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ORIGINAL ARTICLE

Prenatal diagnostic services in three regional centers in Vietnam

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Abstract
Objectives This study aims to give information on the prenatal diagnostic (PND) services provided in three major regional PND centers in Vietnam.
Methods This cross-sectional study was conducted in early 2014. An inventory of services, human resources, facilities, and equipment and in-depth interviews were carried out.
Results Three regional PND centers were set up between 2007 and 2014, and technical guidelines on PND tests were released by the Ministry of Health in 2010. There were a variety of services among centers, and the number of services provided by the three PND centers was far below the target set by the Ministry of Health. There is still limited capacity of human resources, facilities, and equipment in PND centers. Different measures were implemented by hospitals to improve capacity, including counseling.
Conclusions Despite a late start, with government support, PND services in Vietnam have developed quickly. However, to reach the objectives of 15 % of women receiving PND services by 2015 and 50 % by 2020, several actions should be taken to expand the service coverage and capacity of centers.

Keywords Prenatal diagnostic · Services · Availability · Quality · Vietnam

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Introduction

In 2006, the World Health Organization (WHO) estimated that 7.9 million children are born annually with severe congenital or genetic disorders (birth defects), and 94 % of these are in low- or middle-income countries. Over 3.3 million children under 5 years old die each year from birth defects, with the majority of these deaths occurring in low- or middle-income countries (WHO 2006). The factors contributing to these disorders are poor public health prevention measures, advanced maternal age, and customary consanguineous marriages (Alwan and Modell 2003; WHO 2011). When adequate prevention services are in place, about 70 % of these disorders can be treated or avoided (Alwan and Modell 2003; WHO 2006). Families that include an individual with a genetic disorder have a much higher probability of having a child with birth defects and will often seek prenatal counseling and diagnosis (Afroze and Jehan 2014; Sinh and Ngoc 2010).

With advances in genetics and molecular biology, prenatal diagnostic (PND) services are able to provide an improved scientific explanation for fetal developmental abnormalities (Titus and Moodley 2012). The screening tests (maternal serum test and ultrasound) provide a probability of a fetal abnormality, whereas the diagnostic tests (chorionic villus sampling and amniocentesis) can determine with near certainty whether a fetus has a particular condition (Dickerson 2013). Prior to PND services, prenatal counseling must be offered, which requires the practicing obstetrician to be aware of the available options and effective counseling, so patients are able to enter into an informed decision-making process (Zhang et al. 2012).

Vietnam is a lower middle-income country with a population of 90.5 million (Vietnam General Statistics Office 2015). The total fertility rate is 2.09 live births per

woman and there are about 1.6 million newborns per year (Vietnam General Statistics Office 2014). The government is committed to equitable health care for the population as a whole. However, the country lacks an organization that is responsible for the registry or surveillance of birth defects. A few research studies in communities found the rate of birth defects varied from 4.38 to 6.02 % in the period 2008–2012 (Hoang et al. 2013; Dat et al. 2013). More data are available in hospitals that suggest an increasing trend. In the 1960s, the rate of birth defects in the major hospitals of obstetrics and gynecology (OBGYN) was 0.9 %, which increased to 1.7 % in 1986, 2.7 % in 2001, and 5.4 % in 2005 (Hong 2011; Huong NTT 2014). At the national level, the rate is lower at 0.5 % and the mortality rate is 2.3 % (Ministry of Health 2013). In pediatric hospitals/departments, congenital malformation is the leading cause of infant morbidity and mortality, varying between 12.9 and 27.2 %, though many conditions are underdiagnosed because of a lack of physician expertise (Tran et al. 2015; Hong 2011).

In 2007, the Ministry of Health (MOH) started a project of improving quality of life of the population through the development and expansion of a network for prenatal and newborn screening. This included the establishment of two PND centers at the National Hospitals of OBGYN in Hanoi and Tu Du Hospital in Ho Chi Minh City (HCMC). Later, in 2010, a new center in Hue Medical Teaching Hospital was established.

