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Hurricanes Katrina and Rita - Effects on Children's Healthcare

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1. Introduction

Hurricanes Katrina and, to a lesser extent, Rita caused significant damage to a major population center and medical referral center for children's healthcare in the southeastern United States. As such, there were disruptions in children's healthcare not only at the site of maximal damage, but also extending to the greater region served by these referral centers, the effects of which continue to linger even now, after the fifth anniversary of the storms. The damage and disruption of the storms was not uniform, and the challenges to the healthcare system varied both geographically and temporally. In this chapter I will review these challenges, and how the healthcare system responded to each one, from the perspective of a pediatric specialist practicing in the area, using my first-hand experiences and data collected from my practice before and after the hurricane events. Also important to consider is that the healthcare system in the United States is a free-market system, and as such much of this response was not directed by an organized plan, but rather the result of reaction by individual hospitals and practitioners to the circumstances as they presented themselves. These special circumstances go beyond the initial first response – the focus of this chapter will be the short- and long-term challenges faced by the healthcare system after a major natural disaster.

2. The geography

Most are familiar with the damage to downtown New Orleans from Hurricane Katrina. The statistics speak for themselves, over 60,000 homes destroyed, flooding in excess of 10 feet of water, no power, no phone lines, no running water, and no working sewerage. In this region, none of the hospitals were able to continue to function. Patient records were either inaccessible or destroyed. Any local practices were closed, and the physicians and staff evacuated, usually without working contact information. For those who had forwarding contact information, phone numbers (including cell phones) with the local area code could not receive calls due to damage to the phone switchboard. Healthcare consisted of providing first aid followed by evacuation. The hospitals themselves were evacuated and closed. Likewise, nearly the entire population was evacuated.

This portion of the population lost all their usual connections with the health care system. Their medical records were mostly lost. Physicians were themselves evacuated and could

not be reached. Prescription renewals could not be obtained. Care for these individuals was conducted according to models of other natural disasters – evacuation to shelters, emergency response teams providing temporary care until the individuals were ultimately relocated.

To the east of New Orleans, the situation was not much different. The eye of the hurricane had passed through this region, again causing massive damage. Importantly, the bridges connecting to New Orleans from the east had all been destroyed, making the city accessible only from the west. This became extremely important in later stages of the recovery phases, as emergency response teams and returning residents would have to approach the city from this direction.

Immediately to the west of New Orleans is Jefferson Parish. Jefferson Parish is an industrial center with a population similar to that of New Orleans (around 400,000). This region had been spared much of the worst of the flooding from the storm surge, but did sustain significant damage from wind and rain flooding. Residents were again mostly evacuated and businesses were closed, but hospitals were still functioning, albeit on emergency power and with reduced staffing. My own hospital, Ochsner Hospital, is located in this region, along with East Jefferson Hospital. While these hospitals were open, they were not in a position to provide much more than continued care for the few patients on the hospital floors. Smaller offices and local practices were all closed.

West of Jefferson Parish is St. Charles Parish. St. Charles Parish is a rural community with a much smaller population (around 60,000), but does have significant heavy industry (oil refineries, chemical plants, and a nuclear reactor). This region sustained disruptions from power outages and significant debris, but little structural damage and minimal flooding. Hospitals may have temporarily closed for the storm itself, but were quickly reopened. Business disruptions were greater, with most businesses closed or functioning on emergency plans. Most residents evacuated for the storm itself but quickly returned.

Importantly, the three regions discussed here have independent parish governments and emergency operations centers, which operated independently of each other. Different decisions by these entities through the various phases of response/recovery had almost as much impact on the recovery process and healthcare delivery as did the extent of hurricane damage. It is fair to say that early in the response, neither the state nor the federal agencies had significant influence in the decisions of these independent parish governments.

3. The first stage – disaster response

While Orleans, Jefferson, and St. Charles parish had each ordered mandatory evacuations prior to the arrival of Hurricane Katrina, there was no enforcement of this order. Thus, while most residents had evacuated, there were a significant number of residents present during the storm itself. Emergency response teams thus focused on 'search and rescue' operations in the immediate poststorm period, particularly in the regions with the worst flooding.

3.1 Orleans Parish

Many of the residents who did not evacuate prior to Hurricane Katrina were highly visible, having congregated in the Superdome before the storm, or in the Louisiana Convention Center afterwards. Others were not, having stayed in their homes. Those in the city proper were certainly faced with difficult living situations – no power, no water, no sewerage, no open businesses, and as was well publicized, almost no law and order. The major challenges to the healthcare system were not so much how to provide care, but how to make an orderly

withdrawal. Hospitals could not provide care under these circumstances; they were systematically closed and evacuated. What healthcare was provided consisted of immediate first-aid and, if necessary, evacuation to a treatment center. Most common ailments included dehydration and wound infections from floodwaters. This is a well-established model, used in any major natural disaster or man-made 'disaster' (more commonly referred to as combat). Field hospitals were established at convenient gathering points (the New Orleans International Airport) or at the nearest mostly unaffected facilities in Baton Rouge. The only unique challenge was the difficulty of conducting these evacuations through the flooding without the benefit of amphibious vehicles – mostly this was accomplished by helicopter or boat. These well-coordinated efforts have been well documented extensively elsewhere.

