The Likely Impact of Congenital Zika Syndrome on Families: Considerations for Family Supports and Services

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abstract Congenital Zika virus infection has obvious implications for infants, and considerable research has addressed the nature and consequences of congenital Zika syndrome (CZS). Children with classic CZS meet the criteria for “children with medical complexity,” and ongoing research is required to understand the range of needs and optimal treatment options. Far less attention has been given to the consequences of CZS for families, which are both immediate and lifelong. Although families of children with CZS have much in common with families of other children with disabilities, at least 4 features of CZS have special family implications: (1) the severity of the impact on children with obvious abnormalities at birth, coupled with the anticipation of a lifetime of caregiving and economic burdens; (2) uncertainty about the unfolding consequences, both for obviously affected children and for exposed children with no symptoms at birth; (3) a lack of specialized professional knowledge about the course of the disease or treatment options; and (4) social isolation, a lack of social or community supports, and potential stigma. Supporting families will require a family-centered approach to services, extensive care coordination, access to evolving new information, ongoing surveillance, formal and informal supports, and individualized child and family services.

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Initial reports in 2015 of the relationship between Zika virus (ZIKV) infection during pregnancy and microcephaly and other birth defects in newborns led to an unprecedented and rapid worldwide response. As reported by the U.S. Centers for Disease Control and Prevention, a number of notable public health achievements occurred in the ensuing 12 months, including (1) travel guidance for pregnant women; (2) clinical guidelines for the care of women and children; (3) documentation of sexual contact as a source of transmission and the persistence of ZIKV in semen; (4) policies to ensure the safety of blood supplies; (5) laboratory procedures, kits, and reagents to diagnose infection; (6) verification of a causal link between in utero exposure and birth defects; (7) surveillance protocols to determine the relationship between exposure and outcomes; (8) enhanced access to contraception methods; (9) aggressive vector control strategies; and (10) evidence of possible risk for Guillain-Barré syndrome in adults.¹ Research continues to be conducted on each of these fronts, with the primary goals of understanding the pathways by which ZIKV is transmitted and causes birth defects, controlling and eradicating mosquitoes, and developing vaccines to prevent infection.

Remarkably, none of these achievements addressed the needs of families who have a child with congenital Zika syndrome (CZS), the term used to characterize the continuum of consequences of prenatal ZIKV exposure for infants.² Families who have a child with CZS face an immediate set of demands for specialized caregiving and an anticipated lifelong responsibility. The cumulative burden of other factors such as the economic impact, stigmatism, marital strain, limited spouse and family support, uncertain future outcomes for children, and

lack of access to information or appropriate health care will add further strain to parents or other caregivers trying to cope with a child with a significant disability. The long-term needs of families and the ultimate societal burden are not yet known, but the human impact is large and will endure for a generation or more. Identifying and addressing the risk and protective factors associated with infant development and family well-being are critical for understanding and maximizing family adaptation.

IMPLICATIONS OF CZS FOR FAMILIES

All families raising a child with an intellectual or developmental disability face substantial challenges, among which are included expanded caregiving responsibilities, the need to find and access specialized support services, social isolation, economic burden, concern about the future, and adverse physical and mental health outcomes, all of which can compromise individual and family quality of life.^{3,4} In many ways, families of children with CZS will face these same challenges, but 4 features of CZS will almost certainly have special implications: (1) the medical complexity and severity of the impact on children with obvious abnormalities at birth, coupled with the anticipation of a lifetime of caregiving and economic burdens; (2) uncertainty about the unfolding consequences of CZS for obviously affected children, as well as for children with no symptoms at birth; (3) limited specialized professional knowledge about the course of the disease and treatment options; and (4) social isolation, a lack of social or community supports, and potential stigma. The cumulative impact of these and other factors could include elevated stress, anxiety, and depression, with the potential for adverse effects on well-being and quality of life, factors that

must be considered in providing comprehensive child and family services.

