization, 2004). In this context, understanding how policy and practice develop has the potential to facilitate a more effective use of research evidence (Haworth-Brockman, 2016; Deas, Mattu, & Gnich, 2013).

Policymakers have unique needs of their own—they require help in navigating the profuse but fragmented information sources available to them. The task of sifting through mountains of undigested information is a time-consuming and perplexing one, and research studies—especially in the medical sciences—often yield conflicting results (Joseph, 2013). Policymakers complain that information is generally too dense and copious, creating difficulties for them in picking out relevant or even useful information (Feldman, Nadash, & Gursen, 2001). As Lewis (2007) puts it, "Few will embark on a lengthy treasure hunt to chase down the parts and assemble them into a whole." Policymakers maintain that their use of research-based information is largely contingent on its conversion into simple and understandable terms that make it relevant to the problems they face and enable them to persuade others of its significance (Feldman, Nadash, & Gursen, 2001). These needs highlight the importance of *translation* (conversion) and *synthesis* (amalgamation)—activities needed to digest evidence-based information, to help policymakers slice through the overabundance of information and interpret its meaning for policy formulation and incorporation into practice.

McNatt et al (2010) discovered that 42% of research articles do not discuss implications for practice, which is a staggering amount of research that potentially does not translate to the practice environment. They assert that although the gap may never be closed, with better efforts, it may certainly be narrowed. The central challenge for evidence-based policy is to develop more rigorous, systematic, and global methods for identifying, interpreting, and applying evidence in decision-making contexts (Dobrow, Goel, Lemieux-Charles, & Black, 2006).

There are already a number of initiatives dedicated to bridging this gap in healthcare, such as the U.S. Agency for Healthcare Research and Quality, the Cochrane Collaboration's Effective Practice and Organization of Care Group, and The National Institute for Health and Care Excellence in the United Kingdom. Teachman et al (2012) indicate that if researchers asked how they could make ongoing outcome assessment feasible for practitioners and assisted with translating efficacy research into clinical practice, then multiple levels of translation could be invoked, to better implement a two-way bridge between research and practice. Kadzin (2008) says that with better communication and connection, both "sides" of the gap can win, because collaboration will not only foster improved clinical care but will also serve to develop and strengthen the existing knowledge base.

Knowledge Translation as Digestion

Knowledge translation constitutes the deliberate intention to digest research findings for practical application (Haworth-Brockman, 2016). Although the concept has been around for more than 100 years, in the 1990s, the Canadian Institutes of Health Research (CIHR) published a landmark report in which they defined *knowledge translation* as "a dynamic and iterative process that includes the synthesis, dissemination, exchange, and ethically-sound application of knowledge to…provide more effective health services and products, and strengthen the healthcare system" (Canadian Institutes of Health Research, 2017; Joseph, 2013). With this report, a deliberate strategy was adopted to encourage clinical and other health researchers to consider and convey how their studies could be beneficial and how

their results might be adapted in practice settings. Explicitly linking research to practice was deemed essential—and it continues to be (Haworth-Brockman, 2016).

The process of knowledge translation in biomedicine can be notoriously slow and haphazard (Graham et al, 2006), with research averaging 17 years to reach policy and practice (Green, Ottoson, García, & Hiatt, 2009) and often taking 20 years (Clancy, Glied, & Lurie, 2012; U.S. Department for Health & Human Services, 2001; Dingfelder & Mandell, 2011). This can be problematic because failing to seize upon accessible evidence may delay critical medical interventions or perpetuate the use of suboptimal ones. For example, it took nearly 20 years to effect serious policy changes after publication of the Harvard Medical Practice Study on medical errors (Clancy, Glied, & Lurie, 2012). However, the methods used to define the gap in these reports were not clearly elucidated, which creates a somewhat nebulous picture of how the research-practice gap has been defined previously. For knowledge brokers to be able to assist in bridging the gap, more precise information is needed. Indeed, only by more fully understanding these processes can we begin to ensure better use of appropriate knowledge, so that interventions are as effective as possible (Deas, Mattu, & Gnich, 2013).

The medical community has realized that medical practice covers much more than the application of biomedical science to patient care and is thus being transformed by "translational medicine," which is attempting to bridge the gap between medical researchers and care providers (Jackson, Garfin, & Enquist, 2017). In the biomedical realm, when we discuss knowledge translation, *knowledge* is shorthand for *evidence*—which has been understood to mean empirically derived results (Haworth-Brockman, 2016).

When the CIHR developed its knowledge translation requirements, the intent was to promote evidence-based practice and the use of research in practice (Haworth-Brockman, 2016). The focus was on encouraging interaction among the producers and users of research, removing the barriers to research use, and tailoring information to different target audiences so that effective interventions are used more widely. In medicine especially, knowledge translation is a critical undertaking because poorly translated information is often not used (Feldman, Nadash, & Gursen, 2001), leading to wasted research and resources.

Undigested findings from individual studies ideally undergo *replication* (reproduction/validation) and *synthesis,* processes that help "digest" them for uptake in policy and practice (Ioannidis, 2006). Therefore, the cumulative evidence that results is what ultimately becomes part of the accepted knowledge base. As such, *knowledge management* is becoming an important strategy to ensure that any knowledge produced is actually used to improve health. This term refers to not only the body of knowledge, but also how this knowledge is systematically accessed, collected, archived, disseminated, synthesized, and used. In addition to the well-known use of biomedical knowledge to develop drugs, vaccines, diagnostics, devices, and other interventions, *knowledge management* also includes the utilization of knowledge to inform policy, practice, and public opinion (World Health Organization, 2004). The processes and desired outcomes of knowledge management affect not only decision makers (who establish health policy), but governments and funding bodies, as well (Haworth-Brockman, 2016).

Many people view the knowledge translation model as the most promising way to bridge the gap between the care people *should* be receiving and the care they *actually* receive (World Health Organization, 2004). However, knowledge translation funnels and diagrams are typically one-way affairs (Green, Ottoson, García, & Hiatt, 2009; Graham et al, 2006; Pronovost, Berenholtz, & Needham, 2008). In the center of the standard knowledge translation model is a funnel, where knowledge "flows" in stages, from initial inquiry, to synthesis of multiple knowledge sources, to particular tools or resources developed for specific audiences (Haworth-Brockman, 2016). Westen et al (2004) believe that too much emphasis is placed on the "flow" of knowledge from researchers to practitioners, creating a unidirectional model of science and practice. With this model, researchers express frustration because their basic science and RCT findings are not being implemented in everyday practice (Teachman et al, 2012). Thus, this unidirectional approach has been shown to be less effective than a more circular method, where researchers get feedback and input from practitioners, policymakers, and patients. There is a need for a more bidirectional model, but the knowledge translation process is skill-intensive, time-consuming, fluid, and variable, which makes it impossible to use a one-size-fits-all approach. In other words, there is no one model that can be applied to all situations (Deas, Mattu, & Gnich, 2013; Lavis et al, 2003).

In reality, the process of knowledge translation is messy and complicated, and the problem of making evidence or knowledge in any of its forms available for practical application is a pervasive one (Haworth-Brockman, 2016). Knowledge translation requires a shift in thinking, from the idea of research findings being meritorious in their own right to packaging knowledge as a commodity to be used for application (Phillipson, 2014). Within this strategy, the *digestion* (condensation) of the research findings is key. Findings must be

presented in clear language that is free of research jargon, and researchers must think through and unambiguously articulate the policy implications of their work (Feldman, Nadash, & Gursen, 2001). This is where knowledge brokers come into play.

Knowledge Brokers

Knowledge brokers are organizations and individuals who translate and disseminate research findings in an accessible format for use in policymaking and practice. They essentially act as intermediaries between the worlds of research and action (Grimshaw et al, 2012). Conklin et al (2013) define *knowledge brokers* as those who engage in analytical, technical, and relational activities to foster the development and operation of practice communities—a vital task often performed by professional communicators or other intermediaries.

In effect, knowledge brokers serve as "middle men," by simplifying and combining information in ways that make it more transparent and understandable. They provide policymakers and practitioners with accurate and reliable digested information, to allow quality decisions to be made on the basis of quality information. This is a very important step of the process, for which research funding usually does not provide (Choi et al, 2005). Like knowledge translation itself, Conklin and colleagues (2013) maintain that the role of the knowledge broker is perhaps not yet fully understood.

Berta et al (2010) found that the ability to apply knowledge to practice is dependent on the ability of institutions and organizations to facilitate the adoption of new information. Thus, a knowledge broker engages with knowledge producers and end-users to identify issues that require solutions. The broker also brings producers and users together to determine shared

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goals, as well as mutual understandings of language, opportunities, and constraints (Dobbins et al, 2009). Many policymakers rely on knowledge brokers to assemble and package research findings for them, to create bite-sized bundles of information they can use. Brokers facilitate this exchange of knowledge to help policymakers develop needed health solutions (Haworth-Brockman, 2016).

When dealing with information overload, it is increasingly important to foster effective and scientifically sound brokerage activities. Policymakers estimate that 49% of the information they receive is not relevant to their current work (Sorian & Baugh, 2002). It can be difficult to communicate complex, evidence-based information to policymakers, who are already awash in information and who have to wade through masses of information and make sense of it (Feldman, Nadash, & Gursen, 2001). Therefore, to maximize policy uptake, scholars who work on the research-policy interface advise sticking close to the data, using value-neutral language, and not making unwarranted leaps from data to advocating particular policies. Knowledge brokering organizations can also become trustworthy to policymakers if they are seen as objective and evenhanded (Huston, 2008).

Some organizations, such as the American Academy of Pediatrics, have developed their own information brokering capacity. A number of membership organizations that represent policymakers include brokering activities among their services to focus on topics important to their constituents (Feldman, Nadash, & Gursen, 2001). Brokerage entities include advocacy organizations, government agencies, university research centers, for-profit and nonprofit research centers, bridging organizations, constituent organizations, and foundations (Feldman, Nadash, & Gursen, 2001). Subject areas undertaken for translation

can reflect the membership, the brokers' established areas of expertise, and the organizational goals.

Information brokerages such as the American Academy of Pediatrics are often independent *bridging organizations* that link the two distinct worlds of research production and policymaking (Feldman, Nadash, & Gursen, 2001). Bridging organizations focus on identifying important policy issues and conveying policy-relevant information. They often work through committees of policymakers to identify key issues and needs. Some cultivate their own in-house staff of technical communicators to synthesize and translate existing research or assist in policy-related activities. By effectively translating the huge amount of research being conducted into usable outcomes, knowledge brokers can nurture and build relationships among individuals within and among organizations who have different types of knowledge (World Health Organization, 2004), thereby promoting maximum benefit for all stakeholders.

The Gap in Pediatrics

Children are Unique

Children are a medically unique and chronically underserved population in medicine (Children and Clinical Studies, 2018; Dingfelder & Mandell, 2011; World Health Organization, 2004; Huston, 2008). Pediatric patients in various age groups respond differently to care—a 7-month-old is different than a 7-year-old, who is different than a 17-year-old. At each stage of growth, children need different doses of medicine, different types of treatments, and differently sized medical devices (Children and Clinical Studies, 2018). Studies must therefore be conducted in children of all ages to ensure maximum effectiveness

of interventions.