3.2 Jefferson Parish

The majority of residents of Jefferson Parish had also evacuated prior to the arrival of Katrina, but again some residents remained behind during the storm. By geography and by chance, most of these were spared major flooding. The now-famous 17th street canal is actually located at the boundary between Jefferson and Orleans Parish; that only the Orleans Parish side breached was a matter of chance. However, Jefferson Parish is also mostly below sea level, and while the levee's held, the pumping stations that would normally pump out the rainwater were not manned during the storm. This curious decision led to more minor but equally widespread flooding throughout the parish. This combined with wind damage and debris from fallen trees effectively shut down normal business operations. The water was not drinkable, and sewerage systems were not operating. Remaining residents were not trapped, but were in a difficult living situation. Again, the most common ailments were dehydration and wound infections from floodwaters.

The major centers in the healthcare system were themselves on life support but remained functioning. Hospitals were operating with skeleton crews on emergency power, and could only provide minimal services for existing patients. It is not clear if first responders in Orleans Parish were aware that these facilities were open and functioning, and even if they were, the facilities were in no condition to serve as triage points. Any practices or facilities not tied to the major hospitals were closed. Overall, the healthcare system in this region was neither an asset nor a burden. First responders passed through on their way into New Orleans, and evacuated residents passed through on their way out of New Orleans.

3.3 St. Charles Parish

It is not clear how many of the residents of St. Charles Parish evacuated prior to Katrina, but regardless, even those that did evacuate did not stay evacuated for very long. The populated areas of this parish are mostly above sea level. The levees did not breach and pumping stations continued to function, so there was minimal flooding. Access was limited initially due to an excess of downed foliage (a bigger problem in a rural parish), but this was quickly cleared. Importantly, generators were utilized at water purification plants and sewerage treatment plants, providing both potable water and working sewerage systems to residents. The local hospital was quickly reopened, and there were even some business open (supermarkets, gas stations). Pharmacies and smaller physician practice sites remained closed. Again, the healthcare system in the region was neither an asset nor a burden, although this was about to change in a most dramatic way.

4. The second stage – an extended evacuation

Hurricane evacuations are a way of life in southern Louisiana. People grab the essentials and a few day's supplies and head out on the road, fully expecting to return in a few days time. This applies to medications as well. Katrina made landfall at the end of August, and most people renew their prescriptions on the first of each month. As such, most people evacuated with only those few pills left from their August prescriptions. When it became clear that they would not be returning to their homes in the next few days, this became a very big problem. Ordinarily, one would simply have one's physician call in a prescription renewal to a local pharmacy. However, the physicians offices were closed or damaged, and the physicians themselves were evacuated, most with no way for their patients to contact them. As New Orleans had served as a regional medical referral center, this affected not just residents of the city proper, but of the surrounding regions as well.

4.1 Evacuated residents

The biggest healthcare-related problem for evacuated residents was obtaining medication refills and continued care for chronic medical problems. Ordinarily, a new prescription would be provided by the original prescribing physician, and a referral (complete with past medical records) would be sent to the designated new physician. As neither original prescribing physicians nor medical records were available, a new system developed. Individual patients would arrive with empty pill bottles at pharmacies around the country, pleading their cases for additional medications. Pharmacists technically needed to contact the prescribing physician for refill authorization. They would of course make this attempt, but, knowing the situation, would generally provide the patient with a refill despite the lack of a response. When I arrived back at my office 3 days after the storm, the last thing I expected to see was a stack of faxed medication refill requests, from literally all over the country, but indeed that is what I found. Likewise, physicians offices were generally very accommodating in providing temporary care for these individuals. Even insurance companies suspended all in-network requirements for their plans. As most hurricane evacuees were scattered around the country, staying with friends or relatives, this did not necessarily provide a strain on the local healthcare system.

Included in this group were children with specialty care needs. As the only available pediatric specialist, I found myself attempting to coordinate care for these children, most often by coordinating evacuation to another regional center.

4.2 Orleans Parish – flooded regions

It is fair to consider Orleans parish in two parts, those that flooded and those that did not. The flooded regions were absolutely devastated. Any residents who did not evacuate before the storm were evacuated soon afterwards. The hospitals had all been closed and evacuated by this time. The only healthcare provided was by emergency medical technicians (and a now-famous pathologist) on the scene prior to evacuation.

4.3 Jefferson Parish and non-flooded regions of orleans parish

While Jefferson Parish and the non-flooded regions of Orleans parish did not suffer the devastating damage seen in the heavily flooded areas, there remained widespread minor damage and disruption of critical services, including electricity, water, and sewerage. Most debris had not been cleared from the streets, limiting access. As such, residents were generally

not allowed into their homes for a month or more after the storm. This did not, however, stop people from trying, and rather than being safely esconced at a distant evacuation site, most had gathered on the western border of Jefferson Parish waiting to be allowed back into their homes; a few managed to sneak back in. These combined with the residents who had never evacuated made for a very small population to serve. The most common reason for seeking medical care was running out of medications. Other common complaints were dehydration, wound infections from floodwaters, and minor injuries during home repairs.

While the individual health care practices and smaller facilities remained closed, the hospitals were gradually re-establishing normal operations. The Ochsner Clinic reopened to much fanfare but few patients, as the parish residents were held up at checkpoints on the parish borders. Those few who did make it were well cared for – their records were fully accessible, prescription refills could be easily provided and filled at a hospital pharmacy. Personnel at the hospital was an issue, as most of the employees had to be housed in hospital beds. There were also lingering questions of safety making hospital workers hesitant to return. Interestingly, security was probably the least issue, with private contractors having been employed by the hospitals throughout the storm period. Underlying it all was a concern if normal operations would ever resume, a concern which was on some levels realized during the next stage of response.