In 2010, the MOH issued Decision 573/QD-BYT on guidelines for prenatal screening and diagnostic testing for pregnant women in obstetric facilities (Ministry of Health 2010). The pregnant women with certain specific conditions were targeted, including those with an advanced maternal age (defined as over 35 years old); a history of spontaneous abortion, birth defects, and neonatal mortality; a family history of chromosomal abnormality, such as Down syndrome or genetic diseases like thalassemia; customary consanguineous marriage; infection with rubella, herpes etc.; and, exposure to drugs or toxins harmful to fetal development. Figure 1 provides the pathways for screening and diagnostic PND services according to MOH guidelines.

Screening tests for chromosomal abnormalities include a combination test, involving serum markers PAPP-A and β-HCG at 11–14 weeks of gestation, along with a nuchal translucency measurement during a general ultrasound scan. Alternatively, women can opt for the triple test (serum marker AFP, β-HCG, estriol) at 14–21 weeks of gestation. Screening for structural abnormalities is offered at between 20 and 24 weeks of gestation if the termination of the pregnancy due to a severe fetal malformation is considered an option for the family.

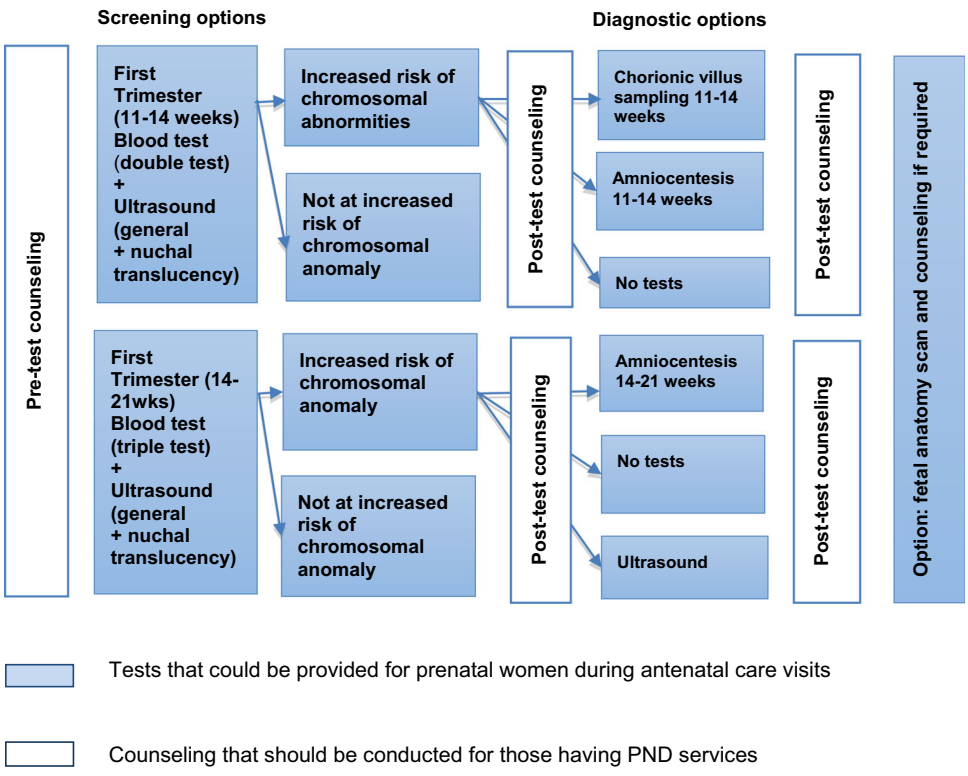

Fig. 1 Pathway for prenatal screening and diagnostic services in Vietnam 2014

In 2011, the MOH issued the National Strategy for Population and Reproductive Health between 2011 and 2020 with the objective of enabling 15 % of pregnant women to receive prenatal diagnostic services by 2015 and 50 % by 2020 (Prime Minister 2011). After almost 7 years since the establishment of PND centers, there is no study on the delivery of PND services in Vietnam, whether or not the objectives of National Strategy are being met. This study aims to provide information on the PND services provided in three major regional PND centers with regards to human resources, available facilities/equipment, and supportive policies.

Methods

The study was conducted from January to June 2014 in three regional PND centers, representing three regions in Vietnam (northern, central and highland, and southern Vietnam) (Fig. 2). Each center operated within a hospital that is responsible for technical support for OBGYN activities in each region. These hospitals were the National Hospital of OBGYN in Hanoi; Hue Medical Teaching University, and Tu Du Hospital.