Historically, huge gaps existed between best evidence and practice in the implementation of clinical practice guidelines (Davis et al, 2003). For this reason, the U.S. Agency for Healthcare Research and Quality rolled out their Translating Research Into Practice (TRIP) initiatives (U.S. Agency for Healthcare Research and Quality, 2017) to assist in the translation of research findings into clinical practice. Notably, six of the primary projects undertaken by TRIP were pediatric in focus. These projects included pediatric asthma management, Head Start, preterm infant care, tobacco cessation programs affecting the pediatric population, and adolescent concerns (U.S. Agency for Healthcare Research and Quality, 2001). Because of such initiatives, the spread of Early Intervention childhood development programs is an example of strong, cumulative evidence that contributed to a policy consensus (Huston, 2008).

However, knowledge that an intervention works is only half of the equation. The Bellatio Study Group on Child Survival (2003) states that what truly stands in the way of improved pediatric health is knowing how to effectively implement and *use* an intervention. A health system is therefore much more than a vehicle to deliver the products of research; it also contains a wealth of knowledge that must be tapped to be able to complete the second half of the equation (World Health Organization, 2004). However, Tenopir et al (2007) found that two-thirds of office-based pediatric practitioners deemed the volume of medical literature to be "unmanageable" and bemoaned the amount of "irrelevant" material they have to cull through to be able to find what they need. For this reason, evidence-based

therapies—some of which could prevent morbidity or death—often do not get translated into real-world clinical practice (Pronovost, Berenholtz, & Needham, 2008).

Children Are Underserved

Policymakers and practitioners are constantly faced with the reality that a significant portion of the pediatric population is underserved by healthcare initiatives. In the United States alone, one-quarter of all children under the age of six live in poverty, and half of this group lives in extreme poverty. Additionally, large numbers of children are affected by at least one risk factor associated with poor health and academic failure (Schmit, Matthews, Smith, & Robbins, 2013). The increasing prevalence of pediatric obesity, for example, is highest for minority children and adolescents from economically disadvantaged families (Jelalian, Wember, Bungeroth, & Birmaher, 2007). In low-income settings in particular, evidence-based practice is particularly important, because limited resources must not be wasted (World Health Organization, 2004).

More than one in four children in the United States has a parent born outside the country, and young children of immigrants are less likely to have access to health care and early education. A complex mix of state and federal policies affects the access of low-income families to quality early child care and education; but currently, many of these policies do not benefit large numbers of young children who are experiencing economic hardship and other circumstances that seriously risk their healthy development and success in school. State policies on such matters (such as Head Start and child care subsidies) affect whether immigrant families are able to participate in and benefit from such programs (Schmit, Matthews, Smith, & Robbins, 2013). When creating these policies, all available information

must be weighed, including data on the magnitude of the problem, epidemiological data on determinants, stakeholder opinions on the nature of the problem and acceptable solutions, existing practices and traditions, less robust yet promising intervention analyses, program options within budgetary constraints, and legal considerations, such as privacy laws (Anderson et al, 2005).

From a broader view, children are also underserved globally—this is not a problem exclusive to the United States. Each year, an estimated 15 million children—40,000 children per day—die from infection and malnutrition (World Health Organization, 2004). In 2013, 5.9 million children died from easily preventable or treatable causes (American Academy of Pediatrics, 2018); and nearly two-thirds of the deaths in children younger than five could be prevented by applying simple, cost-effective interventions (Bellagio Study Group on Child Survival, 2003).

In pediatric medicine, research dissemination efforts are often targeted at federal policymakers, but state and local administrators also make and oversee many policy decisions that affect children and families (Huston, 2008). Therefore, the issue of disseminating timely and effective information on interventions to policymakers at all levels is a critical one. Adding fatty acids to infant formulas, developing obesity and nutrition guidelines, supporting neurological development, and gauging cognitive development are all widespread pediatric healthcare issues affected by the research-practice gap.

In the midst of these austere needs and challenges, the American Academy of Pediatrics functions as a primary knowledge brokerage organization in pediatrics, endeavoring to

bridge the gap between researchers, policymakers, and practitioners. It generates a wide array of dissemination materials for pediatric practitioners, including clinical and consumer books, patient education materials, and five peer-reviewed journals, as well as supporting policymaking and other federal and international advocacy efforts on the behalf of all children. I therefore selected *Pediatrics,* the flagship research journal of the Academy, for analysis in my study because it is a primary source of research evidence that supports policymaking and practice in the pediatric field. It is the most-cited journal in pediatric medicine and among the top 100 most-cited journals in all of science and medicine (American Academy of Pediatrics, 2018).

Policy: The Meat of the Sandwich

For medical practitioners, *policy* represents the mobilization of research-based knowledge into healthcare delivery. As such, the domains of policy and practice are inextricably intertwined. As Choi (2005) puts it, policy is the "meat" in the scientific sandwich, with science the "before and after" on either side. Jewell and Bero (2008) describe the necessity of incorporating high-quality research into compelling health policy to personalize and concretize its impact. For example, clinical practice guidelines are evidence-based policy guidelines that are distilled from research and used by practitioners to guide their approach to clinical practice. In this way, evidence-based health policy endeavors to establish best practice to ensure that patients receive optimum care, according to current evidence.

However, researchers and policymakers are "like oil and water" (Greenlick, Goldberg, Lopes, & Tallon, 2005). Clancy et al (2012) observe that researchers and policymakers often seem locked in an unrequited love affair; each seeks the attention and respect of the other,

and yet each is endlessly frustrated. The challenges are substantial when successfully translating scientific evidence into appropriate and effective public policy, because researchers and policymakers have significantly different decision-making processes (Brownson, Royer, Ewing, & McBride, 2006). The process of tailoring information for use by policymakers is complex and has led to the development of synthesis methods for guiding policy and practice (Anderson et al, 2005).

Policymakers' decisions are affected by "The Four I's:" ideology, interests, information, and institutional contexts (Huston, 2008). Science contributes to one of these areas—information—in combination with other sources, such as expert opinion and common sense. Policymakers use research as a basis for general knowledge, as well as for choosing specific policy alternatives—especially when that information is scientifically sound and relevant to potential policy actions (Huston, 2008).

There is a strong preference among policymakers for short, easy-to-digest information (Sorian & Baugh, 2002). The uptake of science into policy is more successful when findings are converted into unambiguous messages that are meaningful to policymakers and easy to apply (Berta et al, 2010). In medicine, multidisciplinary policymaking teams are tasked with developing lists of possible interventions; then, for each intervention, effectiveness studies are identified and assessed for quality. Main effects are summarized, characteristics that influenced effectiveness are described, barriers to implementation and unintended consequences are detailed, and costs are estimated. Finally, depending on the availability and strength of the evidence, the team recommends for or against an intervention or determines the evidence to be insufficient to draw conclusions (Anderson et al, 2005).

Policymakers report frustration with researchers' unwillingness to clearly articulate the policy implications of their research, to "go out on a limb" and make policy recommendations based on their findings (Feldman, Nadash, & Gursen, 2001). Researchers' reluctance to draw clear-cut conclusions is at odds with the demands of practitioners, who must make concrete decisions about which interventions to use (Dingfelder & Mandell, 2011). Ovretveit and Klazinga (2013) conclude that research could contribute more to national policy and local practice if researchers worked more closely with decision makers at all levels, took their questions more seriously, and used methods that can provide practical answers instead of theoretical ones, as well as improving the communication of their findings. Effective techniques for communicating research findings to decision makers include presenting readily understandable data in visually compelling formats, sending clear key messages about the meaning of data, and suggesting ways to use research findings for answering important policy questions (Feldman, Nadash, & Gursen, 2001).

In medicine, the main users of research are medical staff, health system managers, health insurers, policymakers, patients, and other researchers (World Health Organization, 2004). As innovations are developed, it is crucial to evaluate them carefully so they can be added to the evidence base. When evidence is synthesized, many studies are combined to find consistencies in a set of findings (Anderson et al, 2005). However, there are few systematic reviews for interventions to evaluate the effects of knowledge translation strategies for policymakers (Grimshaw et al, 2012). What evaluations do exist have shown this process to result in the meaningful translation of scientific discoveries into policies (Brownson, Royer, Ewing, & McBride, 2006), because decisions are better informed by putting the best available evidence at the center of the policy process (UNICEF, 2008). Thus, the enactment

of policy is a shared responsibility between scientists and policymakers, because policymakers need quality information to be able to understand policy options and craft the most appropriate policy decisions (Brownson, Royer, Ewing, & McBride, 2006).

Policymakers are tasked with allocating dollars, targeting services, and promoting efficiencies in delivery systems to expand access to high-quality health care. They must therefore focus on many factors besides research evidence, including budgetary considerations, regulations, court decisions, demographics, available service delivery systems, potential targeted interventions, and other legislation. Additionally, policymakers prefer to use information obtained directly from trusted sources, such as those with immediate knowledge of their circumstances, priorities, and needs. The substance of such information is generally perceived as more convincing and more readily applicable to current or anticipated policy problems than "undigested" information obtained from the academic literature (Feldman, Nadash, & Gursen, 2001). The findings of various information-producing activities should thus be synthesized and digested for use.

According to the World Health Organization (2004), there is not enough evidence between health research and policy for systematic reviews to be able to reach definitive conclusions or establish what may be "best practices," which is reflected in the fact that case studies are often used to establish links between the two. However, in lieu of case studies, there are exciting new resources being developed to be able to measure the impact of research on health policy (Bornmann, 2014).

Measuring Research Impact

Since the 1970s, citation analyses have been used to determine the most influential authors and articles in a particular journal or field by examining the frequency of citations in articles and other texts (Barbic, Tubman, Lam, & Barbic, 2016). With traditional citation analysis, the evaluation of individual articles makes sense in the case of excellent reports, such as the top 5% of cited articles in a given field (Rasmussen & Andersen, 2013). In evaluating the impact of research, however, investigators at the Washington University School of Medicine discovered that *(a)* traditional citation analysis is not a sufficient tool for assessing the impact of research findings and that *(b)* results of citation analysis are not predictive of clinical applications that result in meaningful health outcomes (Sarli, Dubinsky, & Holmes, 2010). They maintain that knowledge transfer *can* be documented and quantified, but that it is *not readily discoverable* via standard citation analysis. In lieu of traditional citation analysis, the Washington University School of Medicine researchers developed "The Becker Model" of research impact (updated most recently in 2014), in which *health policy* is identified as a beneficial clinical implementation outcome to measure (Washington University School of Medicine, 2018).

Scholarly publishing has entered a new era, in which new publication types are springing up from open science communities on the Internet. These are subsuming the role of the more traditional print journals (Patthi et al, 2017; Rasmussen & Andersen, 2013), for which citation analysis was developed. Citations are slow to accumulate; therefore, citation analyses rarely take into account new forms of scholarly content. In contrast, biomedical researchers, healthcare professionals, and patients are currently applying social media and new scholarly e-tools in broader ways, to facilitate and improve their knowledge and communication

(Patthi et al, 2017). This transition to digital dissemination is permitting access to a treasure trove of new metrics to track research impact (Thoma, Mohindra, Artz, & Chan, 2015), tailored to these new publication types and channels. Accordingly, the rise of online scholarly tools has led to the creation of new metrics for the impact of scholarly publications (Patthi et al, 2017). These new avenues have collectively been dubbed "altmetrics," indicating their nature as alternatives to the established bibliometric methodology (Priem, Taraborelli, Groth, & Neylon, 2010; Rasmussen & Andersen, 2013).

