Prevalent Congenital Anomalies and Metabolic Disorders among Live-Born Neonates in Hospitals in General Santos City, Philippines (2009-2012)

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ABSTRACT

Objective. Birth defects are among the leading causes of infant mortality and morbidity in the Philippines. While affected infants make up a sizeable portion of live births in General Santos City (GSC), no information is available about their actual numbers. This study aims to fill the knowledge gap about the prevalence and nature of congenital anomalies (CAs) and congenital metabolic disorders (CMDs) in the city from 2009 to 2012.

Methods. A retrospective study of in-patient records from six (6) medical facilities was done for CA/CMD cases from 2009-2012. Among the CMDs tested were congenital hypothyroidism (CH), congenital adrenal hyperplasia (CAH), galactosemia (GAL), hyperphenyalaninemia (HPA), phenylketonuria (PKU) and glucose-6-phosphate dehydrogenase deficiency (G6PD def).

Results. Collected data revealed 109 cases of CAs with limb deformities, oro-facial clefting and neural tube disorders comprising majority of cases. There were 878 reported cases of CMDs with glucose-6-phosphate dehydrogenase deficiency (G6PD def) as the most prevalent at 829 cases. There was also a preponderance of CAs/CMDs in a government hospital for the indigent.

Conclusions. These results underscore the emergence of CAs and CMDs as a major health problem among newborns in GSC. Higher incidences of birth defects in one district hospital also reveal a tentative link between CA/CMD incidence and socio-economic status. It is of paramount importance therefore, to undertake expansion of the newborn screening program and to establish local birth registries so that a more comprehensive and realistic picture of CA/CMD prevalence in the city will be obtained.

Key Words: congenital anomalies, congenital metabolic disorders, live-born neonates

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Introduction

Congenital anomalies (CAs), defined as structural and functional abnormalities present at birth, are a major cause of infant mortality and childhood morbidity.[1] Reports from the Philippines indicate that birth defects account for 11.2% of infant morbidity.[2] Furthermore, infants born with CAs have very special needs which hospitals and medical facilities are oftentimes ill-equipped to address. Congenital metabolic disorders (CMDs) on the other hand, are inborn errors of metabolism resulting from single gene disorders which when left unchecked invariably cause either mental retardation or death of the affected patients. Since newborns with CMD appear to be normal at birth, early detection is vital in preventing the progression of symptoms of the disorder. In the Philippines, the Newborn Screening Reference Center is directly responsible for maintaining the national testing database and case registries. As of the time the study was conducted (2012), the CMDs being tested in General Santos City hospitals were congenital hypothyroidism (CH), congenital adrenal hyperplasia (CAH), galactosemia (GAL), hyperphenyalaninemia (HPA), phenylketonuria (PKU) and glucose-6-phosphate dehydrogenase deficiency (G6PD def).

In 2008, the Philippine Birth Defects Surveillance Group was launched to establish a surveillance system for congenital anomalies and their associated risk factors. Starting with 32 participating facilities, it had expanded into 64 facilities in 2010. In GSC, a study was conducted by Zapico et al on congenital anomalies among live-born neonates from 2006 to 2008.[3] The study, however, was exploratory in nature and focused more on inborn metabolic disorders and to a limited extent tackled congenital malformations and chromosomal abnormalities observed in the newborn.

The impact of CA/CMD on the pediatric population in particular and the paucity of information about its prevalence have made the study timely and relevant. This present research therefore seeks to address this problem regarding scanty data on CA/CMD incidence and to fill the knowledge gap *vis a vis* the prevalence trends of these congenital anomalies in GSC from 2009 to 2012. This is especially important since General Santos hospitals provide

medical services to other areas in South Cotabato and Sarangani Province. Finally, studies such as this will provide information about CA/CMD incidence in this area of the Philippines where no such data is available and there is no facility or agency for their ascertainment.

Methods

General Santos, which is found at the southernmost tip of the Philippines, is a highly urbanized city with 53,606-hectare land area and is considered as the 15th most populous city in the country having a population of 538,086 as of 2010.[4] General Santos City is part of the SOCCSKSARGEN (South Cotabato, Cotabato, Sultan Kudarat, Sarangani Province and General Santos) region and has 26 barangays of which half can be considered urban. The availability of jobs, opportunities for leisure, business and education, and the accessibility of the city via sea, land and air transport resulted in increasing migration and in the influx of daily transients. Using current population growth rate (3.53%), it can be projected that the population will increase from 658,834 in 2011 to 864,388 in 2017. As a consequence of economic development, rapid population growth, uncontrolled urban sprawl and socio-economic problems are beginning to take hold of the place. Studies such as this therefore provide baseline data about CA/CMD incidences in a medium-sized city such as GSC which is on the brink of economic development.

