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Review Article

**NEONATAL SCREENING IN PRIMARY HEALTH CARE IN
SAUDI ARABIA; A SYSTEMATIC REVIEW****Saud Hatem Aman^{1*}, Fawaz Faruqi², Muhammad Abdullah M Almalki³, Manal Mutaib
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Studies, ⁵Al-Iman general hospital, ⁶Taif University, ⁷King Abdulaziz Hospital.**Abstract:**

Background: Neonatal screening can help in the early detection of many disorders in neonates including congenital diseases; however, it still requires increasing efforts to make national protocols for the program especially in Saudi Arabia.

Objective: This study aims at reviewing the literature to evaluate the neonatal screening in primary health care units in Saudi Arabia.

Methods: The literature was reviewed through PubMed database in the duration between 2009 and 2019. Search terms included were a combination of Neonatal, "screening" and "Saudi Arabia". The results were then filtered to include original research articles neonatal screening in primary care units. Selected trials mentioned full details on the performed screening test and its type.

Result: A total of 84 articles were retrieved. Following exclusion of articles on animals and including only trials on humans, 28 articles appeared. A total of six articles were considered as eligible, published between 2009 and 2019 covering a total of 105,074 neonate presented for neonatal screening.

Conclusion: Neonatal screening test can decrease morbidity and mortality in this vulnerable population. The service needs to be applied all over Saudi Arabia, also awareness about the importance of neonatal screening among the Saudi population needs to be increased.

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INTRODUCTION:

Neonatal screening, utilizing biochemical indicators to determine particular congenital disorders [1], is a known healthcare strategy which targets the prompt detection and treatment of diseased neonates so as to decrease neonatal morbidity and mortality [2].

It is a complete scheme of screening, diagnosis, treatment in addition to follow up and education [3]. This system should be organized and applied within all community healthcare units which is usually confronted by some cultural, economic and political issues [4].

Launching neonatal screening in developing nations and gulf area is considered somewhat slow due to various reasons [5]. Although many nations have some obstacles to start neonatal screening, developing nations can have extra constraints regarding poverty, political problems, and geographical restrictions [6].

In spite of these challenges, neonatal screening is an emerging precedence in a wide range of developing nations [7]. Effective neonatal screening programs previously were implemented through efforts exerted by healthcare professionals concerned about improving neonates' lives and their families as well [8].

Usually, such efforts took some years to start. Though some neonatal screening programs were started as governmental facility, these normally were restricted to small nations or even cities [9]. For continuity, neonatal screening should be included in governmental health plans immediately [7,8].

This development usually needed a balancing between many variables including personnel, finance and resources [10]. Attainment of implementing neonatal screening program was mainly due to continuous efforts of ambitious policy makers who aim at acquiring resources as well as knowledge in order to bypass the mentioned obstacles especially in gulf area and Saudi Arabia in particular [4,6].

Therefore, the aim of this study is to examine the current figures for neonatal screening in primary care units in Saudi Arabia through reviewing the medical literature in the past ten years.

METHODOLOGY:

This systemic review of literature was done on PubMed database in the duration between 2009 and 2019, in order to evaluate the neonatal screening programs in primary care units in Saudi Arabia. Search terms included were a combination of "neonatal", "screening" and "Saudi Arabia".

All the titles in addition to abstracts appeared from this search were reviewed thoroughly. The results were then filtered to include original research articles investigating neonatal screening in Saudi Arabia. Additionally, the selected trials mentioned the type of screening test performed. Only trials published in English language were classified as related articles which can be further evaluated in the second step.

The following step was determining the inclusion criteria to choose the studies that will be considered in the systematic review. Abstracts were revised manually to choose the appropriate abstracts to be considered. The inclusion criteria were the presence of sufficient details on the neonatal screening test. Furthermore, only trials recruiting neonates was included.

Furthermore, references of selected trials were revised in order to define any related articles. Finally, the required data sets were collected from the final record of eligible articles and summarized.

Before conducting any study related procedures, institutional approval was obtained. There was no need to obtain consent form as the study is not involving any interventions on patients.