The premise of traditional citation analysis is that scientifically important articles are cited more frequently and that the number of citations indicate a direct measure of a research article's impact on its scientific field (Barbic, Tubman, Lam, & Barbic, 2016). This is commonly measured with standard metrics, such as the h-index, Eigenfactor score, and Impact Factor. However, the Impact Factor is a measure that applies only to a journal as a whole, and not to a particular article (Kwok, 2013). Additionally, citation-based bibliometric standards such as these have been widely criticized of late (Barbic, Tubman, Lam, & Barbic, 2016; Trueger et al, 2015). Citation analyses do not take into account the reasons for citation, nor do they consider the impact a research article has outside the realm of academia (Barbic, Tubman, Lam, & Barbic, 2016). Further, it can take years for citations to appear after the original article was published, which makes a real-time study of research impact virtually impossible. In peer-reviewed ophthalmologic journals, for instance, peak citations occurred three to four years after publication (Liu, Gai, Zhang, & Wang, 2015). In this setting of imperfect research impact estimation methods, Wouters and Costas (2012) have identified four benefits of altmetrics: broadness, diversity, speed, and openness. With altmetrics, impact data can be retrieved days to weeks after an article is published (Bornmann, 2014;

Citrome, 2015), thus providing a real-time analysis of research impact in a broader context than academia alone.

Weighted Altmetric citations take policy mentions, Wikipedia content, scholarly blogs, Mendeley, Twitter, Facebook, and traditional news media sources into account (Altmetric, 2017), to generate a quantitative Altmetric "score." This allows the impact of an individual article to be compared numerically against other research studies. While traditional citation analysis provides a similar illustration, it does not follow that highly downloaded articles are also highly cited (Rasmussen & Andersen, 2013). In fact, Lin and Fenner (2013) revealed that only one person in 70 cites a paper they downloaded from the Public Library of Science. Thus, for the present study, I chose to isolate the policy-tracking capabilities of the Altmetric platform as a means of quantifying the gap in pediatrics research impact.

Because the altmetrics method is an article-level measurement tool, it is now being used to track novel types of impact data. It provides a more complete picture of research impact by revealing scholarly activities *other than* the communication amongst researchers (Rasmussen & Andersen, 2013). The Altmetric score reveals the instantaneous scientific and public interest in a research paper (Patthi et al, 2017) and aims to address many of the failings of traditional impact metrics; Altmetric scores may provide more accurate assessments of total overall readership by incorporating more metrics than simply citations in traditional journals (Trueger et al, 2015). With recent technological advancements, millions of citations can now be evaluated for large-scale patterns and knowledge discovery (Barbic, Tubman, Lam, & Barbic, 2016), and our ability to discuss, download, and share material in real time and across the globe has grown exponentially (Rasmussen & Andersen, 2013). "Hidden impacts," such

as effects on health policy and clinical practice, are now being revealed with the altmetrics paradigm (Bornmann, 2014). For this reason, Trueger et al (2015) propose that altmetrics be thought of as a measure of "disseminative impact." With the widespread adoption of electronic publishing, dissemination of scientific outputs occurs across more channels than it did in the print age and happens faster than ever before (Melero, 2015).

Altmetrics permit quantitative analyses of *societal impact,* which allows for the evaluation of a whole different side of research output than traditional analysis (Rasmussen & Andersen, 2013). The purpose of the method is to provide an alternative, multidimensional view of impact (Priem, Piwowar, & Hemminger, 2012; Rasmussen & Andersen, 2013) by tapping different sources than were available previously (Rasmussen & Andersen, 2013)—including the assemblage of health policy data derived from research sources. The use of both traditional and altmetrics approaches to scientific knowledge dissemination may allow decision makers and stakeholders to determine which articles are deemed most important from a knowledge translation and synthesis perspective, by assessing traditional and nontraditional uptake of the literature (Barbic, Tubman, Lam, & Barbic, 2016).

In this digital era, the evaluation of research output on both institutional and individual levels is becoming increasingly important (Vrkić, Škorić, & Petrak, 2017). *Transparency* is an important piece of the altmetrics equation on both of these levels, because it permits the identification and use of trustworthy indicators of research impact (Rasmussen & Andersen, 2013), as well as transparent descriptions of the usage, reach, and interest of scholarly products (Bornmann, 2014). Altmetrics discourages "gaming," or the manipulation of indicators, which is what bedevils the Impact Factor measure (Rasmussen & Andersen,

2013). Indeed, Gonzalez-Valiente et al (2016) refer to the Impact Factor as "already institutionalized," because of the way it has been manipulated by research outlets. In contrast, multiple citations from the same source are not included in the Altmetric citation-tracking system and thus cannot be factored into the weighted score more than once (Altmetric, 2017; Rasmussen & Andersen, 2013).

Due to its versatility, its potential for pinpointing and studying multiple forms of research impact, its transparency, and its ability to meet the impact criteria laid out in the Becker model (Washington University School of Medicine, 2018), the Altmetric platform served as an ideal approach for me to be able to define the know-do gap for *Pediatrics*.

CHAPTER 3

METHODS

Since the American Academy of Pediatrics is a primary knowledge brokerage in the pediatric

field, the decision to select its foremost research journal *Pediatrics* as a source for study was a

natural one. Not only does *Pediatrics* publish research on every subspecialty within the

pediatric field, but it also includes research for every age group, from prenatal care and

newborns to adolescents and young adults, thereby representing a sufficiently broad patient

population. It consequently has one of the highest impact factors of any pediatrics research

journal indexed in the 2016 Thompson Reuters Journal Citation Report (American Academy

of Pediatrics, 2018).

The research questions I investigated were as follows:

What is the specific knowledge translation gap between original research publication in

the journal *Pediatrics* and its eventual uptake in policy?

Is this knowledge translation gap *the same* between sample years of policy, or is it *variable?*

Are there differences or no differences in this gap among the various policymaking

organizations that use *Pediatrics* research evidence?

Approach

With the Altmetric tool, for every single use of an electronic resource, Altmetric records who

used it, where, and when, as well as where the resource came from (Kurtz & Bollen, 2010)

by using a centralized digital object identifier. Sources include citations, mentions, usage,

captures, and social media (Melero, 2015). Instead of accessing citations of a paper in a

database, Altmetric.com uses a proprietary algorithm (Thoma, Mohindra, Artz, & Chan, 2015) to measure article downloads, views, policy mentions, news coverage (with more weight given to news outlets such as *The New York Times,* as opposed to smaller publications; Citrome, 2015), book citations, discussions, and more across various platforms (Bornmann, 2014). It can therefore readily be used to track policy mentions derived from articles published in the journal *Pediatrics.*

The data available in the Altmetric system permitted the use of both quantitative and qualitative analyses. Since a quantitative research approach is used to determine the *extent* of a phenomenon, whereas a qualitative research method is applied to explore its *nature* (Kumar, 2014)*,* I chose a mixed-methods approach, as it offers the attributes of both. I surmised that the combination approach would provide a better understanding of my research findings than either method could alone. Thus, a mixed-methods approach served as the basis for my Altmetric search.

Data Collection

To obtain a representative cross-section of the know-do gap in pediatrics and assemble a balanced sampling, I extracted mentions of *Pediatrics* articles in policy documents for three sample years. My intent was to obtain a variegated data set, while simultaneously keeping my findings as current (and therefore relevant) as possible. I selected policy documents from the years 2010, 2013, and 2016 for analysis. By building in a three-year lapse between samples, I aimed to avoid sampling too narrow of a window. I also wanted to ensure that the findings were somewhat spaced out, so that a true cross-section could be identified (ie, I avoided sampling consecutive years of data).

Within Altmetric Explorer, first I performed a general search for research outputs derived from the journal *Pediatrics*. The result of this search is provided in **Figure 1**. Note that the various output types are grouped in tabs along the top of the screen, with the proportions for each visually demonstrated along the bottom. The user can dive deeper into any particular type of research output by clicking on any of the 15 output tabs.
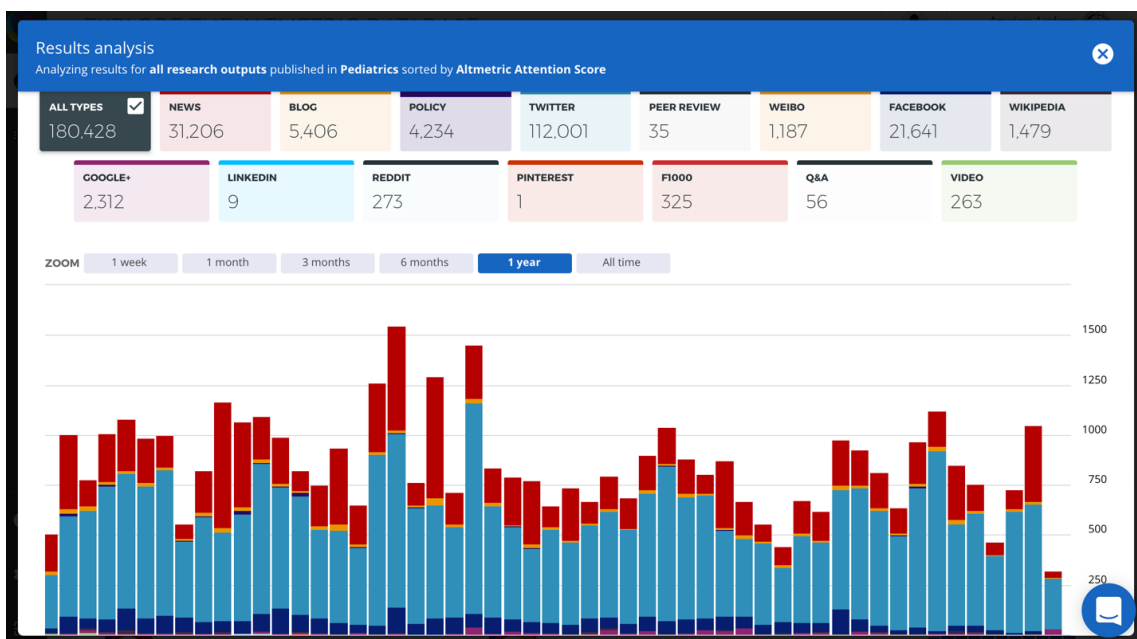
Figure 1. The search return screen for research outputs from the journal *Pediatrics*.

I isolated the policy outputs for further analysis by clicking on the "Policy" tab, which indicated that there were 4234 policy mentions for *Pediatrics* articles. **Figure 2** provides an overview of the policy mentions available for study, broken out by years.
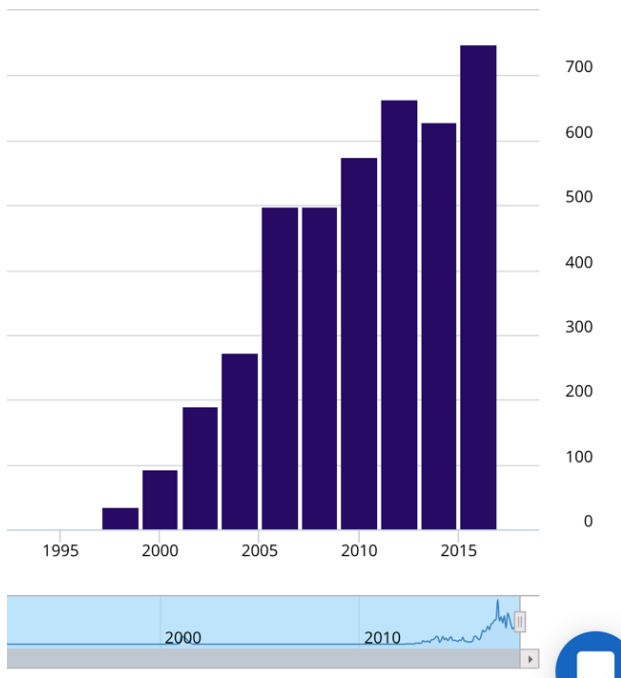
Figure 2. An overview of the policy data available for analysis, broken out by years.