General Santos medical facilities which signified their interest to take part in the study were the following: Mindanao Medical Center (MMC), General Santos City District Hospital (GSCDH), St. Elizabeth Hospital (SEH), General Santos Doctor's Hospital (GSDH), SOCKSARGEN County Hospital (SCH), and Puericulture Family Planning and Maternity Clinic (PFPMC). Pertinent data were also collected from the local National Statistics Office. Since there was no local Ethics Review Board as of the time the study was conducted, permission was secured from Hon. Rosalita Nunez, the Chairman of the Committee on Health of the Sanguniang Panglungsod (City Legislative Council) and Dr. Jacinto Maquilang, the City Health Officer. Letters of prior informed consent were also sent to the different hospital directors before data collection was done. Henceforth, retrospective study of in-patient records from the above-mentioned hospitals was done for live births that occurred from January 2009 to December 2012. Live newborns diagnosed with at least 1 CA were recorded and the prevalence of each anomaly was calculated. Obtained data from the selected hospitals were the number of CAs, CMDs, live births and the birth defect prevalence rates from 2009-2012.

Results

Shown in Table 1 is a listing of health-related statistics recorded in the city from 2009-2012. These data were taken from 6 private hospitals, 4 maternal clinics and 1 government-managed hospital in the city. For this study, 6 medical institutions *viz.* GSCDH, GSDH, MMC, SEH, SCH and PFPMC furnished the researchers with needed data. GSDH, SEH, MMC, and SCH are tertiary private hospitals while GSCDH is a government-managed hospital catering to indigent patients. This latter public hospital has the largest number of births per year among the medical facilities (Table 2). On the other hand, PFPMC is a government-managed maternity clinic which has the second largest number of births per year except for 2010.

Table 1. Related Health Statistics of General Santos City

	2009	2010	2011	2012
Total Population of General Santos City	567,588	587,623	608,634	567,645
Number of Births	14,566	14,603	15,911	15,905
Number of Deaths	2,004	2,666	2,544	2,842
Infant Mortality Rate (IMR/1000LB)	6.17	8.76	8.42	11.56
Number of Infant Deaths	90	128	134	184
Number of Fetal Deaths	56	54	77	49
Facility Based Deliveries	48.00%	43.00%	58.00%	61.76%

Source: National Statistics Office, General Santos City

Table 2. Total Number of Births in Selected Medical Facilities in General Santos City

	2009	**2010**	**2011**	**2012**
General Santos City District Hospital (GSCDH)	3, 424	3, 844	4, 449	4, 244
Saint Elizabeth Hospital (SHE)	528	612	609	686
General Santos Doctors' Hospital(GSDH)	542	512	546	544
Mindanao Medical Center(MMC)	357	284	241	255
SOCSKSARGEN County Hospital(SCH)	248	289	337	496
JCC. Sr. Puericulture Center Maternity Clinic (PFPMC)	566	517	680	979
General Santos City (Total)	14, 566	14, 603	15, 911	15, 905

Prevalence of Congenital Anomalies from 2009 – 2012

A total of 109 CA cases were reported in the selected General Santos City medical facilities during the years 2009-2012. A breakdown of the 109 reported cases in this study revealed 53.21% isolated CAs, 21.10% combination of CAs (more than 1 malformation in single organ category in an individual), 17.43% multiple CAs (more than 1 malformation in different organ systems in one individual) while the remaining 8.26% constituted syndromic CAs (combinations of developmental defects sharing a common etiology). Of the 109 cases, 71 were recorded from GSCDH and 21 cases were from GSDH (Figure 1).

Table 3 reveals the nature of CAs observed in Gen. Santos City during the inclusive years of the study. A cumulative number of 30 cases were observed for limb deformities which translates roughly to 11.63 patients/10,000

births. These deformities included clubfoot (8 cases), polydactyly (6 cases), limb deficiencies (5 cases), syndactyly (1 case), brachysyndactyly (1 case), amniotic band syndrome (2 cases), underdeveloped limbs (2 cases), calcaneovalgus feet - unspecified (1 case), and other limb deformities (2 cases).