RESULTS:

A total of 84 articles were retrieved by searching *PubMed* using the combination of the three terms "Neonatal", "screening" and "Saudi Arabia". Following exclusion of articles on animals and including only trials on humans, 28 articles appeared.

After searching the abstracts and checking for the eligibility criteria in identified potential abstracts, a total of eight articles [12-17] were considered as eligible to be included in our systematic review that were published between 2009 and 2019 covering a total of 105,074 neonate presented for neonatal screening.

Out of the six included trials, two studies [13,15] evaluated screening for different group of endocrine disorders, one trial [12] examined screening for glucose 6 phosphate dehydrogenase deficiency, one study [14] examined hearing disorders, one study [16] investigated neonatal diabetes and one study [17] discussed screening for thyroid disorders in neonates .

Turning to study design, three studies had a retrospective design [12, 13, 15] while the other three studies had a prospective design [14,16,17] . Additionally, all the included studies used blood samples except for two studies [12,17] that used umbilical cord samples in addition to blood samples and Alyami et al [14] that was a non-interventional study that used a self-administered questionnaire. The included trials are discussed in details in table 1.

Author(s)	Year	Study design	Sample size	Type of screening test	Type of sample used	Objective	Result
Alsai et al [12]	2017	Retrospect-ive cross sectional	8139	glucose-6-phosphate dehydrogen-ase deficiency	cord and peripheral blood samples	To determine the incidence and gender distribution of G6PD deficiency, and compare the results of cord against peripheral blood in identifying G6PD deficiency in neonates using quantitative enzyme activity assay	There is no difference between cord and peripheral blood samples in discriminating between G6PD deficient and non-deficient neonates. A significantly higher mean peripheral G6PD assay reinforces the use of cord blood for neonatal screening since it has substantially low false negative results.
Alfadhel et al [13]	2017	Retrospective	743	16 disorders from a selective list of inborn errors of metabolism and endocrine disorders.	Heel prick dry blood spot	To address the implementation of the National Newborn Screening Program in Saudi Arabia and stratify the incidence of the screened disorders.	The article highlights the experience of the NBS Program in Saudi Arabia and providing data on specific regional incidences of all the screened disorders included in the programme; and showed that the incidence of these disorders is one of the highest reported so far worldwide.
Alyami et al [14]	2016	Descriptive quantitative, prospective study	60	Hearing	Interviews (Questionnaires)	To determine the status of early intervention services provided to children who are deaf or hard of hearing and their parents/caregivers from birth to five years of age at two main state hospitals in Riyadh, Saudi Arabia, based on their parents' perceptions.	Limited services of detection and intervention for deaf or hard of hearing children and residential area of participants are likely to be barriers to early access to intervention services. It is proposed that the benefits of neonatal screening accompanied by appropriate early intervention services should be made available in all regions throughout Saudi Arabia.
Al Jurayyan [15]	2012	Retrospective	100	Different endocrinal disorders	blood	To present the pattern of endocrinopathy seen in a specialized clinic	The frequency and pattern of endocrine disorders indicate the need for well-trained neonatologists and pediatricians to improve the health of the population.

Habeb et al [16]	2011	Prospective	17	Permanent neonatal diabetes mellitus (PNDM)	blood	To define the incidence, genetic etiology, and clinical phenotype of PNDM in Al-Madinah region, northwest Saudi Arabia.	Al-Madinah region has the highest reported incidence of PNDM worldwide. In this region with high consanguinity, PNDM has different genetic etiology and in the majority of cases presents as a part of rare familial autosomal-recessive syndrome rather than in isolation.
Abdul-jabbar, et al [17]	2009	Prospective	96015	total thyroxin	Umbilical cord blood	To assess the performance of the use of umbilical cord blood for screening of primary congenital hypothyroidism in the Saudi Aramco Medical Services Organization newborn thyroid screening program.	The use of cord blood thyroxin is a valid screening strategy for primary congenital hypothyroidism. It meets the metabolic screening demands of early discharge policy and guarantees screening all newborns delivered in the hospital

DISCUSSION:

Neonatal Screening tests are routinely performed in developed countries. It has shown to decrease morbidity and mortality. After launching the neonatal screening program in Saudi Arabia, the screening is now available in many primary health care units in the kingdom. However, neonatal screening is still absent in some regions also some disorders are still not included in the program.