When the policy search results were further expanded, an itemized listing appeared for each policy document in the Altmetric database, including original research articles cited, policy publication date, and so on. A sample breakout search result is illustrated in **Figure 3**. Note the live policy document title, source, and date of posting, as well as the policy publication date; the original research article title, source, and publication date; and the weighted Altmetric score provided for each original research publication, indicated by the colored "wreaths," or badges.
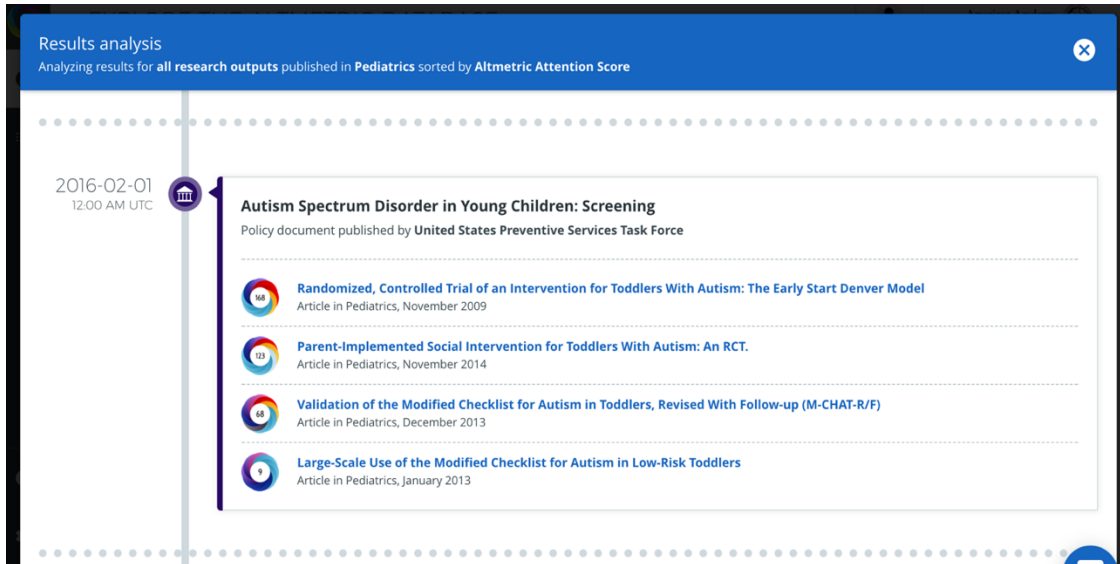
Figure 3. A sample expanded view of an Altmetric output for a United States Preventive Services Task Force policy document that cited *Pediatrics* articles.

Once I had isolated and captured the policy mentions for all three sample years of 2010, 2013, and 2016, I was able to generate three respective .csv files for export. These data pulls included article title and original publication date, mention type ("policy document"), policy uptake date, policy outlet, policy document title and url, research output title, research source (the journal *Pediatrics*), output type, Altmetric score, article DOI, PubMed ID, and more (**Figure 4**).

Figure 4. A sample Altmetric database .csv export.

I then used Excel to evaluate the Altmetric data. Not only is Excel compatible with the .csv

format, but it is a versatile program that allows various forms of sorting, analysis, and

calculation that were ideal for this investigation.

Data Analysis

Quantitative Analysis

The data pull yielded a total of 1110 policy mentions of *Pediatrics* articles across the three

sample years. To begin to break the data down, first I verified that the "mention type" was

"policy document" for all entries, in all three data sets. I also verified that the journal

Pediatrics was the source of all original articles cited. Second, I scanned through each .csv file

and identified outputs for which the original publication dates were missing. For these, I had

to look up each article on the American Academy of Pediatrics website *(aap.org)* and plug in the publication date, to ensure that I had a full data set to work with.

Once I had finished this task, I searched the spreadsheets for any remaining anomalies. Across the three sample years, there were eight outputs for which the original publication dates did not resolve with the policy uptake dates (ie, the policy uptake dates occurred before the dates of original publication, thus not allowing a calculation of the gap between them). These outputs were omitted from the analysis. This discrepancy appeared to be caused by the original articles being published online ahead of print, with the policy documents citing them in advance of their print date. However, there was no way to know this for certain, and a calculation of the gap for these inverse dates was not possible. So, these anomalies were eliminated from the data sets, yielding a total of 1102 policy mentions for analysis.

Next, for each mention, I used the Excel "Formulas" function to calculate the gap between each individual original publication date and the consequent policy uptake date. When creating the formulas, I chose for the results to be calculated in months, instead of years, to yield the most specific values possible (when Excel calculates results in years, it provides them in whole-year increments, and I wanted partial years to be included, to obtain the most accurate results). Next, I created formulas to calculate the mean, median, maximum, and minimum values (all in months) to be able to quantify and define the gap within each sample year. I then converted these results (in months) to years and partial years (for example, a result of 186 months was converted to 15.5 years [186 months/12 months per year = 15.5 years]).

Once I had quantitatively defined the gap per each sample year, I began comparing the results between years, to determine whether there were marked differences or similarities between them. With my overall quantitative findings in place, I then began my qualitative analysis to determine *where* policy was being cited, by *which* policymaking organizations, and *how* these organizations related to each other.

Qualitative Analysis

I began coding each policymaking organization as "U.S." or "International," as a preliminary means of sorting each mention to begin to determine which policymaking organizations cited *Pediatrics* research articles and whether they were based in the United States or elsewhere. Once each entry was coded, I took stock of how many U.S. and International mentions there were for each sample year and determined the overall proportions of each. Then I began compiling lists of the discrete policymaking organizations that cited *Pediatrics* articles and identifying which ones appeared in the data sets for each sample year. I noted similarities and differences between the data sets as I went along.

Since some of the organizations were international, and the names of them appeared in languages other than English, I had to research them further to determine whether they were different entities from each other, or the same. For example, outputs from the Netherlands appeared as "overheid.nl" or "rijksoverheid.nl." As I investigated each of these outputs, I translated the contents of the web pages from Dutch to English, to allow me to discern how they related to each other. In this case, "rijksoverheid.nl" is the site for the National Government for the Netherlands, and "overheid.nl" represents an initiative of the Ministry of the Interior and Kingdom Relations in the Netherlands. I noted these findings and the

relationships between the entities, as I considered how to subcategorize the policymaking bodies cited.

With the organizations generally mapped out, I then began to research each individual policymaking body one by one, to decide how to further subcategorize the data sets. For example, the *World Health Organization* and the *Food and Agriculture Organization of the United Nations* are both agencies of the United Nations, which distinguished them from the other types of policymaking organizations—so these were assigned their own subcategory.

When I had finished researching each organization, I was able to cluster the organizations into the most specific subcategories I could identify—which yielded a total of nine subcategories. I then amended the original "International" and "U.S." codes assigned to elucidate the following nine subcategories:

(a) International Government: A policymaking body of a foreign (non-U.S.) government

(b) International Organization: A non–government-based international policymaking body

(c) International Government-Funded Organization: A foreign (non-U.S.) policymaking organization *funded by* a foreign government but not a part of the government itself

(d) U.S. Government: A policymaking body of the United States government

(e) U.S. Charter: A U.S. policymaking organization chartered by the United States Congress

(f) International Government-Funded Banking Cooperative: An international government-funded banking coalition that establishes policy and provides development financing to countries

(g) Agency of the United Nations: A policymaking body of the United Nations

(h) International Nonprofit Organization: A foreign (non-U.S.) nonprofit policymaking body

(i) U.S. Nonprofit Organization: A U.S.-based nonprofit policymaking body

The clustering of organizations into subcategories is detailed in the Results section.

After all entries were fully coded and subcategorized within each sample year, I then combined the data for all three sample years and began defining the know-do gap both as a whole and according to each subcategory. I used the Excel Formulas function to find the mean, median, maximum, and minimum values for each subcategory and compared and contrasted the results between each. On the basis of the ranges in values, I then began breaking the gap out into 5- and 10-year increments and tallying how many mentions appeared within each time frame, to more closely pinpoint the time at which *Pediatrics* articles were cited in policy and how this was the same or different between policymaking bodies. This allowed me to "crack open" the cumulative gap and reveal how the know-do gap in pediatrics may truly be characterized.

This strategy constituted the limits of my focused investigation. I did not examine how the *Pediatrics* articles were used in the policy documents, for example, since there were thousands of mentions in policy documents, and I would have had to research each one individually. I restricted my analysis to defining and assessing the gap between the original publication of research and its eventual uptake in policy.

By the time I was finished analyzing the data, I had examined the gap from a number of different angles, broken out and combined in many different ways, to illustrate what the gap in pediatrics looked like not only as a whole, but also across and among the various landscapes of different countries, agencies, and funding sources.

CHAPTER 4

RESULTS

The policy mentions of *Pediatrics* articles identified with the Altmetric tool allowed patterns

to be identified and definitive conclusions to be drawn about the knowledge translation gap

in pediatrics. The mixed-methods approach permitted my quantitative findings to be nested

within a more qualitative context; the results are presented herein. When discussing the

results of this investigation, the *mean* is defined as the central tendency of the data, the *median*

is defined as the midpoint of the distribution, the *minimum* is defined as the smallest value in

a data set, the *maximum* is defined as the largest value in a data set, and the *range* is defined as

the minimum to maximum values.