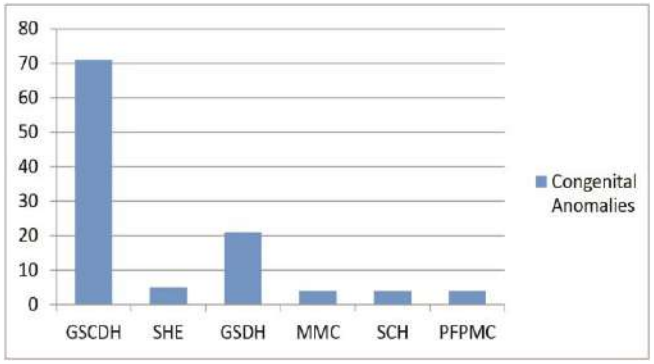

Figure 1. Reported Congenital Anomalies in major Medical Facilities in General Santos City from 2009- 2012.

Table 3. Top 10 Birth Defects Prevalence Rates from 2009-2012.

Type of CAs	Number of Cases	Rate per 10, 000 births
Limb Deformities	30	11.63
Orofacial Clefts	25	9.69
NTD (Neural Tube Defects)	13	5.04
Atresia	9	3.49
Down Syndrome	8	3.10
Hydrocephalus	7	2.71
Gastroschisis	3	1.16

Oro-facial clefts followed closely at 25 cases and a prevalence rate of 9.69/10,000 births. The variable nature of oro-facial clefting was demonstrated in the following percentages obtained: cleft lip made up 24% of total orofacial cleft cases while cleft lip/palate and cleft palate comprised 60% and 16% of reported cases, respectively. Furthermore, 80% of orofacial clefts were observed to be isolated cases whereas the remaining 20% in the study were either in combination with other malformations found in a single organ category or in multiple congenital anomalies.

There were 13 identified neural tube defect (NTD) cases in this study of which 53.84% were meningocele and 46.15% were anencephaly cases. Other CA cases observed were 9 cases of atresia, of which 77% of the neonates had imperforate anus while the remaining malformations were due to duodenal atresia and an uncategorized atresia. The study also identified 8 cases of Down syndrome with a prevalence rate of 3.10/10, 000 live births. This prevalence rate is considerably lower when compared to an earlier study conducted by Padilla et al in Manila and Zapico et al in General Santos City.[5,3] Furthermore, the prevalence rate of congenital hydrocephalus in the study was 2.71/10, 000 live births which was slightly higher than the prevalence rate reported by the Philippine Birth Defects Registry Project.[5]

Congenital Metabolic Disorders (CMDs) Detected during Neonate Screening

Figure 2 shows the number of neonates manifesting any form of CMD during the study period. As can be seen from the graph, there was a drastic increase in CMD cases from 2010 to 2012 for GSCDH. PFPMC, as a lying in clinic, was not included in the table since it did not have data on these specific metabolic disorders.

Figure 2. Congenital Metabolic Disorders Among Neonates in General Santos City

Shown in Table 4 are the numbers of live newborns exhibiting CMDs. A total of 829 cases of G6PD deficiency were reported in the selected medical facilities from 2009-2012. Starting from 2010 up to 2012, there was a remarkable increase in the number of G6PD deficiency cases in GSCDH when compared with the other medical facilities. G6PD deficiency, the most common metabolic condition observed in this study, is an X-linked recessive disorder characterized by enzyme defects of red blood cells.[6] Usual symptoms of G6PD deficiency include hemolytic anemia, tea-colored urine, jaundice and pallor.[7] G6PD patients also have decreased RBC lifespan and may have cataract formation.

Table 4 also shows a cumulative number of 16 cases of neonates born with CH. Of this number, 6 cases were reported in SCH in 2012 while the remaining cases were noted in MMC and GSCDH. CH, which is due to a deficiency of thyroid hormones present at birth, is usually caused by thyroid dysgenesis or defects in thyroid metabolism. Physiological consequences if left untreated are severe mental retardation, neurologic complications, and physical delays.

Table 4. Congenital Metabolic Disorders Detected among Live-born Neonates in Gen. Santos City (2009-2012)

Medical Facilities	G6PD Def				Congenital Hypothyroidism				Congenital Adrenal Hyperplasia				Galactosemia				PKU/HPA			
	2009	2010	2011	2012	2009	2010	2011	2012	2009	2010	2011	2012	2009	2010	2011	2012	2009	2010	2011	2012
GSCDH	41	65	134	201	1	1	4	-	3	5	3	-	-	1	-	1	-	2	2	3
SEH	44	36	32	41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GSDH	31	31	27	30	-	-	-	-	2	2	-	1	-	-	-	-	-	-	-	-
MMC	20	10	13	11	1	1	2	-	2	1	-	-	-	-	-	1	-	-	-	-
SCH	6	17	18	21	-	-	1	6	2	2	-	1	-	-	-		-	-	-	-