Medical Complexity and Lifelong Severity of Impact

The authors of a recent review concluded that CZS, at least in children with obvious symptoms at birth, differs from other congenital infections, with 5 distinct features: (1) “severe microcephaly with partially collapsed skull; (2) thin cerebral cortices with subcortical calcifications; (3) macular scarring and focal pigmentary retinal mottling; (4) congenital contractures; and (5) marked early hypertonia and symptoms of extrapyramidal involvement.”⁵ Infants with these characteristics of classic CZS will almost certainly have severe or profound cognitive and motor impairments. Other medical and developmental outcomes are becoming clear, involving multiple systems and including seizures, hydrocephaly, dysphagia, vision and hearing impairments, and sleep problems.^{6–8}

Longitudinal surveillance and natural history studies are needed to understand the full range of time-varying effects of CZS on outcomes such as growth, neurologic sequelae, cognitive and functional impairment, vision, hearing, motor development, communication, and social skills. We do not know whether or how many children will be able to walk, speak, use the toilet independently, or perform a range of other adaptive daily living skills. But even without such studies, it is safe to say that most children with CZS signs or symptoms at birth will have major impairments in comparison with typically developing children that will not be easily treated by surgery, medication, or therapy services. As “children with medical complexity,” infants and children with CZS will have substantial health care needs, severe chronic impairments, major

functional limitations, and a high need for coordinated care.^{9,10} Their families will face a lifetime of caregiving responsibility and the resulting direct and indirect economic burdens (eg, see Bailey et al¹¹ and Ouyang et al¹²). To address the multisystem involvement and functional limitations, they will require services from a variety of disciplines,¹³ including pediatric neurology, neurosurgery, ophthalmology, audiology, speech and hearing sciences, physical therapy, occupational therapy, special education, psychology, and social work.

Ideally, a service coordinator and a transdisciplinary team would serve as the central coordinating point for families. Those within disciplinary care organizations in some communities have demonstrated effective models for integrating medical and behavioral health services, often using a nurse or social worker as a care manager to serve as both the intermediary and the coordinator of services (eg, see Mastal et al¹⁴). But such services are not available in many communities, and the reality is that most families will need to play a major role in finding services, integrating information across multiple providers, and taking on professional roles in providing care throughout the day.¹⁰

Uncertainty About the Unfolding Consequences of CZS

Although we know much more about the consequences of ZIKV infection in pregnancy than we did even a year ago, much remains to be learned.⁶ The lack of longitudinal research means that neither the families of infants with obvious birth defects nor the professionals who serve them will be able to predict outcomes. The life expectancy of children with CZS is unknown, although the authors of initial reports suggest a fatality rate in Brazil as high as 8% to 10%

in the early years.¹⁵ The extent to which this rate is due to a lack of services in certain areas of Brazil or whether this rate would be expected in other countries is unknown, but clearly the risk for infant death is a reality about which families will be greatly concerned. Caregivers will be living in a constant state of uncertainty about the emergence of new symptoms (such as seizures), their child's future life, the possible death of their child, and their own lives as parents.

But only a small subset of infants exposed to prenatal ZIKV infection have obvious abnormalities at birth. For some families, unfortunately, the relief will be short-lived, because some exposed infants will rapidly begin to display abnormalities during the first months of life, as a result of continued ZIKV replication in the brain after birth.¹⁶ For example, the authors of a study of 13 infants with prenatal ZIKV infection without microcephaly at birth showed that all had brain abnormalities consistent with CZS.¹⁷ Surprisingly, head growth decelerated after birth, and by 5 months, 11 had microcephaly. The authors of another study reported ocular and neurologic findings in the absence of microcephaly in a 6-day-old infant.¹⁸

But the evidence to date suggests that most infants exposed to prenatal ZIKV infection will develop few, if any, obvious symptoms during the first year or 2 of life. A large unknown factor is the extent to which they are at risk for later-onset developmental delays, behavior problems, or other subtle impairments (eg, attention-deficit disorder, hyperactivity, learning disabilities). Only through large, longitudinal population cohort studies will it be possible to determine the full relationship between exposure and outcomes and identify factors (eg, genetics, environmental exposures) that contribute to variability in outcomes.¹⁹

The uncertainty that many parents inevitably will experience is analogous to the experience of those described as "patients in waiting,"^{20,21} who are individuals with a diagnosis or risk factor that places them in a position of vulnerability, requiring ongoing surveillance to determine when and if symptoms will appear. For some parents, knowledge of prenatal ZIKV exposure could result in over-attribution of causality, prompting questions as to whether any health problem that emerges over time is the result of early ZIKV exposure or whether it is simply a normal pattern of illness. Furthermore, the fact that most people do not even know if they have had a ZIKV infection suggests that elevated anxiety may be possible for other women living in high-risk geographical regions. If they have children with mild learning or behavior problems, they may wonder whether they were unknowingly infected during pregnancy.