Quantitative Findings

The total number of *Pediatrics* policy mentions available for analysis included 246 mentions

for the year 2010, 363 mentions for the year 2013, and 493 mentions for the year 2016, for a

grand total of 1102 mentions. The mean knowledge translation gap was 6.0 years for 2010,

7.3 years for 2013, and 7.6 years for 2016. The gap ranged from 0 to 32.8 years across all

policy mentions, and the median gap ranged from 5.3 to 7.0 years across the three data sets

(**Figure 5**).
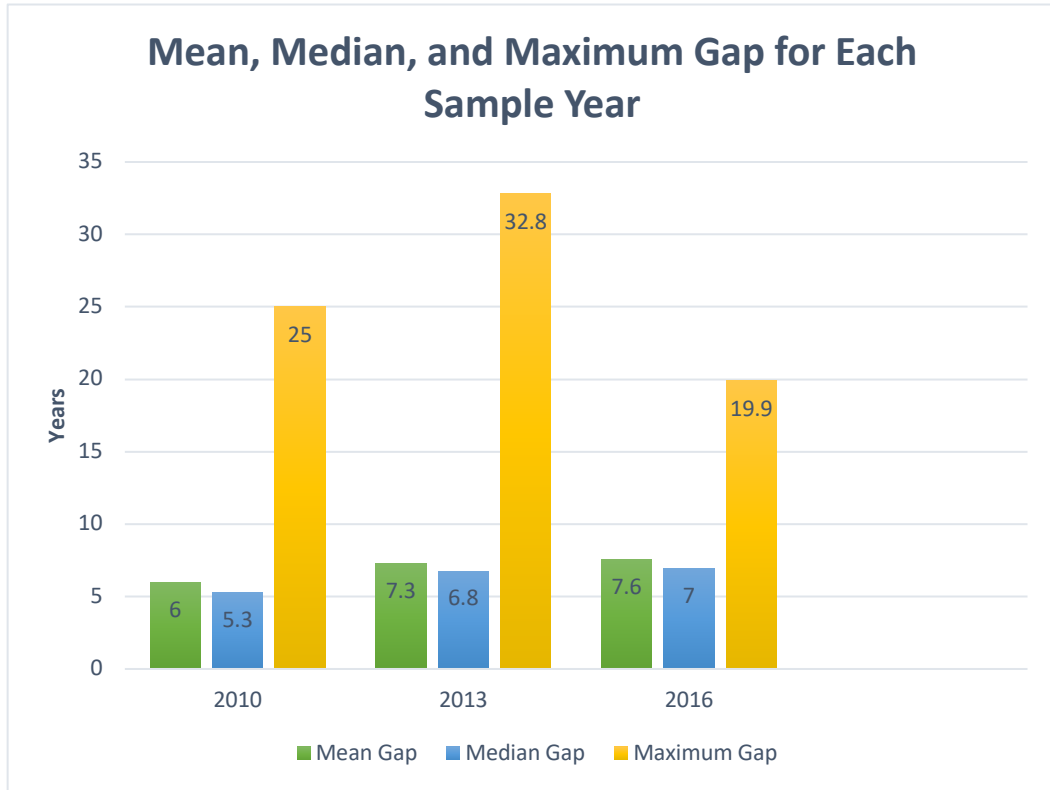
Figure 5. The mean, median, and maximum gap for each sample year of 2010, 2013, and 2016.

U.S. Versus International Results

When the policy mentions were classified according to U.S. versus international mentions, there were more international policy mentions of *Pediatrics* articles than there were U.S. mentions, with 593 international policy mentions and 509 U.S. policy mentions (**Table 1**).

Table 1. Number of U.S. Versus International Policy Mentions

Sample Year	Total No. of *Pediatrics* Mentions	International Policy Mentions	U.S. Policy Mentions
2010	246	137 (55.7%)	109 (44.3%)
2013	363	177 (48.8%)	186 (51.2%)
2016	493	279 (56.6%)	214 (43.4%)
Total	**1102**	**593 (53.8%)**	**509 (46.2%)**

When the gap was calculated between international and U.S. policy mentions, the mean gap for international policy uptake was 7.6 years, whereas the mean gap for U.S. policy uptake was 6.6 years. Therefore, even though more *Pediatrics* articles were cited in international policy than in U.S. policy, the findings showed that the research information made it through the knowledge translation process more quickly in the United States than it did in the rest of the world (**Table 2**). The range of the gap was also wider in the United States than it was for the rest of the world, with lower minimum values and higher maximum values.

Table 2. The Gap Between International and U.S. Policymaking Organizations

Policymaking Location	No. of Mentions (*n* = 1102)	Range (years)	Mean (years)	Median (years)
United States	509 (46.2%)	0–32.8	6.6	5.8
Other countries	593 (53.8%)	0.5–25.0	7.6	7.0

The Overall Gap

When the overall (combined) gap was tabulated across all sample years and all policy mentions, the mean gap was 7.1 years, with a median of 6.5 years. To further characterize what the gap looked like overall and between U.S. and international policy mentions, I stratified the mentions according to 5- and 10-year increments to be able to compare and contrast them.

Interestingly, only 0.4% of *Pediatrics* articles were cited in policy 20 years or more after the time of original publication, and fewer than one-quarter of articles were cited in policy 10–20 years after original publication. More than three-quarters of *Pediatrics* articles took fewer than 10 years to achieve uptake in policy (**Figure 6**).
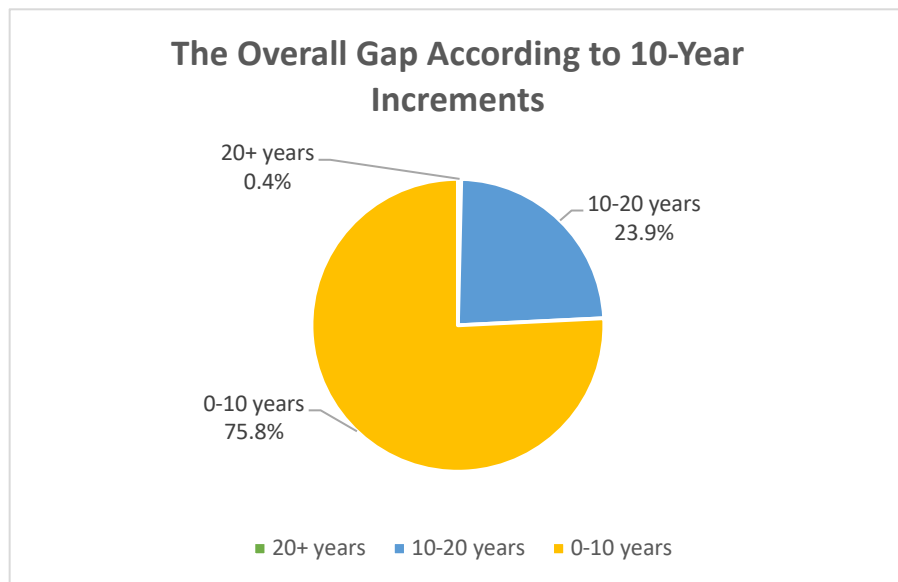
Figure 6. The overall gap according to 10-year increments.

Further Gap Characterization

When I broke the data out further, I found that not only were the vast majority of articles

cited less than 10 years after publication, but in fact, nearly 40% of articles were cited *fewer*

than five years after publication (**Table 3**).

Table 3. The Overall Gap According to Five-Year Increments

Time Interval	No. of Policy Documents (*n* = 1102)	Percentage
20+ years	4	0.4%
15–20 years	59	5.4%
10–15 years	204	18.5%
5–10 years	403	36.5%
0–5 years	**432**	**39.2%**

When I tallied how many *Pediatrics* articles took 1 year or less to reach the point of policy

uptake (mentions of articles in policy), I found that across all years, 8.2% of U.S. policy

mentions reached policy uptake in 1 year or less, whereas 1.2% of international policy

mentions reached policy uptake in 1 year or less. This represented a marked difference

between U.S. and international policy mentions. When the two categories were combined, a

total of 4.5% of articles were cited in 1 year or less, across all policy mentions.

Regarding trends in the gap between U.S. and international policy, 80% of *Pediatrics* articles were cited in U.S. policy within 10 years after original publication (**Figure 7**), and 45% of articles were cited in U.S. policy within 5 years (**Table 4**, **Figure 8**).
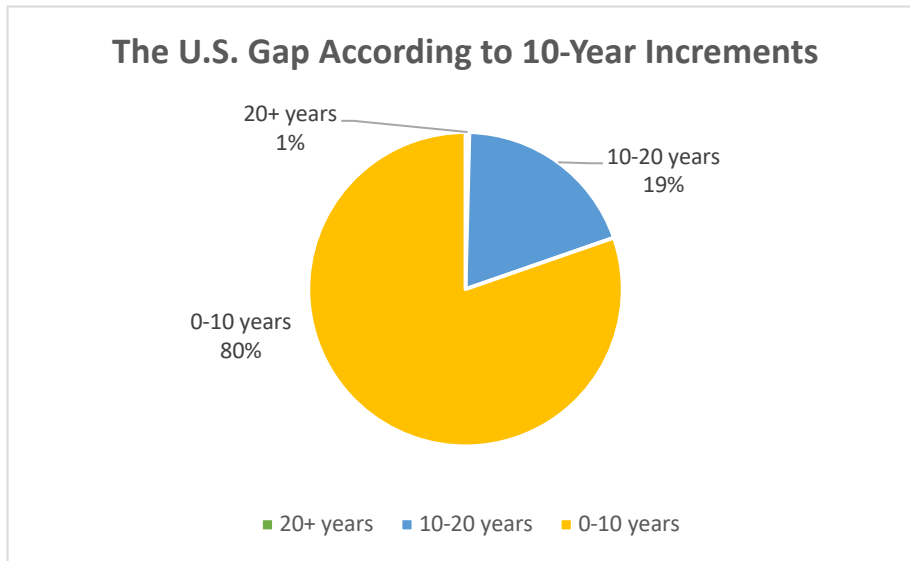
Figure 7. The U.S. gap according to 10-year increments.

Table 4. The U.S. Gap According to Five-Year Increments

Time Interval	No. of Policy Documents (*n* = 509)	Percentage (%)
20+ years	2	0.4%
15–20 years	22	4.3%
10–15 years	76	14.9%
5–10 years	179	35.2%
0–5 years	**229**	**45.0%**
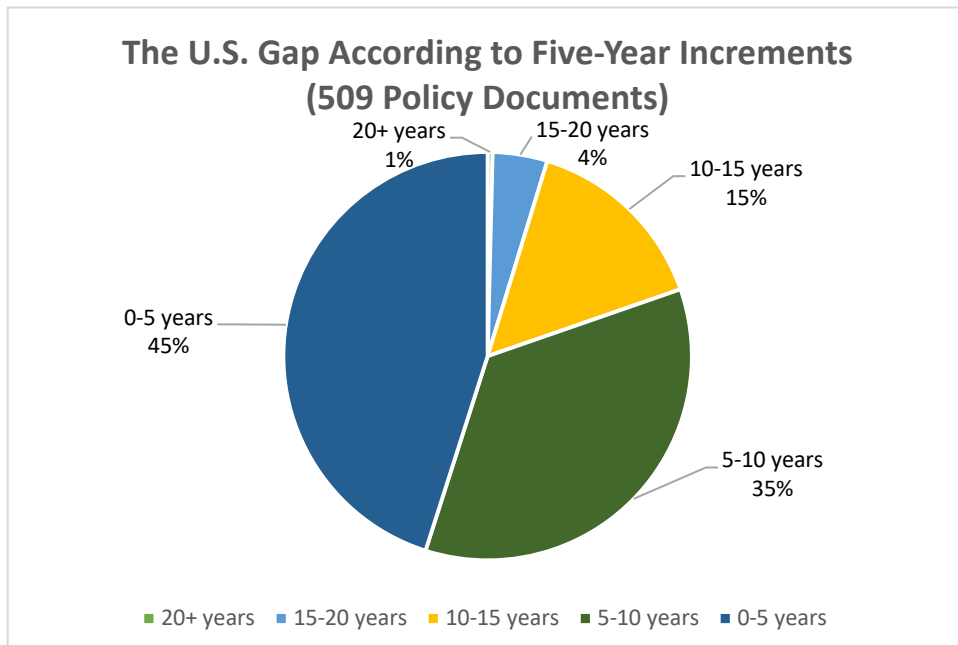
Figure 8. The U.S. gap according to five-year increments (509 policy documents).