4.4 St. Charles Parish

St. Charles Parish had suffered significant damage from the storm, but was in an excellent position to mount a rapid recovery. The early decisions to remove debris from roads and establish potable water and a working sewerage system proved critical. These allowed residents to return earlier, minimizing ongoing damage to property (roof leaks were repaired or covered, etc), and further hastening the removal of debris (everyone cleared their own lawns). Some businesses were able to reopen on generator power, with their regular employees available for work and their regular customers lining up at the doors. Shortly thereafter, convoys of power trucks arrived to repair the power lines. As Jefferson Parish and Orleans Parish were still inaccessible, they repaired the damaged power lines in St. Charles Parish instead. My own home in St. Charles Parish had electrical power restored exactly one week after the storm (by comparison, I had no power for 3 weeks after the much weaker Hurricane Gustav past over and caused considerably less damage). Hospitals were open and some medical practices re-opened, although most pharmacies remained closed, apparently due to issues with supply chains.

However, St. Charles Parish faced a challenge a new, particularly to its healthcare system, that would have pressed it under the best of circumstances. Those residents who were not allowed into Jefferson Parish or Orleans Parish were stranded in St. Charles Parish. An infrastructure designed to serve a population of ~60,000 was strained by literally hundreds of thousands of people waiting to be allowed back into their homes. The strain on the healthcare system was particularly severe, as these patients developed minor ailments or ran out of their chronic medications. In response, the local hospital, St. Charles Parish Hospital, set up an outpatient triage center, where around 1000 patients each day could quickly be seen and provided prescriptions for their medications. Physician volunteers from around the country, or in my case from down the street, came to help provide care at this center. Of course, the lack of pharmacies also became an issue, as we could provide prescription refills, but there was no place for the patients to fill them. The savior for this problem came in the unlikely form of caravans of dark sedans driven by what we refer to as “drug reps”. These sales representatives

from the pharmaceutical companies would normally provide medication samples to physicians; after Katrina, they had evidently tapped into regional and national stores of these samples to provide free medications to hospitals in the hurricane zone, quite literally one truckload at a time. To my knowledge, the importance of this effort to the healthcare response teams has not been acknowledged, and I would like to do so now.

In addition to patients out of medications for chronic illnesses, the major illnesses treated at this triage center included minor illnesses and wound infections from cuts while wading through floodwaters, still present in parts of Jefferson Parish and much of Orleans Parish. It must also be mentioned the disappointingly large number of patients on chronic narcotics for back pain, who had been cared for in “pain clinics” in Jefferson Parish.

Healthcare in the United States is usually not free, but no patients were charged for the services at this temporary outpatient center. To do so would have been totally impractical. Happily, this is one good deed which was rewarded – the hospital did keep records of the patients treated (including copies of photo ID’s where possible), as was ultimately compensated by the federal government. I had joked about coming back someday to see the new hospital wing, and in fact did just that as part of my grand jury service 2 years later.

5. The third stage – “Where are the patients?”

As people were eventually allowed to return to their homes, new challenges emerged to healthcare delivery. These challenges were more difficult to anticipate, and less outside assistance was provided in meeting them. The challenge to the healthcare system at this stage was primarily economic, from reduced patient volumes seen despite the reduction in the total number of hospitals. The average daily census of hospital beds in the region fell by 50% during the 4 month period after the storm, from 2,500 patients to 1,237 (Louisiana Public Health Institute, “NOLA Dashboard”, and U.S. Government Accountability Office, 2006). In a free market health care system, reduced patient volume directly translates into reduced revenue, and hospitals began reporting significant financial losses. Bond ratings were lowered, limiting hospitals’ ability to borrow money. While the reduced patient volumes and financial losses are easy to document, they were harder to explain. Facing this same challenge in my practice, I prepared a compilation of the patient visits and new referrals before and after the storm, and with this can postulate an explanation which may be relevant to the recovery phase following other natural disasters, hurricanes or otherwise.

5.1 The new demographics

A new term, “Demographic Shift”, has been applied to the populations changes of the greater New Orleans area following Hurricane Katrina. Initially this was a euphemism for a reduced number of African Americans living in the city, made famous (infamous?) by Mayor Ray Naggin’s comments about New Orleans being a “chocolate city”. In fact, the population shifts were far more complex. The reported numbers are staggering, with >75% reduction in the population of Orleans Parish (based on United States Census data). However, there was not a corresponding 75% reduction in traffic, nor was there a 75% reduction in business volume, or in patient volume, for that matter. Clearly, there were fewer residents of public assistance housing, as these were mostly destroyed in the storm and were not reopened. However, this appears to have been offset by an influx of temporary workers attracted by job opportunities in construction. I say “appears” because there are no statistics that can be referenced for this. Many of the workers were undocumented aliens.

Those that were not mostly continued to claim their home address as where they came from, even though they may have spent years in the New Orleans area. Thus the US Census would not show them as residents of New Orleans. The post office could use mail forwarding out of New Orleans to determine who had left, but there was no system for tracking mail forwarding into Orleans Parish. These uncertainties made appropriate resource allocation and long-term planning extremely difficult, particularly with regards to healthcare. Interestingly, they also made crime statistics unreliable, as these are reported as incidents per unit population.