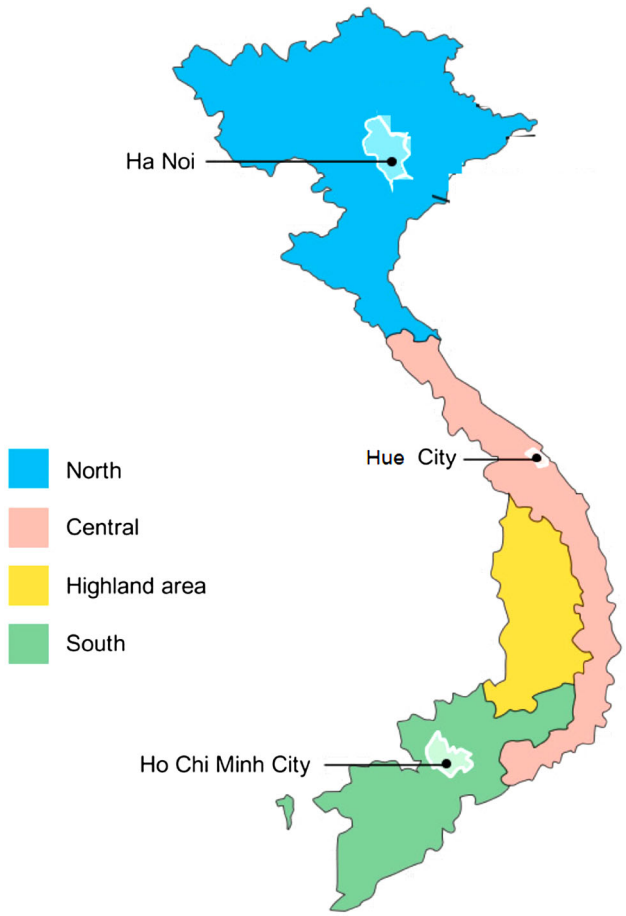

Fig. 2 Map of Vietnam with regional prenatal diagnostic centers

A cross-sectional design was adopted. Two methods of data collection were employed: document reviews and in-depth interviews with key informants.

Purposive sampling was selected. In each center, three health providers with different backgrounds (physician, technician, and midwives) and one hospital manager in charge of PND center were selected. The interview guide was developed to get information on key informants' awareness and experiences in providing PND services. The debriefing interview section was conducted at the end of each day during the fieldwork to review interview records and to plan for improving in the next interviews. A total of 12 interviews were conducted in three hospitals.

Informed consent was obtained from all respondents before the interviews took place and all interviews were audio recorded and transcribed for analysis. Interviewees were two midwives with experience in providing PND services and trained in interview techniques. Each interview lasted 30–50 min and was conducted in Vietnamese in the hospitals.

Relevant documents on PND policy and services at different levels were reviewed, such as MOH Strategy on Population and Reproductive Health 2011–2020, MOH guidelines on PND services, hospitals reports and records on PND facilities, human resources, facilities, equipment and services provided, etc. The inventory form was created to collect information on human resources (number of health personnel and their qualification), facilities, and equipment (types and number of pieces of equipment) in each center.

A framework approach adapted from the WHO's six building blocks for a health system was used to analyze the data (WHO 2007). The data from all sources were continuously triangulated throughout the analysis process, which was conducted by at least two researchers to ensure the validity and reliability of the findings.

Ethical approval (No. 023/2014/YTCC-HD3, dated 03/03/2014) for the study was obtained from the Institutional Review Board of the Hanoi School of Public Health.

Results

The analysis of records of PND services was performed to determine the service provision in three hospitals in 2013. A total of 102,677 PND services, including screening and diagnostic testing with specific genetic tests, are provided across the three PND centers (Table 1). Tu Du Hospital provided the highest proportion of total services (68 %), followed by the National Hospital of OBGYN (25 %) and Hue Medical Teaching Hospital (6 %).