In international policy mentions, 27.6% of *Pediatrics* articles were cited between 10 and 20 years after original publication, with the vast majority (71.8%) cited 10 years or less after original publication (**Figure 9**). A total of 34.1% of international policy mentions occurred within 5 years of original publication.
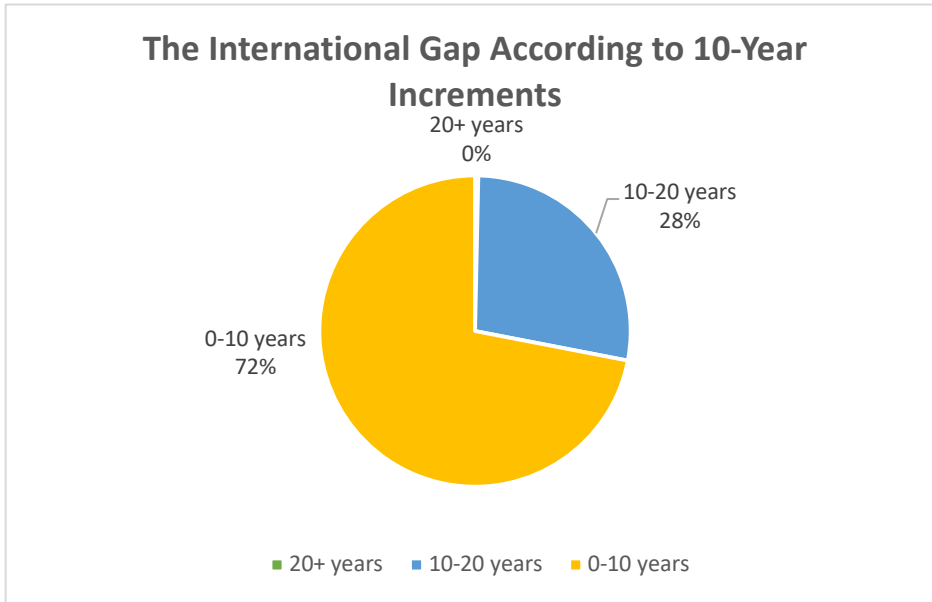
Figure 9. The international gap according to 10-year increments.

When the international gap was further characterized, the most noteworthy difference with U.S. policy mentions is that while the majority of U.S. mentions occurred in policy documents in 5 years or less, this was not the case with international mentions. Most international mentions (37.8%) required 5 to 10 years to make it through the process of knowledge translation (**Table 5, Figure 10**). This is consistent with the finding of slightly longer mean and median uptake times for *Pediatrics* research cited in international policy.

Table 5. The Gap for International Policy According to Five-Year Increments

Time Interval	No. of Policy Documents (*n* = 593)	Percentage (%)
20+ years	2	0.3%
15–20 years	36	6.1%
10–15 years	128	21.6%
5–10 years	**224**	**37.8%**
0–5 years	202	34.1%
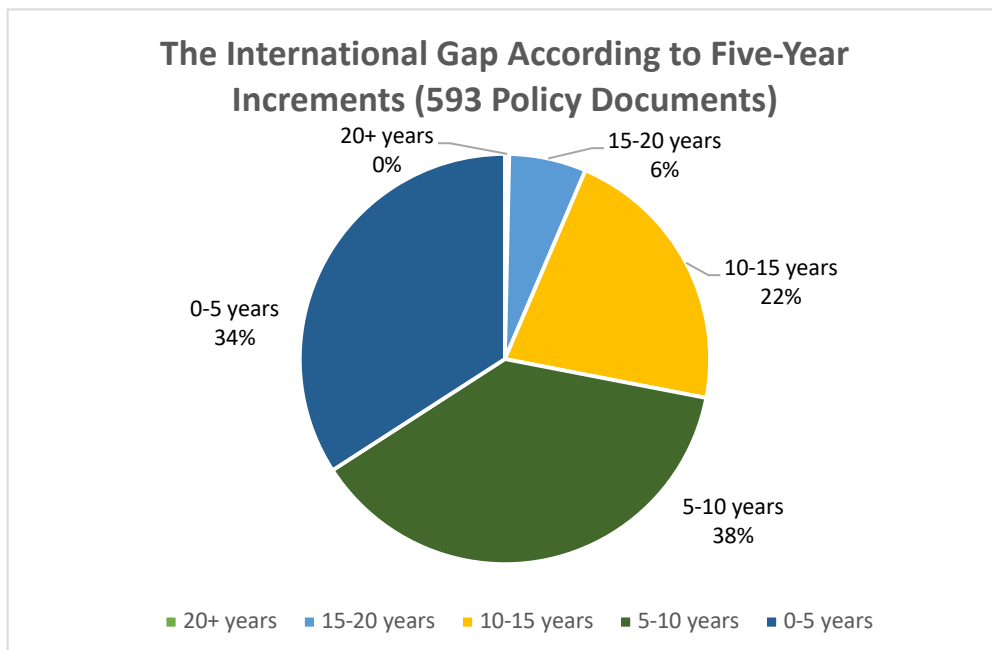
Figure 10. The international gap according to five-year increments (593 policy documents).

It is not known why the research took slightly longer to reach the point of policy uptake in international policy than in U.S. policy.

Qualitative Findings

A total of 22 policymaking bodies cited *Pediatrics* policy, comprising 16 international

organizations and eight U.S. organizations. The international bodies were from the United

Kingdom, the Netherlands, Germany, and Australia and included international government-

funded cooperatives that have memberships of up to 189 countries worldwide (World Bank,

2018). The organizations represented a wide swathe of policymaking bodies around the

globe, from governments to the European Union. The individual organizations that cited

Pediatrics articles in their policy for each sample year are provided in **Table 6**.

Table 6. Policymaking Organizations That Cited *Pediatrics* Research, by Sample Year

Policymaking Organization	2010 Policy	2013 Policy	2016 Policy
The U.S. Centers for Disease Control and Prevention	X	X	X
The World Health Organization	X	X	X
The Government of the United Kingdom	X	X	X
The United Kingdom National Institute for Health and Care Excellence	X	X	X
The Australian Government	X	X	X
The United States Preventive Services Task Force		X	X
The National Government for the Netherlands	X	X	X
The Scottish Intercollegiate Guidelines Network	X	X	X
The National Academies Press	X	X	X
The World Bank	X	X	X
The Association of the Scientific Medical Societies in Germany	X	X	X
The Mental Health Foundation		X	X
The United Kingdom Parliament			X
The European Union			X
The European Food Safety Authority	X	X	
The American Speech-Language-Hearing Association		X	
The Food and Agriculture Organization of the United Nations			X
Overheid, An Initiative of the Ministry of the Interior and Kingdom Relations in the Netherlands		X	X
The World Economic Forum			X
The Inter-American Development Bank			X
The National Bureau of Economic Research	X	X	X
The Brookings Institute	X	X	

The organizations were coded according to their location, type, and funding sources and were ultimately classified as belonging to one of nine subcategories. The resultant subcategorization structure is presented in **Table 7**.

Table 7. Finalized Clusters of Policymaking Organizations for Coding Purposes

Subcategory	Policymaking Organization
International government	The Government of the United Kingdom The United Kingdom Parliament The United Kingdom National Institute for Health and Care Excellence The Australian Government The National Government for the Netherlands Overheid, An Initiative of the Ministry of the Interior and Kingdom Relations in the Netherlands
U.S. government	The U.S. Centers for Disease Control and Prevention The United States Preventive Services Task Force
Agency of the United Nations	The World Health Organization The Food and Agriculture Organization of the United Nations
International organization	The European Union The European Food Safety Authority The Association of the Scientific Medical Societies in Germany
International government-funded organization	The Scottish Intercollegiate Guidelines Network
Charter of the U.S. government	The National Academies Press
International government-funded banking cooperative	The World Bank The Inter-American Development Bank
International nonprofit organization	The Mental Health Foundation The World Economic Forum
U.S. nonprofit organization	The American Speech-Language-Hearing Association The National Bureau of Economic Research The Brookings Institute

The number of *Pediatrics* mentions in policy created by each subcategory was tallied, and the results appear in **Figure 11**. Since there were so few mentions for nonprofit organizations, the U.S. and international nonprofit organizations were combined for the purposes of visual presentation.
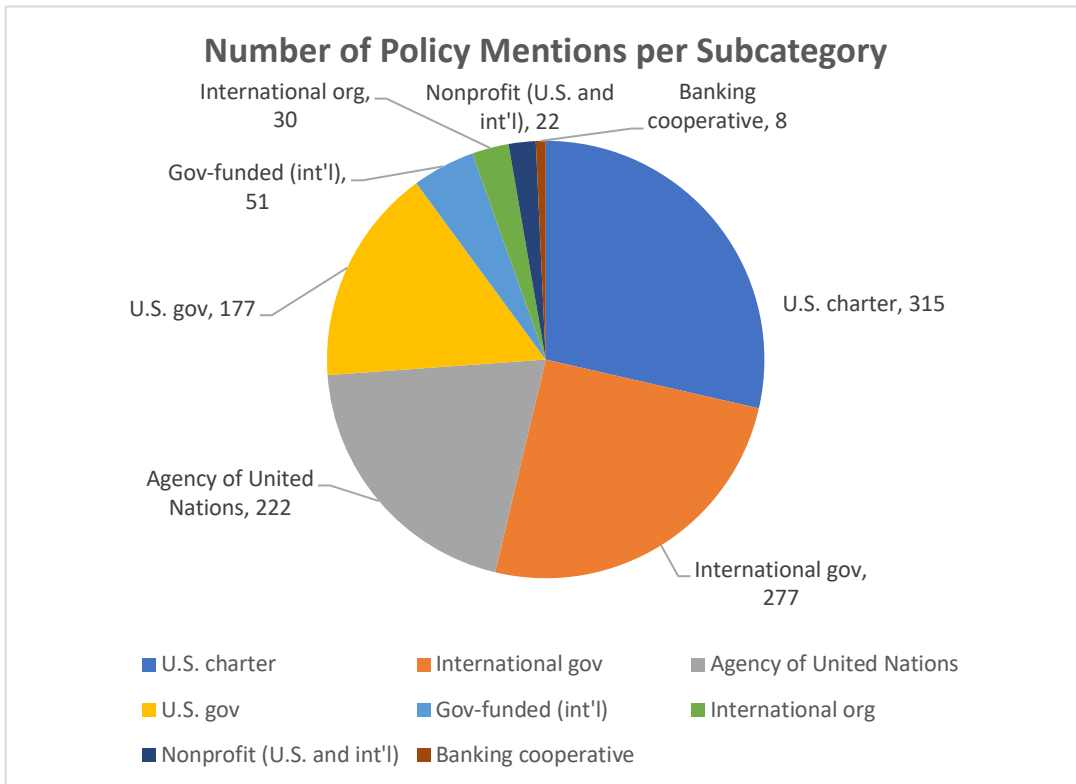
Figure 11. The number of *Pediatrics* policy mentions released by each policymaking subcategory.

The most mentions came from organizations chartered by the U.S. government, followed by international governments and agencies of the United Nations. With only one organization in the U.S. charter category, this means that one single body (the National Academies Press) was responsible for more mentions than any other category (315 mentions). The National Academies Press was created by a U.S. Congressional charter to advise the federal government on matters of national importance and urgency, regarding questions of health policy, science, and technology (The National Academies Press, 2018)—so it is a highly active policymaking organization.

The international governments that used *Pediatrics* research in their policy included the United Kingdom government and Parliament, the National Government for the Netherlands, and the Australian government. The fewest mentions came from the international government-funded banking cooperatives and the nonprofit organizations, both in the United States and abroad.