The present review examined the medical literature to describe the figures of neonatal screening in primary care units in Saudi Arabia. This will be a guiding tool for decision makers for the future plans and protocols of the national neonatal screening program.

The review included six trials [12-17] from *Pubmed* database published during the past ten years. All the studies discussed neonatal screening programs in Saudi Arabia for a wide range of disorders. It is observed that most of the screening programs focus on early detection of endocrine and hormonal disorders. On the other hand, sensory disorders (i.e. deafness, blindness..etc.) need more recognition and inclusion in the screening programs.

The limited screening for sensory disorders like deafness was raised by Alyami et al [14]. This small, yet prospective study investigated the perception of parents and caregivers toward the early interventions done to deaf neonates. Alyami et al [14] used self-administered questionnaires to know the opinion of parents.

The study observed that the services provided for early detection and dealing with deaf or children with impaired hearing is very limited. Alyami et al [14] also recommend to implement neonatal screening with intervention services for hearing disorders all over the kingdom.

Turning to hormonal disorders, Abduljabbar et al [17] investigated using cord blood to screen for primary congenital hypothyroidism through total thyroxin levels. The test was found to be reliable and convenient for early detection of this congenital program in all delivered newborns in the study site and recommended to expand their experience in other areas in Saudi Arabia.

Additionally, another study that used cord blood for screening was Alsai et al [12]. The study compared the use of umbilical cord blood versus peripheral blood sample to screen for glucose 6 phosphate dehydrogenase deficiencies in 8139 neonate.

Alsai et al [12] revealed that there was no significant difference between both samples in differentiating between glucose 6 phosphate dehydrogenase deficient and non-deficient neonates. However, umbilical cord blood samples showed low false negative results

compared to peripheral blood samples. It is worth to mention that the design of this study was retrospective in spite of the large sample size.

Moreover, two studies examined screening of different types of endocrine disorders. Alfadhel et al [13] and Al Jurayyan et al [15] investigated a wide range of screened disorders in neonates as part of the national newborn screening program implemented in Saudi Arabia.

Both Alfadhel et al [13] and Al Jurayyan et al [15] insisted on the increased incidence of the metabolic disorders among newborns in Saudi Arabia that was revealed by the data gathered from the program and proposed the urgent need for well-trained physicians to deal with these common cases.

The increased incidence of endocrine problems in neonates in Saudi Arabia was also highlighted by the small prospective study of Habeb et al [16] which examined the incidence of permanent neonatal diabetes mellitus. Habeb et al [16] used blood samples to screen for the disease. The study showed that Al Madinah Al Monoura showed the highest incidence worldwide for permanent neonatal diabetes mellitus where this finding should be considered seriously to develop action plan to solve this problem.

Finally, to our knowledge, this is the first systemic review to investigate the situation of neonatal screening in primary care units all over Saudi Arabia through an updated examination of the medical literature. Further care should be given for developing interventions in order to treat the detected disorders during the screening.

CONCLUSION:

Neonatal screening tests are crucial for the early detection of congenital problems which will help in decreasing morbidity and mortality. However the service is still not applied in all centers in Saudi Arabia. More efforts should be done to include furthermore tests in the neonatal screening and the awareness of the community about the importance of this investigation. Further studies are required to investigate the attitudes and level of knowledge of the Saudi population on the importance of neonatal screening test.

REFERENCES:

1. Mechtler TP, Stary S, Metz TF, De Jesús VR, Greber-Platzer S, Pollak A, Herkner KR, Streubel B, Kasper DC. Neonatal screening for lysosomal storage disorders: feasibility and incidence from a nationwide study in Austria. *The Lancet*. 2012 Jan 28;379(9813):335-41.