Limited Professional Knowledge and Services

Families of children with developmental disabilities in the United States and around the world experience challenges with limited health care and therapy services²² and often are in the position of having to advocate for more or more appropriate services for their children.²³ But in the case of CZS, most professionals will not have previous experience on which to draw. The Centers for Disease Control and Prevention, the American Academy of Pediatrics, and other professional associations have provided limited guidance for clinicians,^{24–26} but this guidance continues to be updated, reflecting the rapidly changing knowledge base. Many parents will understandably be frustrated with the lack of knowledge and expertise, and some will find themselves traveling long distances to find a specialty clinic.

SOCIAL CONSEQUENCES OF CZS

The experience of raising any child with a disability can result in social isolation for families. Caregiving demands limit opportunities for normal social experiences for parents; family and other support systems may not be present; and, in the case of rare diseases, parents have limited opportunities to meet other families of a child with the same disorder. These factors will be true for CZS but could be further exacerbated by the likely transient nature of the CZS epidemic, which almost certainly will have limited impact within a 2- to 3-year period, as a result of natural immunity, vaccine development, and vector control. Parents could find themselves part of a small group of families caught in a unique moment in time, unlucky enough to become pregnant during the years of greatest risk. And some parents may experience real or perceived stigma. It would be easy to imagine a situation in which a parent was judged or felt guilty about possibly not having done enough to protect themselves against mosquito bites during pregnancy.

Recent reviews make it clear that stress is a pervasive problem for almost all families of children with intellectual and developmental disabilities.^{27,28} Families of children with medical complexity, such as is the case of children with classic CZS, are at even greater risk for extreme levels of stress and caregiving burdens.¹⁰ The cumulative effect of these and other factors creates elevated risk for a variety of adverse mental health outcomes for families (anxiety, depression, stress, anger, and fatigue), all of which can affect parents' emotional well-being and ultimately have a debilitating effect on hope, optimism, physical health, and quality of life.

SUPPORTING FAMILIES AFFECTED BY CZS

Health care and allied health professionals will naturally and appropriately focus initial attention on the medical, therapeutic, and other treatment needs of children with CZS. But attending to family needs, priorities, and concerns will be of equal importance. A family-centered approach in the context of a medical home is the standard of care for all children, and the following principles and practices underlying these models will be essential for families of children with CZS: (1) viewing families as partners in service planning, (2) focusing on the strengths as well as the needs of children, (3) respecting a family's choices regarding goals and services, (4) facilitating collaboration and the coordination of services, (5) using effective communication strategies, (6) promoting community-based supports, and (6) ultimately providing hope and optimism for families facing a potentially difficult future. Researchers have suggested that the quality of family services not only supports the attainment of positive family outcomes²⁹ but also has a direct relationship with outcomes for children.^{30,31}

All children with classic CZS will be eligible for early intervention in the United States. Pediatricians should immediately refer children to early intervention programs and work with early intervention providers to develop a comprehensive plan of services.

Although there is no ZIKV-specific evidence-based approach to supporting families, we draw on other models of care and research to suggest a framework by which professionals can support families, beginning with a consideration of the goals that will hopefully be achieved. Several years ago, we led an evidence-based process with extensive stakeholder input that resulted in 5 outcomes by which

the effectiveness of services for any family of a child with an intellectual or developmental disability could be evaluated: (1) understanding their child's strengths, abilities, and special needs; (2) knowing their rights and advocating effectively for their child; (3) helping their child develop and learn; (4) having adequate support systems; and (5) being able to gain access to desired services and activities in their community.³² Researchers have suggested that these outcomes can be measured,³³ and their attainment is related to reports of greater family quality of life.³⁴