Table 1 Services provided in three regional prenatal diagnostic centers in 2013 in Vietnam

No.	Types of services	National Hospital of Obstetric and Gynecology (Hanoi)	Hue Medical Teaching Hospital	Tu Du Hospital (Ho Chi Minh city)	Total
	Prenatal screening				
1.	Prenatal counseling	2470	224	12,051	14,745
2.	Ultrasound (general and nuchal translucency)	5687	2407	6816	14,910
3.	Biochemical blood tests for chromosomal abnormalities (double test, triple test)	12,737	2225	39,490	54,452
	Prenatal diagnosis				
4.	Chorionic villus sampling (CVS)	202			202
5.	Amniocentesis	1726	156	5973	7855
	Specific tests				
6.	Karyotype	1726	NA	5973	7699
7.	PCR test (QF-PCR, FISH with amniocentesis test)	576	224	NA	800
8.	Single gene disease (thalassemia)	Started	1096 couples	NA	1096
9.	Chromosomal test for couples	913	NA	NA	913
10.	Infectious diseases (rubella diagnosis)	4	NA	1	5
	Total	26,041 (25 %)	6332 (6 %)	70,304 (68 %)	102,677 (100 %)

NA information not available

Table 2 Health personnel in the three regional prenatal diagnostic centers in Vietnam in 2013

No.	Personnel	National Hospital of Obstetric Gynecology (Hanoi)	Hue Medical Teaching Hospital (Hue)	Tu Du Hospital (Ho Chi Minh)
1.	Professors and associate professors	2	5	0
2.	Medical doctors with PhD or master's degree in genetic specialization	4	5	7
3.	Specialists in ultrasound and prenatal diagnostic testing	5	1	14
4.	Obstetricians	3	1	
5.	Health technicians	5	4	12
6.	Nurses and midwives	10	0	16
7.	Other	3	2	4
	Total	32	18	53

The most frequent service provided in all centers is screening tests, including biochemistry blood tests, ultrasound, and counseling. The number of diagnostic services was smaller and the majority of them were amniocentesis. The most frequent specific tests were karyotype.

There is a difference of services across the different hospitals. In terms of screening tests, the number of biochemical tests was highest in the National Hospital of OBGYN and Tu Du Hospital, while the ultrasound services were highest in Hue Medical Teaching Hospital. However, the number of counseling services provided is less than half compared to ultrasound services in National Hospital of OBGYN and Hue Medical Teaching Hospital.

Diagnostic services (amniocentesis) are provided in the three centers, but CVS is only offered in the National Hospital of OBGYN. The specific tests like PCR, DNA, and rubella are only offered at the National Hospital of OBGYN. According to the interviews, all services provided are in accordance with the technical guidelines from MOH. The specificity and sensitivity of all tests are over 90 %. The weekly PND consultation with different experts on difficult cases was available only at the National Hospital of OBGYN. The follow-up of PND cases is not reported in three centers.

Information on human resources is described in Table 2. There are a wide variety of personnel across the three centers. The number of personnel was highest in the PND center in Tu Du Hospital and lowest in the Hue Medical Teaching Hospital. However, the number of qualified specialists was highest in Hue Medical Teaching Hospital,

and the number of genetic ultrasound specialists and medical technicians was highest in Tu Du Hospital.

The limited capacity of human resources in different centers

According to the interviews, only the PND center at the National Hospital of OBGYN has comprehensive service delivery with both screening and diagnostic services supported by laboratory tests. The other two centers are mainly staffed with part-time personnel, with expertise in genetics but not prenatal diagnosis.

> "At this moment, we do not have sufficient human resources in the delivery of such services. Full time [there is] only one person, the other[s] are part time. They have other tasks such as teaching and management duties. So some time there [is] work overload" (Health technician, PND center, Hue Teaching Hospital).

> "Most personnel have not trained in PND… They mainly work based on experience. Most medical doctors are general practitioners with specialization in obstetrics. There is no doctor receiv[ing] training in PND" (Midwife, PND center, National OB/GYN center).

Inadequate facilities and equipment

The inventory of medical equipment that is available in the three centers suggested a lack of equipment in all PND centers.

> "We lack equipment… and the machine[s] are nonstop operating and very quickly worn out…" (Manager, Tu Du Hospital).

The work spaces in some centers are inadequate, which limited the capacity to delivery services in all hospitals.