2. Padilla CD, Krotoski D, Therrell Jr BL. Newborn screening progress in developing countries—overcoming internal barriers. In *Seminars in perinatology* 2010 Apr 1 (Vol. 34, No. 2, pp. 145-155). WB Saunders.
3. Al-Rowaily MA, AlFayez AI, AlJomiy MS, AlBadr AM, Abolfotouh MA. Hearing impairments among Saudi preschool children. *International journal of pediatric otorhinolaryngology*. 2012 Nov 1;76(11):1674-7.
4. Therrell Jr BL, Padilla CD. Barriers to implementing sustainable national newborn screening in developing health systems. *International Journal of Pediatrics and Adolescent Medicine*. 2014 Dec 1;1(2):49-60.
5. Bardakdjian-Michau J, Bahuau M, Hurtrel D, Godart C, Riou J, Mathis M, Goossens M. Neonatal screening for sickle cell disease in France. *Journal of Clinical Pathology*. 2009 Jan 1;62(1):31-3.
6. Thuret I, Sarles J, Merono F, Suzineau E, Collomb J, Lena-Russo D, Levy N, Bardakdjian J, Badens C. Neonatal screening for sickle cell disease in France: evaluation of the selective process. *Journal of clinical pathology*. 2010 Jun 1;63(6):548-51.
7. Hamamy H, Bittles AH. Genetic clinics in Arab communities: meeting individual, family and community needs. *Public Health Genomics*. 2009;12(1):30-40.
8. Italia Y, Krishnamurti L, Mehta V, Raicha B, Italia K, Mehta P, Ghosh K, Colah R. Feasibility of a newborn screening and follow-up programme for sickle cell disease among South Gujarat (India) tribal populations. *Journal of medical screening*. 2015 Mar;22(1):1-7.
9. Jastaniah W. Epidemiology of sickle cell disease in Saudi Arabia. *Annals of Saudi medicine*. 2011 May;31(3):289.
10. Almogren A. Antenatal screening for *Toxoplasma gondii* infection at a tertiary care hospital in Riyadh, Saudi Arabia. *Annals of Saudi medicine*. 2011 Nov;31(6):569.
11. Al Hosani H, Salah M, Osman HM, Farag HM, El Assiouty L, Saade D, Hertecant J. Expanding the comprehensive national neonatal screening programme in the United Arab Emirates from 1995 to 2011.
12. AlSaif S, Ponferrada MB, AlKhairy K, AlTawil K, Sallam A, Ahmed I, Khawaji M, AlHathlol K, Baylon B, AlSuhaihani A, AlBalwi M. Screening for glucose-6-phosphate dehydrogenase deficiency in neonates: a comparison between cord and peripheral blood samples. *BMC pediatrics*. 2017 Dec;17(1):159.
13. Alfadhel M, Al Othaim A, Al Saif S, Al Mutairi F, Alsayed M, Rahbeeni Z, Alzaidan H, Alowain M, Al-Hassnan Z, Saeedi M, Aljohery S. Expanded newborn screening program in Saudi Arabia: incidence of screened disorders. *Journal of paediatrics and child health*. 2017 Jun;53(6):585-91.
14. Alyami H, Soer M, Swanepoel A, Pottas L. Deaf or hard of hearing children in Saudi Arabia: Status of early intervention services. *International journal of pediatric otorhinolaryngology*. 2016 Jul 1;86:142-9.
15. Al Jurayyan NA. Spectrum of endocrine disorders at the Paediatric Endocrine Clinic, King Khalid University Hospital, Riyadh, Kingdom of Saudi Arabia. *Journal of Taibah University Medical Sciences*. 2012 Dec 1;7(2):99-103.
16. Habeb AM, Al-Magamsi MS, Eid IM, Ali MI, Hattersley AT, Hussain K, Ellard S. Incidence, genetics, and clinical phenotype of permanent neonatal diabetes mellitus in northwest Saudi Arabia. *Pediatric diabetes*. 2012 Sep;13(6):499-505.
17. Abduljabbar M, Shahri AA, Afifi A. Is umbilical cord blood total thyroxin measurement effective in newborn screening for hypothyroidism?. *Journal of medical screening*. 2009 Sep;16(3):119-23.