The mean and median knowledge translation gap for each subcategory appear in **Figure 12**. Interestingly, the international government-funded banking cooperatives had the shortest knowledge translation gap of the nine subcategories, at 4.0 years. International nongovernment organizations had the second shortest gap at 5.9 years, with international government-funded organizations having the longest gap, at 8.7 years. However, the mean and median gap across all subcategories were still notably under 10 years for all organization types (**Figure 12**).
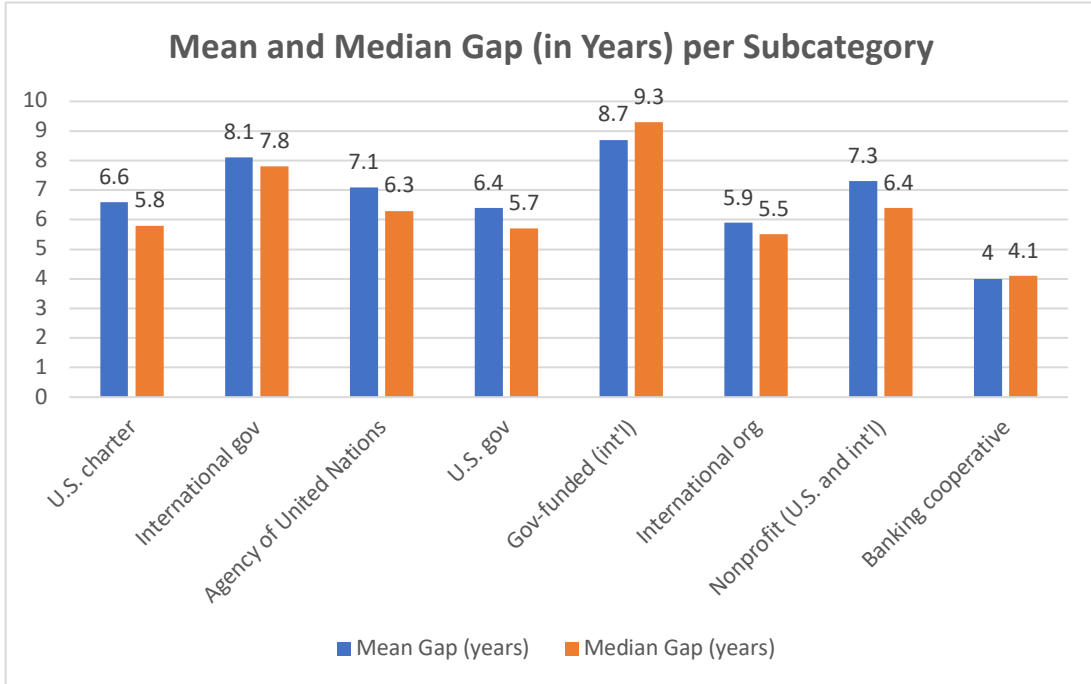
Figure 12. The mean and median gap for each policymaking subcategory. Of note, all values are under 10 years.

CHAPTER 5

DISCUSSION

Answering the Research Questions

Research Question 1: What is the specific knowledge translation gap between original research publication in the journal Pediatrics *and its eventual uptake in policy?*

The data in this study were analyzed a number of ways, and the overall (combined) gap for *Pediatrics* research moving through the knowledge translation model was under 10 years from every analytical angle, with a mean gap of 7.1 years and a median gap of 6.5 years. The gap for *Pediatrics* research therefore came in at significantly less than one-half of the 17-year average reported in the literature for each sample year. This was an unexpected finding, since the literature provided a clear expectation of a gap of up to 20 years, and sometimes more (Green, Ottoson, García, & Hiatt, 2009; Clancy, Glied, & Lurie, 2012; U.S. Department for Health & Human Services, 2001; Dingfelder & Mandell, 2011). The methods previously used to define the gap were not reported, however, so it is difficult to pinpoint what evidence was used to arrive at these earlier estimates, and how it was used. In my study, it is noteworthy that only 0.4% of *Pediatrics* articles were cited in policy 20 years or more after the time of original publication.

Since median values can sometimes provide a better measure of central tendency than the mean, as they are less influenced by outliers such as the 0.4% that occurred in my study, I included median values in my analysis to reduce the sensitivity to outliers and to be able to characterize the gap as fully and as accurately as possible. This is another reason I stratified the gap according to 5- and 10-year intervals, to be able to pinpoint and describe it more

carefully, instead of relying on general, "umbrella" findings alone, and the pitfalls that accompany them. It is worth noting that the 20-year knowledge translation gap described in the literature wound up representing only a handful of outliers in my Altmetric analysis.

Research Question 2: Is this knowledge translation gap the same between sample years of policy, or is it variable?

Whether looking at mean or median values, the gap for the sample years of 2010, 2013, and 2016 was surprisingly uniform. The only variance was from median values of 5.3 to 7.0 years and from mean values of 6.0 to 7.6 years across the three data sets. Given the fact that the cumulative range totaled 0 to 32.8 years, the small variance between mean and median values across sample years was surprisingly slim. The relative consistency across values and analytical angles implies that there are mechanisms in place that affect and perpetuate the gap, outside of any sample-based considerations. I discuss these potential mechanisms and other contributing factors later in this chapter.

Research Question 3: Are there differences or no differences in this gap among the various policymaking organizations that use Pediatrics *research evidence?*

Although there were more international mentions than U.S. mentions, and although U.S. mentions appeared more quickly than the international mentions did on the whole, there were no drastically different findings among the gaps between the different categorizations. Even when the gap for various policymaking subcategories was probed for differences between groups, **Figure 12** demonstrates that the mean and median gap were largely consistent between policymaking bodies, with all cumulative results coming in under 10

years and most residing between 5 and 10 years. The international government-funded

banking cooperatives were admittedly an outlier at 4.0 years. However, this was also

coincidentally the group with the fewest mentions, so these data may be not be a true

reflection of this category, had there been more mentions available for analysis. Either way,

it is remarkable that nearly half of all *Pediatrics* articles were cited in U.S. policy within 5 years

of original publication.

Immediate Implications

Since the knowledge translation gap in pediatrics turned out to be quite different than the

gap reported in the literature, I had to take a step back from the data and ask, "What does

this mean?" and "How did this happen?" Since there were no specific methods discussed in

previous reports for me to compare against my own, I had to instead consider what may

have changed since these prior analyses of the gap were performed, to surmise what could

have reduced the gap so drastically. I also had to take into account that previous reports

were not pediatric in focus, but were general estimates in biomedicine. In the end, I was able

to identify several possible contributing factors.

First, it seems likely that the online environment in which biomedical articles are now

published and exchanged may allow policy and practitioner uptake to occur more rapidly

than was possible prior to the advent of electronic publishing—particularly regarding the

early online release of research articles, before they appear in print. The enhanced online

connectivity of researchers, policymakers, and practitioners, as well as the accessibility and

searchability of articles being made available online today, may significantly reduce the

amount of time it takes for research to make it through the knowledge translation process.

The fact that eight of the original policy mentions pulled from the database were cited *before* publication of the original article would appear to point toward this explanation. While there is no way to assert this definitively, it may play a part.

Second, the results would seem to indicate that the knowledge digestion activities of brokers in health communications—in this case, the brokers involved with the journal *Pediatrics* at the American Academy of Pediatrics—*do* help facilitate the uptake of critical research evidence into policy and practice. For example, when reviewing their research presentation practices, I found that *Pediatrics* takes the extra step of publishing a brief summary with each research article, detailing "what is already known" on the subject and "what the research study adds" to the knowledge base. This reporting practice began in 2009, in an effort to help practitioners and policymakers identify the most important findings presented in each article. In the future, it would be an interesting line of study to determine what the gap for *Pediatrics* looked like, before and after this policy-friendly reporting practice was adopted in 2009.

Research dissemination is not a single or a simple process, and much effort has gone into improving it (UNICEF, 2008). Over the past 10 to 15 years, there has been increasing international attention placed on how to reduce the gap between evidence, policy, and practice (Grimshaw et al, 2012). Indeed, the direct form of summarization adopted by the journal *Pediatrics* succinctly fulfills the needs and requests of policymakers and practitioners, who have been clamoring since the early 2000s for research results that are spelled out for them in plain language (Feldman et al, 2001; Sorian & Baugh, 2002). For this reason, and as evidenced by the expedited process of knowledge translation uncovered in my study, it can be inferred that taking the extra step of "translating" research findings for policymakers and

practitioners really can have a direct and marked impact on the know-do gap. If the brokerage effects in this field were ineffectual, then this would be reflected in the data. However, since the overall gap of 7.1 years for *Pediatrics* research constitutes a fraction of the gap reported for the biomedical literature, it would seem that the journal *Pediatrics* may be doing something right—and can potentially serve as an example of how successful brokerage activities can help narrow the know-do gap in medicine.

Another potential implication is that the methods used to calculate the gap in previous studies are now out of step with current communication practices—particularly electronic publishing and the release of research articles online, ahead of print. It is possible that previous calculations of the biomedical research-practice gap were undertaken prior to the advent of the electronic platform that has now subsumed scientific reporting, and that the gap has metamorphosed in a relatively short amount of time. This metamorphosis may in turn radically change the role and applicability of methods such as traditional citation analysis in tracking the impact of research evidence going forward; new methods may be needed to help define and understand the gap as it stands today. Now that revolutionary tracking resources such as altmetrics are becoming available, it may be possible to redefine the gap more accurately and quickly than before, across and between subspecialties in medicine (Wouters & Costas, 2012; Bornmann, 2014; Citrome, 2015).

Perhaps most importantly, the results would seem to suggest that the requests policymakers and practitioners make for the thoughtful presentation and digestion of research evidence *do* have a direct impact on the uptake of research for policy and practice. Based on the substantial number of *Pediatrics* articles that were cited in policy up to 5 years after

publication (39.2%)—which is less than one-third of the 17-year gap cited in the literature (Green, Ottoson, García, & Hiatt, 2009)—it appears that these reporting practices can have a positive effect on uptake times. Indeed, Huston (2008) maintains that research is the most likely to get attention when it *informs* realistic policy actions. In this way, well-translated synthesis activities can help policymakers see clear links between research findings and policymaking solutions by distilling out unnecessary "noise."

Finally, the longest uptake times after original publication in my study were 32.8 years, 26.9 years, and 25.0 years. All other policy mentions occurred less than 25 years after original publication, and most came in significantly under this. Outliers such as these may reflect the phenomenon that in some cases, the research may need time to mature, with extreme cases being called "sleeping beauties"—articles that can remain uncited for decades, before their worth is discovered (Rasmussen & Andersen, 2013; Van Raan, 2004). Further analysis would be required to determine whether this was the case here.

This last finding also illustrates the fact that just because a study is more than a few years old does not mean that it is not relevant or does not have a place in policymaking decisions being made today. As shown here, some studies may add value even many years after their original publication. This fact alone should give biomedical researchers hope that their findings may yet have value and may still contribute to improved patient outcomes, even if their research takes time to incorporate into the knowledge base. It was beyond the scope of this study to discern whether different study types have different uptake times, but this would be an interesting avenue of study for future evaluation.