5.2 The response of the healthcare industry

Absent compelling evidence to the contrary, most assumed that the census information was correct, that the population of the greater New Orleans area was significantly lower. This led to assumptions that the reduced patient volumes were permanent, causing hospitals to scramble to consolidate services and reduce operating costs. Hospital acquisitions became quite commonplace – Ochsner acquiring Memorial Hospital, Meadowcrest Hospital, Kenner Regional Hospital, and entering into operational agreements with several other hospitals (Summa Hospital in Baton Rouge, St. Anne's Hospital in Raceland, and St. Charles Parish Hospital). Children's Hospital acquired Touro Medical Center. Salaries were reduced and benefits were cut. Ochsner Hospital's new policies included charging vacation time during hurricane evacuations, decreasing subsidies for workers' health insurance, eliminating the pension plan, and conducting a full audit of eligibility for health insurance of workers' dependents (ironically this audit occurred shortly before new rules in the health care reform act caused most of these dependents' health care coverage to be reinstated). Executives were affected as well, taking a substantial pay cut. Other hospitals (most notably Tulane Hospital and the state hospital, the Medical Center of New Orleans), took even more severe measures, laying off staff or placing them on furlough, including physicians and tenured faculty. Unfortunately, these cutbacks came at a time when the cost of living in New Orleans had increased dramatically. Destruction of 75% of the housing in Orleans Parish had a predictable effect on the housing market – rents and new home prices skyrocketed. Likewise, house insurance rates increased 3-4 fold, when available at all. Inventory losses and increased demand led retailers to raise prices. Worker attrition rates predictably skyrocketed as well, as high as 20% per year even among the physician staff. Of course, this was by design, as hospitals were trying to reduce overhead by reducing staffing.

6. A closer look at the post-storm changes in my practice

In my own practice, I did not sense that the patient volumes had not fallen in pace with hospital-wide data. There did, however appear to be some unusual trends emerging, which with the assistance of a student working in my laboratory I decided to investigate further. It was round 6 months after the storm when, while attempting to get a routine confirmatory test for early puberty, I was informed that I would have to wait, as the required medication had been in the clinic during power shutdowns with Hurricane Katrina, and was no longer usable. The surprising thing was it had been that long since I had last performed one of these tests – very unusual for a pediatric endocrinologist. Gonadal function is influenced by stress, and I suspected that the stress of the hurricane recovery was affecting the children, and thus reducing the prevalence of stress-associated endocrine disorders. Evidence of increased stress has been reported after Hurricane Katrina, for both parents and children

(Coker et al., 2006; Desalvo et al., 2007). I became curious what other effects the hurricane event had on referral patterns in my practice.

6.1 The study design

I had recently moved my practice to Ochsner Hospital, 4.5 months prior to Hurricane Katrina to be specific. The patient base of my practice was mostly insured patients (a more upscale patient mix), with the majority of patients living in Jefferson Parish or further west of New Orleans. Wait times for new appointments never exceeded 2 weeks in either the pre- or post-storm periods. I had already confirmed that the total number of patients seen during those 4.5 months, compared to the 4.5 months following the start of normal clinical operations after the storm, had not changed (approximately 450 in each time period), as part of my normal tracking of clinic volumes. We therefore looked at new referrals, both the total number and the number of referrals for specific disorders, some expected to be affected by stress (precocious puberty, pubertal delay, short stature, alopecia areata, ‘spells’), and some not (thyroid disease, premature adrenarche). The data were compiled and statistical significance determined by risk analysis. The raw numbers are shown in Table 1.

| | Pre Storm | | Post Storm | |
|----------------------|-----------|------------|------------|------------|
| Diagnosis | Number | Percentage | Number | Percentage |
| Total Referred | 177 | - | 169 | - |
| Precocious Puberty | 11 | 6.2 | 5 | 3.0 |
| Premature Adrenarche | 10 | 5.6 | 10 | 5.9 |
| Pubertal Delay | 24 | 13.6 | 25 | 14.8 |
| Short Stature | 45 | 25.4 | 30 | 17.8 |
| Thyroid Disorders | 33 | 18.6 | 32 | 18.9 |
| Alopecia | 0 | 0.0 | 2 | 1.2 |

Table 1. Effects of hurricane stress on the pubertal development of the children

6.2 Total referrals

The total number of new patients referred to my practice 4.5 months before and after hurricane Katrina was actually quite similar (Fig. 1). There were no significant differences noted on risk analysis. This was a surprising finding; I had assumed that the total visits were maintained by continued care for existing patients, most of whom were not permanently displaced by the storm. However, there did not appear to be a reduction of new patient referrals, either. Now, it is fair to say I had expanded to a new practice location in Baton Rouge after the hurricane, and this may be the reason the total number of referrals did not decline.