Using these outcomes as targets for services and family-centered practices as the underlying philosophy, we suggest 4 practice areas to support families living with a child with CZS: (1) providing accurate and understandable information about CZS; (2) using active surveillance to identify emerging needs; (3) enabling access to formal support services and informal support systems; and (4) providing both general and targeted interventions as needed to support child health, child development, and positive family adaptation.³⁵

Providing Accurate and Understandable Information

Because CZS is a relatively recent phenomenon, information about natural history, likely outcomes, and appropriate treatments will be limited. Many professionals will never have seen or worked with a child with CZS; thus, both families and professionals will face challenges in getting accurate and up-to-date information. This information will likely come from multiple sources. Most families will be using the Internet and social media to learn as much as they can, and, of course, the quality and accuracy of this information will vary considerably. Professionals should help guide parents to relevant and trusted

sources for information, building on parents' interests as well as professional perceptions of the timely importance of new information as it relates to the family's or child's current circumstance. Unfortunately, much of the information likely to appear in the media or in professional literature will be focused on the unfolding nature of problems associated with ZIKV infection. Professionals will need to balance competing desires for simple yet comprehensive information, help maintain hope and optimism in the face of discouraging reports, and help parents access information in their primary language.

Of all the needs expressed by families of children with disabilities, the need for information consistently emerges at the top.³⁶ Families need information to understand their child's special needs, talk knowledgeably with professionals, and find appropriate services. Accurate and useful information can empower families to engage as active and informed participants in partnerships with professionals.

Using Active Surveillance Strategies

Surveillance refers to the systematic and regular use of standardized screening or assessment tools, paired with clinical observations informed by knowledge of the condition and the range of possible secondary complications. Given the limited knowledge about the natural history of ZIKV during the early childhood years, ongoing surveillance of child development, behavior, and health must be a central part of family-centered services. In addition to professional assessments, parent observations and reports will be essential as part of ongoing assessment, providing important information about the functional consequences of CZS and a way to compare standardized clinic assessments with activities of daily living. With their reports, parents can

provide critical information about symptoms, patient characteristics, and overall functioning and well-being.³⁷ These reports are essential for capturing information about functional adaptation and time-varying events, data almost impossible to collect in a clinic-based assessment.

Ideally, surveillance should be informed by clinical practice guidelines, which, in the case of CZS, will be constantly evolving. Hopefully, as recommended protocols evolve, health care professionals can share data so that, in the absence of formal studies, we can begin to build a more robust understanding of the primary and secondary consequences of CZS. Active surveillance can reassure parents that someone is paying attention to their child's well-being, so that services or treatments will start promptly when needed. Engaging parents as active participants in surveillance is another way to empower families and to help ensure that treatments and services are aligned with family goals and priorities.

Enabling Access to Formal Support Services and Informal Support Systems

There is a large and robust literature revealing the value of both formal and informal support in promoting family well-being. From the professional's perspective, the use of family-centered practices is the most important way of providing support, fostering both the feeling and reality of a partnership between families and providers. An essential form of support for families with CZS will be care coordination. The complex needs of many children with CZS will require the involvement of multiple pediatric specialists. Communication among these specialists will be a challenge; families will often be in a situation in which information is not shared among professionals and will thus

need to repeat information or have the same assessments or laboratory tests replicated in different clinics. Electronic medical records will help if families see specialists in systems with coordinated record-keeping systems, but when practices do not share information, families will feel the responsibility of being the "glue" that integrates information from different specialists and perspectives. The primary care provider in the medical home can play an important facilitative role, helping to mobilize resources when necessary and enhancing a sense of a community among professionals working on behalf of the family and child.

Informal support systems will be essential to family well-being, and some researchers have suggested that informal supports are more salient and powerful than formal supports in long-term adaptation.^{30,38} Families of children with CZS may feel isolated, not knowing other families of children with CZS and feeling like they do not "fit in" with family support groups of children with other types of disabilities. Spousal support and support from extended family members, friends, and community organizations such as churches, child care programs, and respite programs will form an important aspect of informal support services. Families will likely have difficulty finding appropriate child care, limiting their own ability for employment or respite. Parent-to-parent support groups can be useful, but if there are relatively few families of affected children in a geographical area, families may be more likely to turn to virtual communities. Professionals can help by connecting families with community resources and providing information about virtual communities.

