

## Nurses' Performance and Knowledge Regarding Newborn Screening Program for Congenital Hypothyroidism, EL-Behaira Governorate

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### ABSTRACT

**Background:** Nurses have a major role in caring for congenital hypothyroidism (CH) neonates in the pre-analytic phase of the Newborn Screening Program (NSP) as well as at the post-analytic phase. **Objectives:** To assess performance of nurses working in the pre-analytic phase of the Egyptian NSP for CH at Kafr El-Dawar Health District, El-Behaira Governorate and to assess their knowledge regarding this program before and after implementation of educational sessions. **Methods:** Cross-sectional and quasi-experimental designs were used to conduct the study in 39 health units, representing all health units in Kafr El-Dawar health district, and included 122 nurses working in these units. Observational checklist was used to assess their screening performance during collection of samples and their adherence to the program guidelines. The Knowledge was assessed before and after the application of an educational program using knowledge assessment sheet. **Results:** Adherent nurses' performance was observed at all health centres (100%) regarding the following items: the use of appropriate filter paper in collecting the samples; the accuracy in writing cards information; disinfection of the heel; putting the used lancet in the safety box and sending sampling cards to lab in the same day (5 items out of 20 items). On the other hand, washing hands before every sampling was not done in 100% of observations. The lancet was used in the appropriate site in nearly two thirds of observations (74.6%). The sample cards were kept in its special rack in nearly 73.8% of observations. The screening cards were put in its envelope after drying in 81.1% of observations. Health education of mothers about CH in general and CH complications in particular were done with only 57.4% and 28.7% of cases respectively. It was not done about the symptoms of CH in 100% of the observations. There was a statistically significant improvement in nurses' Knowledge after the educational program. **Recommendations:** Continuous education programs should be mandatory for all nurses providing pre-analytical phase services of NSP for CH. In addition, adequate supervision, guidance and regular feedback by head nurses as well as availability of clinical protocols and guidelines are greatly needed to improve nurse's performance. To facilitate implementing the guidelines by nurses, adequate infection control materials should be available in units providing the service.

**Key words:** Congenital hypothyroidism (CH), knowledge, Newborn Screening Program (NSP), nurses' performance, pre-analytical phase

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## INTRODUCTION

Congenital hypothyroidism (CH) is a treatable deficiency of the thyroid hormone that causes severe mental retardation and growth deficiency if it is not detected and treated early.<sup>(1-3)</sup> The term 'newborn screening' is used to describe various types of tests that are done during the first few days of a newborn's life.<sup>(2)</sup> The goal of newborn screening is to detect CH and begin treatment before the infant reaches one month of age. Studies show that by detecting CH at birth or shortly thereafter, and by beginning thyroid replacement therapy with L-thyroxin within the first few weeks of life, hypothyroid infants can be expected to grow and develop normally with only minor problems.<sup>(2,4,5)</sup>

Newborn screening is not just a laboratory test. Newborn screening has evolved into a system that relies on smooth integration of the efforts of a number of individuals and processes. This newborn screening system is comprised of six essential components namely; education (health professionals,

parents, the general public and politicians); screening (proper timing and specimen collection, transport and laboratory testing); early follow-up (abnormal test notification, tracking and confirmatory testing); diagnosis (clinical and biochemical evaluation); management (counselling, treatment monitoring and long term follow-up); Evaluation (outcome monitoring and quality assurance throughout the system).<sup>(2,3,6)</sup>

In general, quality evaluation is only applied to the pure laboratory analytical phase of newborn screening laboratory tests. Less attention is given to the pre-analytical phase (e.g. timely sampling, maximum coverage) and the post-analytical phase.<sup>(7)</sup> Nurses have a major role in caring for CH neonates in the pre-analytic phase of the Newborn Screening Program (NSP) as well as at the post analytic phase.<sup>(5,8)</sup> Pre-analytical processes include reviewing and monitoring any activity occurring prior to testing the specimen.