6.3 Effects of stress in children

To look for evidence of stress in the children, I took advantage of the physiology of normal puberty. Puberty refers to the physical and hormonal changes which typically begin in early adolescence and lead to reproductive maturity and completion of growth. In females the physical changes include growth of the breasts, development of pubic hair, and onset of menstrual periods (menarche). In males the physical changes include growth of the penis and testes, pubic hair, increased muscle mass and strength, and increased body and facial hair. The body changes are triggered by rising levels of the sex steroids (androgens and

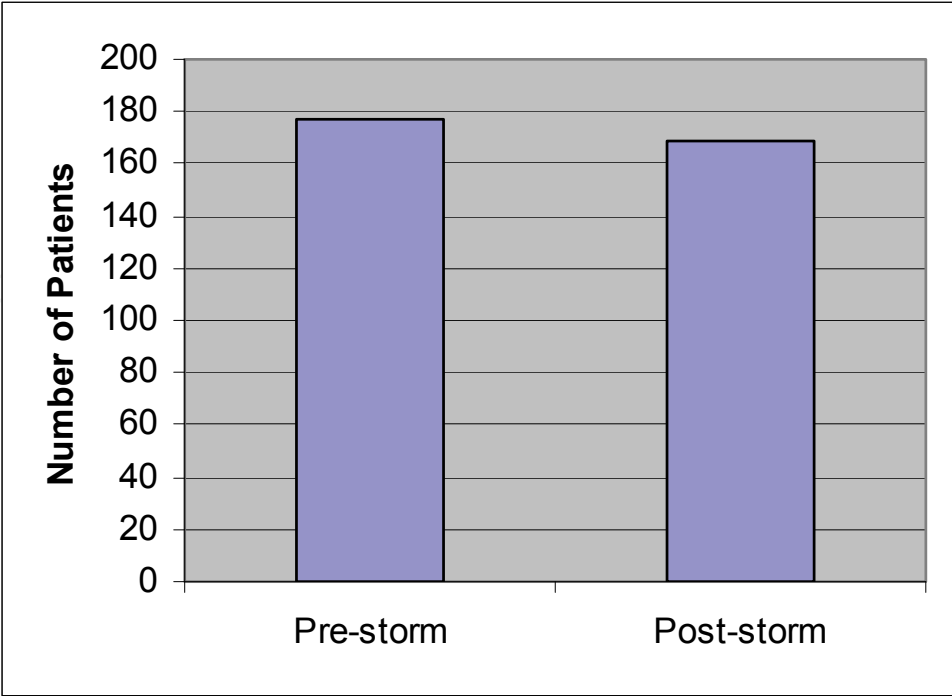


Fig. 1. Total Number of New Referrals. The total number of new patients referred between April 15, 2005-August 28, 2005 (Pre-storm) and those referred between October 1, 2005-February 14, 2006 (Post-storm) are shown.

estrogens). These arise from parallel hormonal processes termed "adrenarche" and "gonadarche." Adrenarche refers to maturation of the adrenal cortex with rising levels of adrenal androgens. These can produce early stages of pubic hair, underarm hair, adult-type body odor, and acne. This process is at least partly independent of gonadarche, which is initiated by the central nervous system via pulsatile release of gonadotropin-releasing hormone from the hypothalamus. This in turn causes the release amplitude of gonadotropins from the pituitary gland, which activates hormone producing cells of the testes or ovaries, resulting in fertility. The two can be distinguished by physical exam and by measuring hormone levels. Importantly, gonadarche is likely to be affected by stress, as stress is well known to induce hypogonadism in adults and may slow pubertal development in children (Charmandari et al., 2003). Interestingly, a recent pediatric study indicated that stress has the opposite effect, accelerating pubertal development (Tremblay & Frigon, 2005), although in this survey-based study the pubertal signs themselves may have been the cause of the associated stress. Adrenarche is not influenced by stress (Zukauskaite S., et. al., 2005), and referrals for this disorder served as an internal control for the study. The details of this study have been published (Ponnapakkam, 2008).

The data shows evidence of health effects from stress in the children – there was a 52% reduction in new patient referrals for gonadarche, while there was only a 4% decrease in new referrals for adrenarche (Fig. 2). Referrals for thyroid disorders, which would also not be expected to be influenced significantly by stress, were also similar in the pre- and post-storm periods. Alopecia areata (a condition of localized hair loss) is another condition which has been shown to be associated with increased stress (Gulec, AT, et. al., 2004). There were 2 referrals for hair loss (alopecia areata) after the hurricane, while there were none in the pre-storm period, further supporting the hypothesis.

6.4 Effects of stress in parents

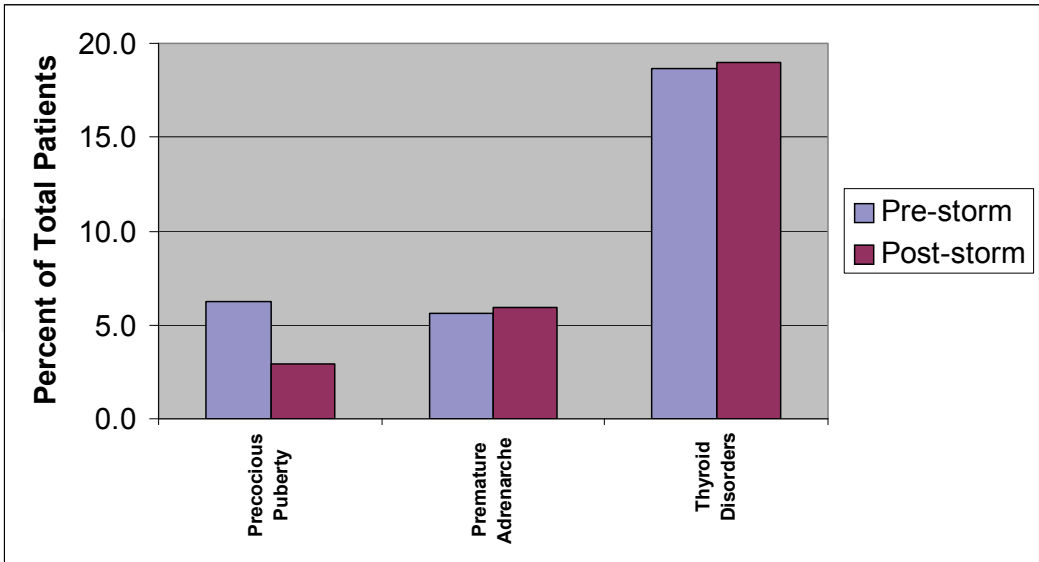


Fig. 2. New Diagnoses - Precocious Puberty. The percent of new patients whose final diagnoses were precocious puberty, premature adrenarche, or thyroid disorders in the pre-storm or post-storm periods are shown.