> "The hospital is facing difficulty in delivery of services due to limited working areas. The center could not provide new technique that meet the needs of people" (Manager, National Hospital of OBGYN).

Different measures implemented to improve the capacity of PND centers

The hospitals recognized that the personnel and medical equipment are the most important factors affecting the delivery of PND services in these centers.

> "I think the most important is the medical equipment and quality of human resource. Those contribute to the quality of services" (Health technician, PND center, Hue's Medical Teaching Hospital).

To improve the capacity of staff, the hospitals provide continuing education for personnel working in these centers to meet their needs.

> "The hospital provided re-training for those working in [the] PND center according to the needs of the center. On-the-job training is the most popular approach here" (Manager, Tu Du Hospital).

Counseling is one of the skills that should be improved, according to the managers.

> "After having results of diagnostic tests, the counseling is important. The counselor should have awareness of screening, diagnostic tests, and be able to counsel the client what to do next... [There should be] more training because no staff has received adequate training on this topic" (Manager, Tu Du Hospital).

In order to improve the condition of the facility, the hospital managers cited decentralization as an option that could help lead to upgrading of facilities and equipment.

> "The socialization is important in [the] PND service. Due to high costs of services, the health insurance is not covered so the costs and therefore socialization is important in upgrading facilities and equipment" (Manager, Hue Medical Teaching Hospital).

Currently, the government funding for health care is declining. Furthermore, PND services are not covered by health insurance programs because of the high costs and patients have to pay themselves. Therefore, the hospitals have to find other sources of funding (socialization) for upgrading facilities and equipment.

Discussion

The establishment of three regional PND centers and promulgation of technical guidelines for PND services provide clear evidence of the government's commitment to the development of PND services, which contribute to improve the quality of life of the population. After 7 years of development, the service availability in three PND centers has reached similar levels to that in other developed countries (Dickerson 2013; Skirton et al. 2014). Nevertheless, with 1.6 million newborns each year, the PND centers should be providing at least 240,000 PND services to reach the target of 15 % of pregnant women by 2015. The number of services provided by the three centers in 2013 was far below the target of PND services in 2015, which suggests the needs to expand the services in Vietnam to meet the needs of communities.

The variety of services among the centers could be attributed to the difference in each center's capacities of human resource, facilities, and equipment. The highest number of services in Tu Du Hospital could be related to the highest number of personnel in this center. The most advanced techniques and tests like CVS, PCA, DNA, and rubella are available only in the National Hospital of OBGYN because only this center has comprehensive service delivery supported by a laboratory. These findings are similar to those in other low-income countries. Factors like facilities, human resources, governance (Wertz and Fletcher 1993; Wonkam et al. 2010), health insurance (Sher et al. 2003), development of new technology, and incentives for students to choose a career in genetics (Paz-y-Mino 2004) are important for PND service provision.

Counseling is supposed to be provided to every pregnant woman as part of the procedure of PND services (Ministry of Health 2010). However, only about half of pregnant women received counseling in the National Hospital of OBGYN and about one-tenth of pregnant women in Hue Medical Teaching Hospital. The findings of this study suggest the need for improvements in counseling services in hospitals. As part of the counseling provided by hospitals, the health service providers should provide patient information about genetic testing, guide patients to an appropriate genetic service, and support patients with the consequences of their choices. This will support women in making an informed decision about the continuation or termination of their pregnancy in the case of a detected screening/diagnostic test abnormality (Titus and Moodley 2012). To make these services available, service providers need to be educated in basic scientific principles of genetics, ethics, and the soft-communication skills and practice associated with genetic counseling. Other suggestions for initiatives could be affiliated with varying levels of training programs, such as a resident-level medical genetics program, or internship training for medical scientists and genetic counselors (Wonkam et al. 2010).

In order to expand the services, the PND centers should plan to develop the new non-invasive prenatal screening tests for detection of parental carrier screening, such as sickle anemia, Tay–Sachs disease, etc., that are already available in other countries (Dickerson 2013). However, with declining government funding for health care services, and policy on decentralization and hospital autonomization in public facilities since 2002 (Le et al. 2015), the needs for mobilization of resources from other sources for upgrading facilities, equipment, and human resources is crucial. Moreover, along with widening service coverage, greater attention should be paid to quality control in order to reduce technical errors and deficiencies (Ibarreta et al. 2004).