Broader Implications for Technical Communicators

Research does and should influence policy (Clancy, Glied, & Lurie, 2012). However, much emphasis is often placed on generating and funding research, while less emphasis is placed on informing the real-world solutions that research can help provide. This is unwise, as Lewis (2007) states that "unassembled" research findings almost never address the broad dilemmas that confront clinicians and policymakers. In the same vein, Feldman et al (2001) demonstrated a mismatch between the needs of policymakers and the activities of researchers and explained that researchers, funders, and others who hope to maximize the use of research information must recognize this reality. The more this "mismatch" can be addressed and rectified—especially by the dedicated efforts of knowledge brokers (technical communicators)—the more useful research findings will become in the world of policy and practice.

Knowledge brokers know that the creation of research that is ignored by policymakers and practitioners results from not understanding good dissemination practice. There can be a lack of motivation on the part of researchers to translate their findings into policy-relevant terms and disseminate them, as well as a lack of resources to support these efforts (Clancy, Glied, & Lurie, 2012). This is where the value of the knowledge broker truly lies. Policymakers and practitioners have to be convinced that a proposed intervention will work in the real world and not only in a laboratory or an academic environment. Knowledge brokers can not only identify the needs of policymakers and practitioners, but they can work with researchers to make sure that these needs are met. Indeed, knowledge brokers may be the key players in ultimately reducing the know-do gap in biomedical reporting.

Many argue that researchers have an obligation to get involved in policy development; in fact, the ethics guidelines of the American College of Epidemiology call on epidemiologists to "report research findings in a timely, understandable, and responsible manner so that the widest possible community stands to benefit" (Brownson, Royer, Ewing, & McBride, 2006). Because scientific knowledge changes over time—particularly in biomedicine—forward advancement requires critical interpretation of empirical findings, evolution of qualitative and quantitative synthesis methods, and improvement in research practice and reporting (Anderson et al, 2005). In this setting, knowledge exchange is the new frontier of bringing research to policy and practice (World Health Organization, 2004), and technical communicators serve on the front lines.

Policymakers emphatically want information that is presented simply, with clear graphics and findings, that can be used without alteration (Feldman, Nadash, & Gursen, 2001), and knowledge brokers can help provide this. Additionally, policymakers have an immediacy in their need for information (Greenlick, Goldberg, Lopes, & Tallon, 2005), which knowledge brokers should be sensitive to in their dissemination efforts. Products that meet these requirements are valued and are actually used (Feldman, Nadash, & Gursen, 2001).

Most importantly, to make their work more usable and understandable, researchers must help facilitate the application of their results in policy actions and practice. Knowledge brokers can assist researchers in this capacity. Effective communication can speed up the use of research findings in practice (World Health Organization, 2004), so it is critical that researchers communicate their findings clearly to be able to translate health services research

into policy (Greenlick, Goldberg, Lopes, & Tallon, 2005). It is the role of the knowledge broker to ensure that this happens effectively and expediently.

Simply producing rigorous and precise results about an important problem is not enough for a piece of research to have a broader impact (Clancy et al, 2012). Dissemination events need to be tailored to the target audience and evaluated (Sorian & Baugh, 2002), and a combination of dissemination methods should be used to share research summaries (UNICEF, 2008). This is the specialty of the technical communicator. Within biomedical communications, research on ways to improve knowledge transfer and access in health systems should be a priority and should address the major barriers of language skills, financial constraints, and quality of scientific publications (World Health Organization, 2004). Ultimately, what the results of this study may prove is that policymakers are more likely to use research if its implications for policy are clearly spelled out for them, as is being done in the journal *Pediatrics*. When research is made *accessible* to policymakers, it results in expedient and meaningful policy development—and in this scenario, everyone wins.

Successful Brokering Efforts

The markedly reduced gap for the research published in the journal *Pediatrics* would seem to indicate that *Pediatrics* is successfully digesting its research content for effective policy and practitioner uptake, and this is likely expedited by the release and exchange of research findings via the electronic environment. It is apparent from the presentation of their research reporting methods that a concerted effort is being made to highlight and disseminate their findings with the policymaker and end user in mind. In other words, they are demonstrating their responsiveness to the needs of policymakers and practitioners by

adjusting their reporting practices over time. This is especially needed in the field of pediatrics because pediatricians are generalists who represent a patient population that has much less agency than others; therefore, they often intersect with public health in ways that no other subspecialty in medicine does. Within the efforts knowledge brokers are making to close the know-do gap in biomedicine, much can be learned from the approach of *Pediatrics* to knowledge translation and dissemination.

Organizations cited as being effective information brokers are those that see good dissemination as the product of sound data and are able to dedicate money and staff for the purposes of information synthesis, translation, and dissemination (Feldman, Nadash, & Gursen, 2001). Academic journals are increasingly taking an active role in the translation of the research that they publish (Thoma, Mohindra, Artz, & Chan, 2015). For instance, it is becoming widely acknowledged that every journal article should be accompanied by a single-page policy piece that states the implications of the research in language that laypeople can understand (Greenlick, Goldberg, Lopes, & Tallon, 2005; Sorian & Baugh, 2002).

In 2017, a longitudinal study of pediatricians showed that they prioritize staying up to date on the latest medical knowledge. They often catch up on work at home, and they stay apprised on how the debate over health care policy affects their patients and their practice (American Academy of Pediatrics, 2017). This may be attributed to some degree by the fact that as part of their bridging efforts, the American Academy of Pediatrics organizes more than 28 national committees, 52 sections, 13 councils, and 66 chapters in both the United States and Canada to help mobilize members and get them involved with children's health care initiatives at all levels of the knowledge translation process (American Academy of

Pediatrics, 2018). Their active brokerage efforts almost certainly affect the level of interest and involvement reflected in their constituency, which contributes to increased participation in a more circular and effective knowledge translation model.

Indeed, through policymaking efforts, educational programming and resources, advocacy for children's health initiatives, and the active translation of policy and education into practice, these activities involve the interaction of practitioners and researchers, coming together to solve health problems. In other words, what the current findings may truly show is what is possible and attainable if knowledge brokers embrace the principles of a nonlinear, circular knowledge translation system and use it to bring members on both sides of the gap together to enact solutions. What the results of my study unwittingly revealed is, effectively, a success story.

What Technical Communicators Can Do

Going forward, a strong emphasis should be placed on improving the linkages between researchers and policymakers—including the need for developing a network of knowledge brokers and other intermediaries to support decision making for policy and practice (World Health Organization, 2004). Science must help to *improve* health systems, and not merely be conducted for its own sake. Research should not only be a "quest for understanding"—it should also involve considerations of use (Huston, 2008), and its findings should be bundled with policymaking and practitioner needs in mind. The overall gap of 7.1 years for the research published in the journal *Pediatrics* embodies the successful results of these efforts.

While scientific knowledge *can* be used to inform the creation and implementation of policies and practice decisions, undigested information is unlikely to have any effect. As such, communications efforts must be directed toward bridging the professional, cultural, and linguistic divide between researchers, policymakers, and practitioners. Bringing researchers and policymakers together can help to make researchers' work more relevant by exposing researchers to real-world problems to which their skills and insights can be applied. To integrate new evidence into practice, researchers and practitioners must work together (Olswang & Prelock, 2015), and knowledge brokers can make this happen by facilitating communication in both directions. After all, biomedical discoveries cannot improve people's health without discerning how they may be applied within diverse populations, health systems, and political and social contexts (World Health Organization, 2004). This is the bread and butter of the technical communicator.

Initiatives created specifically to facilitate high-quality knowledge translation and dissemination include journals, conferences, podcasts, systematic reviews, and evidence-based clinical practice guidelines. Additionally, professional communicators may rely on policy briefs, reports, newsletters, one-on-one communications, academic journals, meetings, Web content, and other methods to facilitate the digestion of research (Feldman, Nadash, & Gursen, 2001). New structures and means of translating knowledge into effective interventions should also be identified. For instance, more research syntheses should be undertaken on health problems with the highest global burden (World Health Organization, 2004), as well as determining what brokerage efforts are needed to alleviate these pain points. The care of children most definitely falls into this category.

Because science tends to be compartmentalized, with each subspecialty possessing its own culture, language, and funding streams, it is a worthwhile endeavor to obtain a current snapshot of the knowledge translation gap within each individual subspecialty in biomedicine. I hope this study serves as an example of what kinds of insights may be revealed by doing so. I would encourage other technical communicators to conduct similar studies, to determine what the current gap looks like in their own subspecialties. Since children are a medically and ethically unique and habitually underserved constituency, discovering what the know-do gap in pediatrics actually looks like, instead of what may be surmised in a general way from the literature, can only help to drill down the enormous efforts currently underway on national, international, and local levels, to expedite the uptake of valuable pediatrics research. Studies like this one should be undertaken to evaluate the uptake for other pediatric journals and content, as well, to determine if the findings here are representative of the entire field, or only of this journal. If it is discovered that the gap for *Pediatrics* research is significantly less than that for other pediatric research outlets, then perhaps other organizations and brokerages can learn from what the American Academy of Pediatrics is doing successfully.

At the end of the day, knowledge is not a commodity—it does not effortlessly flow down a linear gradient, from researchers to decision makers, like a swiftly flowing stream. Efforts must be made on the part of all stakeholders to usher the knowledge forward. If we relate knowledge to the interplay of a soccer game, knowledge is *not* the soccer ball; rather, it is what goes on *between the players*—those who share a belief and a common purpose of moving the ball into the goal (World Health Organization, 2004). Therefore, what each player is doing on the field is critical to the unfolding of the game. To improve the uptake of evidence

in policy and practice, developing better ongoing interaction between the players—the evidence providers, the evidence users, and the technical communicators who facilitate passing the ball—is the way forward (UNICEF, 2008).

Limitations

This study had a few limitations. It is likely that more countries cited *Pediatrics* research in their policy than were actually identified by the Altmetric search. Because the Altmetric platform continues to evolve, it is probable that health policies released by additional countries will be tracked in the Altmetric database in the future. This would have the added benefit of generating greater numbers of mentions for analysis. Since three years' worth of policy were selected for evaluation in this study, it is also possible that sampling additional years could alter the current findings; however, this seems unlikely, since the gap was essentially so consistent across the board. There may be other types of policymaking organizations that were not tracked with this database to date, as well, which may be added to the Altmetric database in the future. Additionally, it is not known whether other research outlets in pediatrics would see the same knowledge translation gap for their materials as the journal *Pediatrics* does—it is possible that their research reporting practices are different, and may yield different results. Further study would be required to determine if this is the case. A final limitation is that this study did not include an analysis of how *Pediatrics* articles were used in each individual policy documents. This might provide a fruitful avenue for further study, as well.

Conclusion

At 7.1 years, the mean gap between what is known from research published in the journal *Pediatrics* and what is actually being used is significantly less than what has been reported in the literature to date. This is welcome news. Furthermore, the alternative impact measures of the Altmetric platform made this analysis possible and may allow additional and more comprehensive analyses to be conducted, to find out how knowledge brokers are really doing in their efforts to narrow the gap in medicine. Going forward, given the huge potential to save the lives of millions of children and improve the health of many more, implementing critical knowledge brokerage efforts to promote the use of evidence-based interventions should be a priority for researchers, policymakers, practitioners, and society in general. Members on both sides of the "know-do divide" see great potential for improved communication, which will lead to better uses of research information (Feldman, Nadash, & Gursen, 2001)—and technical communicators can help make this happen. For children and families everywhere, it could make all the difference.

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