While these data show evidence of stress in the children, some of the other disease-specific referral rates are more difficult to explain by this finding alone. If stress effects on gonadal function is the reason for the reduced incidence of early gondarche, we should also have seen an increase in the incidence of pubertal delay. However, there was only a very modest (9%) increase in referrals for this disorder after the storm, which did not achieve statistical significance (Fig 3). Furthermore, stress has been previously reported to slow growth in stature (Gilmour, J, et. al., 1999, Charmandari, et. al., 2003), but we actually saw a 23% decrease in referrals for short stature after the hurricane, a result which did achieve statistical significance.

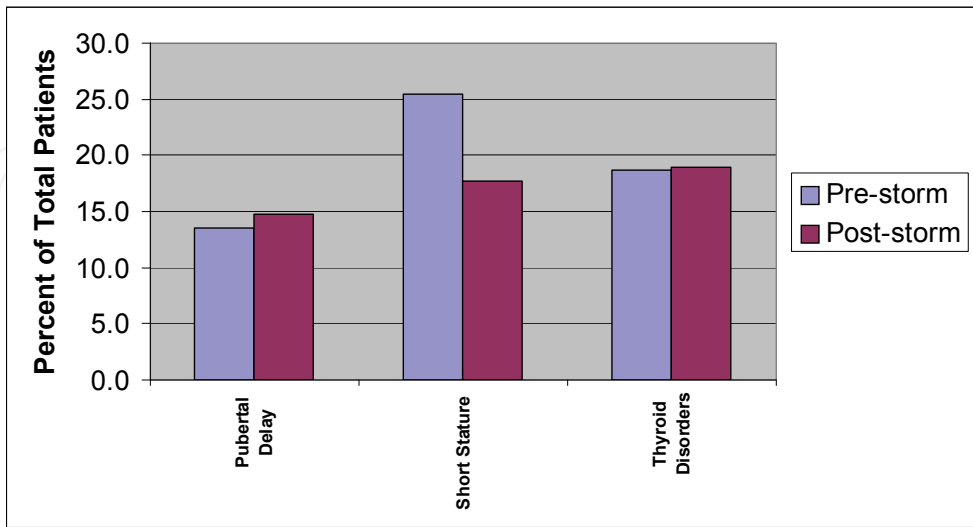


Fig. 3. New Diagnoses - Delayed Puberty. The percent of new patients whose final diagnoses were either pubertal delay, short stature (not associated with pubertal delay), or thyroid disorders in the pre-storm or post-storm periods are shown.

Now, it may be that stress effects on growth might not be as evident in such a relatively short time frame, but it still does not explain why we saw a decrease in referrals. It appears that the explanation is not medical but rather social. Early puberty in children is distressing for parents, so much so that I even saw a case of it while volunteering at the outpatient triage center in St. Charles Parish Hospital. Parents are concerned about early menarche in girls, and even more concerned that the early changes may be caused by a tumor in either sex. Likewise, thyroid disorders cause symptoms which are likely to motivate the patient and parents to seek immediate medical attention (excessive sleeping, constipation, low energy with hypothyroidism; hyperactivity, weight loss with hyperthyroidism). Pubertal delay and short stature do not provoke the same level of anxiety, in either the parent or the physician, and it appears that in the stress of the post-hurricane recovery period these problems were more likely to be ignored. The percent change in incidence for each disorder is summarized in Figure 4.