In countries like Australia, European countries, the UK, and USA, some parts of screening tests like counseling and ultrasound for high-risk women (in case of advanced maternal age, family history of genetic conditions etc.) are included in the routine antenatal care visits without additional charges (Muggli et al. 2006; Boyd et al. 2008; Qureshi et al. 2006; Vassy 2006). These practices contributed to a significant reduction of Down syndrome and other accrued societal costs associated with overall decreased health expenditures. This suggests the option of including routine screening practices for the most common genetic conditions (such as Down syndrome) into the basic package of standard antenatal care in Vietnam that is covered by health insurance in regions with high birth defects that were affected by Agent Orange during the American War in Vietnam like in the Da Nang and Bien Hoa.

Women in low-income countries often are late in their antenatal care visits, which would limit the applicability of these screening and diagnostic tests. This is because these tests are predominantly relevant and feasible in the first half of pregnancy (Titus and Moodley 2012). Therefore, the PND services should be promoted widely to the community and especially high-risk groups, with emphasis on the benefits of screening and the available time frame for testing.

Conclusion

Despite a late start, PND services in Vietnam have developed quite quickly with government support. Vietnam has seen the establishment of three regional centers and technical guidelines on PND screening and diagnostic tests. However, the number of services provided by the three PND centers studied here was far below the target of 15 % of pregnant women receiving PND services by 2015 and 50 % by 2020. There are still limited human resources, facilities, and equipment in PND centers. Different measures were implemented by hospitals to improve the capacity to provide PND services to the pregnant women, including counseling services.

Although the study has focused on the service provision in three PND centers, the following potential policy implications for improving PND services in Vietnam and other similar settings can be derived from the study:

- The factors important for PND service delivery are facilities, equipment, and personnel.
- Within delivery of PND services, counseling should receive special attention.
- The inclusion of screening practices for Down syndrome into the basic package of standard antenatal care visits in health insurance programs in the high-risk region is recommended.

– The benefits of PND screening should be advocated to the wider community.

Further research should be conducted in the PND centers to estimate the prevalence of birth defects and the cost-effectiveness of PND services.

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Authors' contributions Bui Thi Thu Ha contributed to the conception of this work, co-designed the questionnaire, analyzed data, led drafting and revision of the manuscript. Nguyen Thu Huong contributed to the conception of this work, developing of the study design, co-designed the questionnaire, collected data, and revision of the manuscript. Doan Thi Thuy Duong contributed to cleaning and analyzed data, drafting and revision of the manuscript. All authors have read and approved the final version of the manuscript.

Compliance with ethical standards

No funding was received for this study.
All procedures performed in studies involving human participants were in accordance with ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study. No funding was received in conducting this study.

Conflict of interest All the authors declare that they have no conflict of interest.

References

Afroze B, Jehan F (2014) Pre-natal genetic counseling in a resource limited country–a single center geneticist's perspectives. JPMA 64(9):1008–1011

Alwan A, Modell B (2003) Recommendations for introducing genetics services in developing countries. Nat Rev Genet 4(1):61–68. doi:10.1038/nrg978

Boyd PA et al (2008) Survey of prenatal screening policies in Europe for structural malformations and chromosome anomalies, and their impact on detection and termination rates for neural tube defects and Down's syndrome. Fetal Med. doi:10.1111/j.1471-0528.2008.01700

Dat TQ, Phan TD, NV Toan (2013) Rate of abortion, still births and birth defects in Phu Cat District, Binh Dinh. J Med Res 81(1):81–88

Dickerson C (2013) An overview of prenatal genetic screening and diagnostic testing. N C Med J 74(6):518–521

Hoang T, Nguyen DT, Nguyen PVN, Tran DA, Gillerot Y, Reding R, Robert A (2013) External birth defects in southern Vietnam: a population-based study at the grassroots level of health care in Binh Thuan province. BMC Pediatr 13(67). doi:10.1186/1471-2431-13-67

Hong LT (2011) Congenital malformation rate and the role of ultrasonography in prenatal detection of malformation. J Med Res 74(3):238–244

Huong NTT (2014) Situation and factors related to prenatal diagnosis services in 2 regional centers on prenatal diagnosis in Vietnam 2014. Hanoi School of Public Health