Families need emotional and functional assistance from a trusted source, and that support can come from both professionals and the community at large. Families who

feel supported by professionals and a social network are more likely to be optimistic about the future and able to cope with the inevitable adversities and uncertainties that come with either having a child with CZS or having experienced a ZIKV infection during pregnancy, which results in uncertain future outcomes for their child.

Providing Individualized Treatments

Children and families will need individualized treatments and services, and an interdisciplinary approach will almost certainly be called for. General interventions to support parenting and family functioning may need to be paired with more intensive services aimed at addressing specific needs. The timely provision of services will be important to maximize prevention and minimize secondary or tertiary consequences for children and families. Ideally, professionals should work to ensure that treatments or recommended practices meet family-identified goals, fit into family routines, and maximize community participation.

Two major areas of targeted interventions have been used to help support families of children with disabilities. The first type builds on the substantial literature in which authors have demonstrated the power of effective parenting, especially maternal responsivity, on the development and behavior of children with intellectual and developmental disabilities (eg, see Warren et al³⁹). The primary focus of these interventions is on enhancing parenting practices and improving responsivity, on the assumption that such programs will have a direct effect on children's development, as well as on the secondary effects on family adaptation, by enhancing confidence in parenting and promoting children's ability to participate in family routines and the activities of daily living.

These programs are time intensive and require substantial family involvement, but for motivated parents, a robust evidence base reveals the efficacy of several parent training models.²⁷

The second area of targeted interventions is built on compelling evidence that stress is almost a universally experienced consequence of having a child with a disability,⁴⁰ especially for parents with children who have high levels of behavior problems or complex medical needs.^{4,9} As such, the primary focus of these interventions is on reducing parent stress and enhancing quality of life. Major approaches include attempts to strengthen informal support networks, parent support groups, counseling to reduce marital strain, coping and stress management skills, and mindfulness training,^{28,41} all of which have been demonstrated to have positive effects for some parents under some circumstances.

The question of whether 1 approach is preferable to another is not so relevant as is the question of which approach or combination of approaches is right for a particular family. The authors of recent reviews have demonstrated benefits of both approaches, highlighting the potential synergies between the 2 but also highlighting potential problems.^{27,28} For example, a parent training program could have negative consequences for families already stressed by the demands of caring for a child with complex medical needs, adding a further burden of time and possible feelings of guilt if program recommendations are difficult to implement in the home. Likewise, the benefits of a stress management program might be limited in the absence of improvements in the child's functional abilities. Crnic et al²⁷ argue that stress clearly interferes with parent training programs, and without addressing the stress parents feel, such programs will have only

limited efficacy. These data reveal the need for an individualized approach, building on parent-identified priorities. Ongoing formative evaluation strategies are important to monitor effectiveness and receptivity and to adjust program focus or structure as needed.

Reviewers of telemedicine strategies have shown that they have great potential to relieve anxiety in families, provide a mechanism for sharing information as it becomes available, and reduce feelings of isolation.¹⁰ New technologies such as those found in mobile health applications with smartphones have been shown to have even greater promise, with the potential to reduce the frequency of clinic or office visits and enable direct services to a geographically dispersed patient pool. Applications based on versatile platforms allow 2-way sharing of information between parents and professionals.^{42,43} Parents can provide self-reported or even sensor data, and professionals can deliver individualized guidance based on parent-reported problems. Ultimately, mobile health applications allow the possibility for flexibility in response to changing circumstances and integration of new technologies (eg, wearable sensors) and empirically based interventions (eg, stress reduction techniques, parent-child interaction strategies). These applications also have the potential to be used to monitor the effectiveness of interventions, connect individuals through social media and crowdsourcing, and share information and experiences bidirectionally with professionals.

CONCLUSIONS

Prenatal exposure to ZIKV and subsequent CZS consequences for children evoke a range of implications for families that will last a lifetime. Families of children with classic CZS will meet the

definition of children with medical complexity, requiring family-centered approaches to services and extensive care coordination, especially given the range, severity, and persistence of the needs of affected children. Pediatricians, allied health professionals, and other service providers face a substantial challenge in meeting the needs of children with CZS, but engaging and supporting families will be a necessary component of effective care.

ABBREVIATIONS

CZS: congenital Zika syndrome
ZIKV: Zika virus

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