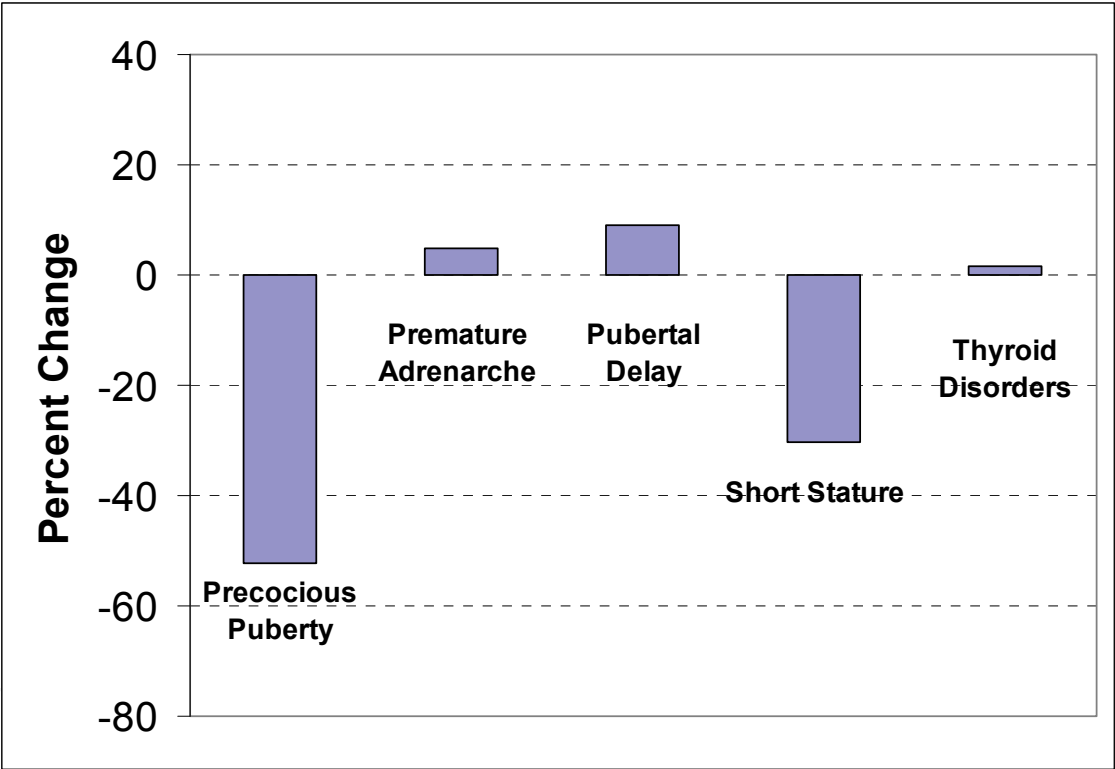


Fig. 4. Percent Change After Hurricane Stress. The percent reduction in the post-storm period of new patients with each of the indicated final diagnoses is shown.

6.5 Study conclusions

The data from the study confirm the hypothesis that chronic stress was influencing the health of children in the New Orleans area after Hurricane Katrina. While I examined illnesses relevant to my specialty, it is likely that other stress-associated illnesses (i.e. inflammatory bowel disease) would have been influenced as well. Of course, effects of chronic stress go well beyond health states, and can have implications in social settings and school performance as well. These have been document in the setting of other hurricane events (La Greca, et. al., 1996 and 1998), and after other natural disasters such as earthquakes (Kitayama , et. al., 2000, Karakaya, et. al., 2004, Uemoto, et. al., 2000).

The findings about parent stress and family situations affecting referral patterns to my practice is perhaps even more important. It suggests that there was an ongoing deferral of aspects of healthcare that might seem non-essential. Of course, this could have contributed to the reduced patient volumes seen during the recovery period, and would have different degrees of effect for different specialties. It also would predict an increase in patient volumes to follow, which a consolidated healthcare system would find difficulty accommodating.

7. The sixth stage – long-term effects

If the above analysis predicted that patient volumes would increase as the population stopped postponing basic healthcare, it is certainly interesting to follow up with what did actually happen. Unfortunately, presenting data on patient volumes is not helpful, as my practice was soon functioning at maximum capacity, and these numbers therefore do not change. What did change was the time interval to the next available appointment. At the time of the analysis, this was 1-2 weeks. By the time of my departure, this was beyond 3 months. To be able to preserve appointment times for existing patients, I was forced to close the practice to new patients on two occasions. Not surprisingly, I was not the only physician in New Orleans experiencing dramatically increased patient volumes. There was a 52% increase in daily hospital census for the region (from 1,237 to 1,877) by 1 year after the hurricane (Louisiana Public Health Institute, "NOLA Dashboard", and U.S. Government Accountability Office, 2006). This had a beneficial effect on hospital finances, and Ochsner Hospital was no longer losing money. It had become problematic for patients, however, who found access to care extremely poor.

In addition to having effectively strangled the health care system, this temporary 'boycott' of healthcare services unfortunately had direct consequences to the patients as well. Not all medical problems can be taken care of at one's leisure; some conditions provide a "window of opportunity" for therapy. At one point, I saw 10 patients in 2 weeks for short stature whose growth phase had already completed (I typically might see one or two a year). Had they come to me sooner, I might have been able to help, but as it was I could not. I also had a patient deceased from a combination thyroid storm and a heart condition (technically not my patient, as I never got the opportunity to see or treat her).

The reductions in healthcare spending during the post-storm period also ultimately had their consequences as well. The uniformly reduced salary and benefits, paired with an increase in cost of living, made the region a fertile recruiting ground for hospitals from around the country that did not suffer these financial setbacks. While all of the physicians in my specialty returned to their practices after the storm (with one physician who had planned to retire postponed those plans during the storm recovery period), by the fifth anniversary of the storm two of the three pediatric endocrine practices (including my own practice) in New Orleans had closed. New Orleans no longer functions as a referral center for pediatric endocrinology; rather, patients are currently being directed out of the city for care.

8. Conclusions – lessons to be learned

The impact of Hurricane Katrina on the New Orleans area healthcare system serves as an important case study for recovery from a natural disaster. Beyond the immediate effects, there will be transient alterations in healthcare utilization, as families prioritize immediate needs

over health maintenance. There will be stress in the population, which will have health consequences of their own. The stress of the parents will be felt by the children as well, affecting their health.

Unfortunately, the free market nature of the healthcare system in the United States appears to have amplified these problems rather than dampening them. A central body might have been able to compensate for the temporarily reduced earnings from patient care during the time period of under-utilization. On the other hand, where the central body could have had the most immediate impact, the results were even more dire. The public hospital in New Orleans, Medical Center of New Orleans was closed after the storm, and remains closed to this day. The Veterans Administration hospital (a hospital network providing care for military veterans in the United States, provided by the federal government) is also closed. It is important for healthcare and government officials to realize the strains that will be faced by the healthcare system during the recovery period, and to plan accordingly.