Ibarreta D, Elles R, Cassiman JJ, Rodriguez-Cerezo E, Dequeker E (2004) Towards quality assurance and harmonization of genetic testing services in the European Union. Nat Biotechnol 22(10):1230–1235. doi:10.1038/nbt1004-1230

Le G, Ha BTT, Mirzoev T, Ha NT (2015) Negotiating compliance: the case of autonomous hospitals in Vietnam. Dev Policy Rev 33(3):373–390

Ministry of Health (2010) Minister's of Health: decision on procedures for screening and diagnosis for prenatal and newborn 573/QD-BYT. Medical Publishing House, Hanoi, Vietnam

Ministry of Health (2013) Health statistic yearbook. Medical Publishing House, Hanoi, Vietnam

Muggli EE, McCloskey D, Halliday JL (2006) Health behaviour modelling for prenatal diagnosis in Australia: a geodemographic framework for health service utilisation and policy development. BMC Health Serv Res 6:109. doi:10.1186/1472-6963-6-109

Paz-y-Mino C (2004) Genetic services in Ecuador. Community Genet 7(2–3):137–141. doi:10.1159/000080784

Prime Minister (2011) National strategy on population and reproductive health period 2011-2020 2013/QD-TTg

Qureshi N, Armstrong S, Modell B (2006) GPs' opinions of their role in prenatal genetic services: a cross-sectional survey. Fam Pract 23(1):106–110. doi:10.1093/fampra/cmi088

Sher C, Romano-Zelekha O, Green MS, Shohat T (2003) Factors affecting performance of prenatal genetic testing by Israeli Jewish women. Am J Med Genet A 120A(3):418–422. doi:10.1002/ajmg.a.20047

Sinh NTT, Ngoc ND (2010) Prenatal diagnosis. J Clin Med 48:21–26

Skirton H, Goldsmith L, Jackson L, Lewis C, Chitty L (2014) Offering prenatal diagnostic tests: European guidelines for clinical practice [corrected]. Eur J Hum Genet 22(5):580–586. doi:10.1038/ejhg.2013.205

Titus MJ, Moodley J (2012) Advances in fetal genetic diagnosis and therapy: ethical issues and appropriate technology in cost-restrained countries. Best Pract Res Clin Obstet Gynaecol 26(5):531–540. doi:10.1016/j.bpobgyn.2012.06.004

Tran HT, Doyle LW, Lee KJ, Dang NM, Graham SM (2015) Morbidity and mortality in hospitalised neonates in central Vietnam. Acta Paediatr 104:e200–e205. doi:10.1111/apa.12960

Vassy C (2006) From a genetic innovation to mass health programmes: the diffusion of Down's syndrome prenatal screening and diagnostic techniques in France. Soc Sci Med 63(8):2041–2051. doi:10.1016/j.socscimed.2006.04.032

Vietnam General Statistics Office (2014) Statistical yearbook of Vietnam 2014. Statistics Public House, Ha Noi

Vietnam General Statistics Office (2015) The 1/4/2014 time point population change and family planning survey: major findings. Statistics Public House, Ha Noi

Wertz DC, Fletcher JC (1993) Prenatal diagnosis and sex selection in 19 nations. Soc Sci Med 37(11):1359–1366

WHO (2006) Management of birth defects and haemoglobin disorders. Report of a joint WHO-MARCH of DIMES meeting. Geneva, Switzerland, 17–19 May 2006. WHO, Geneva

WHO (2007) Everybody business: strengthening health systems to improve health outcomes: WHO's framework for action. WHO, Geneva

WHO (2011) Community genetics services. WHO, Geneva

Wonkam A, Muna W, Ramesar R, Rotimi CN, Newport MJ (2010) Capacity-building in human genetics for developing countries: initiatives and perspectives in sub-Saharan Africa. Public Health Genomics 13(7–8):492–494. doi:10.1159/000294171

Zhang H, Ding J, Wang F, Yu L (2012) Attitudes toward genetic diagnosis and prenatal diagnosis of X-linked Alport syndrome in China. Nephrology (Carlton) 17(4):398–401. doi:10.1111/j.1440-1797.2012.01562.x