From 2009 to 2011, GSCDH had an upsurge in the number of CAH cases though there was no report in 2012 for this metabolic disorder. Other CAH cases were also observed in SCH, GSDH and MMC. CAH is a genetic condition that inhibits hormone secretion by the adrenal glands. All forms of CAH follow autosomal recessive patterns of inheritance and 90% of reported cases is caused by 21-dyhroxylase deficiency (21-DD) which in turn causes hyperplasia of the adrenal cortex. Another consequence of CAH is excessive production of androgens which causes premature puberty in males and virilization in females. Furthermore, only 3 cases of galactosemia were recorded in MMC and GSCDH from 2009 to 2012. GAL is an autosomal recessive disorder in carbohydrate metabolism which results in elevated galactose levels due to deficiencies for galactose-metabolizing enzymes.[7] Signs and symptoms in untreated patients include failure to thrive, feeding problems, hepatocellular damage, bleeding, sepsis and cataracts. Finally, 7 cases of PKU and HPA were noted in GSCDH during the years 2010-2012. HPA and PKU are autosomal recessive disorders characterized by high levels of phenylalanine. The disorder is caused by phenylalanine hydroxylase (PAH) or tetrahydrobiopterin (BH4) deficiency which deficiency causes accumulation of phenylalanine in the blood and other tissues and results in the disruption of transport of certain amino acids across the blood-brain barrier. Clinical symptoms include distinct musty smell, developmental delay, mental retardation, microcephaly, seizure, eczema, and behavioral abnormalities.[7]

Discussion

This study was undertaken to improve the current state of knowledge available on birth prevalence of CA/CMD. While major hospitals in the city had started newborn screening in the early 2000s, there was no effort done to consolidate gathered data to get a true picture of the local prevalence of CAs and CMDs. Therefore, publications like this will evoke a sense of awareness and compassion about this long marginalized group of patients. This will also guide pediatricians and other primary care practitioners as to the special needs of these infants and the management options suitable for them.

In terms of CAs, a positive finding was the reduced number of infants born with anencephaly. This NTD has been known to contribute significantly to neonate mortality.[6] This lowered number of anencephaly in this report when compared to that obtained by Zapico and her colleagues in General Santos City can be ascribed to increased folic intake among pregnant women which is a positive outcome of the government's massive information drive about the importance of nutrient balance during this stage of conception.[3,8,9]

Another noteworthy observation was the preponderance of CAs and CMDs in GSCDH, a government-managed hospital that collects minimal fees for medical procedures and medicines. This hospital also recorded highest numbers for G6PD def/ CAH and was the only medical facility with PKU/HPA cases during these inclusive years. While these numbers may suggest a tentative association between CA/CMD incidences and poverty, the collected data are far too limited to lend credence to such speculations. Moreover, sweeping conclusions about the purported effects of economic deprivations are unwarranted especially with the absence of data about maternal malnutrition and exposure to harmful agents during pregnancy. On the other hand, Grewal et al, Pawluk et al and Clark et al, while studying the effects of nutritional deficiencies on various CAs, acknowledged that the harmful effects of economic deprivations (especially nutritional) and unknowing exposure (possibly to teratogens) could not be totally discounted.[10,11,12]

These perplexing claims provide ample justification for more CA/CMD prevalence studies in GSC especially since home deliveries constitute almost 40% of total live births in the city. These types of studies will be valuable to government agencies, the medical community and other sectors of society concerned with health and human resources. Information from the study can be used to draft certain policies or to source out funds from funding agencies so that the plight of these unfortunate individuals can be improved.

Conclusion

While the study only covered selected hospitals in General Santos City, it may serve as a microcosm of CA/CMD cases of the country at large. Major challenges in newborn screening initiatives in the Philippines are extreme poverty of majority of the Filipinos and their lack of comprehensive health care insurance. Moreover, since only facility-based deliveries were included in the study, these results do not give an accurate account of CA/CMD incidence in the city. Another factor to reckon with is the general ignorance of pregnant women about the harmful effects of teratogenic drugs, substances and other exposures on their developing babies. It is imperative therefore that local birth registries especially at the barangay level be established and that education of women about the perils of indiscriminate drug use and exposure to potentially teratogenic agents be undertaken so that they could take necessary precaution especially during the early stages of pregnancy.

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