9. References

- Charmandari, E., Kino, T., Souvatzoglou, E., & Chrousos, G. P. (2003). Pediatric stress: hormonal mediators and human development. *Horm Res*, 59(4), 161-179.
- Coker, A. L., Hanks, J. S., Eggleston, K. S., Risser, J., Tee, P. G., Chronister, K. J., et al. (2006). Social and mental health needs assessment of Katrina evacuees. *Disaster Manag Response*, 4(3), 88-94.
- Desalvo, K. B., Hyre, A. D., Ompad, D. C., Menke, A., Tynes, L. L., & Muntner, P. (2007). Symptoms of Posttraumatic Stress Disorder in a New Orleans Workforce Following Hurricane Katrina. *J Urban Health*, E-publication.
- Gilmour, J., & Skuse, D. (1999). A case-comparison study of the characteristics of children with a short stature syndrome induced by stress (Hyperphagic Short Stature) and a consecutive series of unaffected "stressed" children. *J Child Psychol Psychiatry*, 40(6), 969-978.
- Gulec, A. T., Tanriverdi, N., Duru, C., Saray, Y., & Akcali, C. (2004). The role of psychological factors in alopecia areata and the impact of the disease on the quality of life. *Int J Dermatol*, 43(5), 352-356.
- Karakaya, I., Agaoglu, B., Coskun, A., Sismanlar, S. G., & Yildiz Oc, O. (2004). [The symptoms of PTSD, depression and anxiety in adolescent students three and a half years after the Marmara earthquake]. *Turk Psikiyatri Derg*, 15(4), 257-263.
- Kitayama, S., Okada, Y., Takumi, T., Takada, S., Inagaki, Y., & Nakamura, H. (2000). Psychological and physical reactions on children after the Hanshin-Awaji earthquake disaster. *Kobe J Med Sci*, 46(5), 189-200.
- La Greca, A., Silverman, W. K., Vernberg, E. M., & Prinstein, M. J. (1996). Symptoms of posttraumatic stress in children after Hurricane Andrew: a prospective study. *J Consult Clin Psychol*, 64(4), 712-723.
- La Greca, A. M., Silverman, W. K., & Wasserstein, S. B. (1998). Children's predisaster functioning as a predictor of posttraumatic stress following Hurricane Andrew. *J Consult Clin Psychol*, 66(6), 883-892.
- Tremblay, L., & Frigon, J. Y. (2005). Precocious puberty in adolescent girls: a biomarker of later psychosocial adjustment problems. *Child Psychiatry Hum Dev*, 36(1), 73-94.
- Ponnappakkam, A., Gensure, R, Effects of Stress After Hurricanes Katrina and Rita on Pubertal Disorders in Children, *The Ochsner Journal* 8:000-000, 2008.

- Uemoto, M., Shioyama, A., Koide, K., Honda, M., Takamiya, S., Shirakawa, K., et al. (2000). [The mental health of school children after the Great Hanshin-Awaji Earthquake: I. Epidemiological study and risk factors for mental distress]. *Seishin Shinkeigaku Zasshi*, 102(5), 459-480.
- U.S. Government Accountability Office, Status of the Health Care System in New Orleans, Pub. no. GAO-06-576R (Washington: GAO, March 2006)
- Zukauskaitė, S., Seibokaite, A., Lasas, L., Lasiene, D., Urbonaite, B., & Kiesilyte, J. (2005). Serum hormone levels and anthropometric characteristics in girls with hyperandrogenism. *Medicina (Kaunas)*, 41(4), 305-312.



Recent Hurricane Research - Climate, Dynamics, and Societal Impacts

Edited by Prof. Anthony Lupo

ISBN 978-953-307-238-8

Hard cover, 616 pages

Publisher InTech

Published online 19, April, 2011

Published in print edition April, 2011

This book represents recent research on tropical cyclones and their impact, and a wide range of topics are covered. An updated global climatology is presented, including the global occurrence of tropical cyclones and the terrestrial factors that may contribute to the variability and long-term trends in their occurrence. Research also examines long term trends in tropical cyclone occurrences and intensity as related to solar activity, while other research discusses the impact climate change may have on these storms. The dynamics and structure of tropical cyclones are studied, with traditional diagnostics employed to examine these as well as more modern approaches in examining their thermodynamics. The book aptly demonstrates how new research into short-range forecasting of tropical cyclone tracks and intensities using satellite information has led to significant improvements. In looking at societal and ecological risks, and damage assessment, authors investigate the use of technology for anticipating, and later evaluating, the amount of damage that is done to human society, watersheds, and forests by land-falling storms. The economic and ecological vulnerability of coastal regions are also studied and are supported by case studies which examine the potential hazards related to the evacuation of populated areas, including medical facilities. These studies provide decision makers with a potential basis for developing improved evacuation techniques.

How to reference

In order to correctly reference this scholarly work, feel free to copy and paste the following:

Gensure, Robert Charles, Ponnappakkam and Adharsh (2011). Hurricanes Katrina and Rita - Effects on Children's Healthcare, Recent Hurricane Research - Climate, Dynamics, and Societal Impacts, Prof. Anthony Lupo (Ed.), ISBN: 978-953-307-238-8, InTech, Available from: <http://www.intechopen.com/books/recent-hurricane-research-climate-dynamics-and-societal-impacts/hurricanes-katrina-and-rita-effects-on-children-s-healthcare>

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