The present study aimed to assess

performance of nurses working in the pre-analytical phase of the Egyptian NSP for CH at Kafr El-Dawar Health District, El-Behaira Governorate. Also, the study aimed to assess knowledge of nurses regarding this program before and after implementation of educational sessions.

## **MATERIALS AND METHODS**

### **Study setting:**

This study was conducted at Kafr El-Dawar Health District and included all health units applying neonatal screening service for CH (39 health units). These health units were categorized into 3 health offices, 3 Maternal and Child Health (MCH) centres and 33 rural family health units. The selection of Kafr El-Dawar Health District was based on three reasons. First, it is considered the largest district at El-Behaira Governorate with the highest number of health units (39) and the highest population density among the other 15 districts of El-Behaira. Second, geographically it is the most adjacent district to Alexandria Governorate, allowing the representation of

both rural and urban population in the sample.

Third, the highest number of nurses working in El-Behaira Governorate is represented at Kafr El-Dawar Health District (122 nurses in NSP for CH).

### **Study design:**

Cross-sectional and quasi-experimental approaches were used in this study. The cross-sectional design was used to assess the performance of nurses during samples collection while, the quasi-experimental design was used to assess nurses' knowledge about the NSP before and after the implementation of an educational program.

### **Study sample:**

All nurses working at Kafr El-Dawar Health District and collecting newborn screening samples for CH (122 nurses distributed upon 39 health units in the indexed district) were acquainted with the aims of the study and assessed before and after the application of an educational program using the knowledge assessment sheet. The nurses (122 nurses) were formally informed through Kafr El-Dawar

health officer to attend monthly at the same time in Directorate of Health Affairs for the program fulfillment.

All health units in Kafr El-Dawar Health District applying CH screening procedure (39 health units) were visited and evaluation of nurses' performance was done separately at each unit using the observational checklist.

#### **Data collection:**

Data was collected over a period of 4 months starting at August 2010 to November 2010 using the following tools:

##### **1) Observational checklist:**

It was designed by the researcher based on The Egyptian Ministry of Health and Population (MOHP) guidelines for NSP for CH.<sup>(3,9,10)</sup> This checklist was used to assess the nurses' screening performance and their adherence to the program guidelines during samples collection. Also, nurses were observed while conducting health education for mothers of screened newborns. This observational checklist included 20 items (Table 1).

Each nurse was observed separately at the health unit where she works. It is important to mention that the observations were done before the application of the knowledge assessment sheet (i.e. before the pre-test or implementation of the educational program). Each activity was assigned score of 1 if done and 0 if not done.

##### **2) Self administered questionnaire:**

It was designed by the researcher according to the policy of the Egyptian MOHP for NSP for CH for the year 2002. It included 8 headings with 25 questions (true or false) to assess nurses' knowledge about definition and causes of CH, treatment type and duration, errors during collecting samples, sending samples to lab in the same day and hand washing before sample collection.

In each unit, randomly selection of one nurse was done to be observed while collecting the sample for one newborn so the number of observation is similar to the number of nurses 122.

Scoring system of nurses' knowledge was

developed by the researcher after reviewing related literature.<sup>(9,11)</sup>

### **Intervention program:**

An educational program was developed by the researcher that aimed to improve nurses' knowledge about CH and their performance of neonatal screening. The intervention was applied in three sessions for nurses as follows:

- The first session took one hour and included pre-test assessment of participant nurses.
- The second session included the educational component of the program and it took two hours. Various teaching methods were used including lectures, group discussion and demonstrations on power point viewer. The educational material included information related to steps of CH samples collection, the common practice errors and health education of mothers about CH and its treatment.
- Third session included post-test assessment of the nurses who attended

the previous two sessions and it took one hour. It was done one month after program implementation.

All indexed nurses were gathered on 3 occasions at the administration office of Kafr El-Dawar health office with the attendance of the supervision team in the health district (4 doctors and 8 head nurses). The presence of monthly formal appointment to all nurses collecting CH samples at Kafr El-Dawar Directorate of Health Affairs facilitated the success of the educational program sessions. There was complete commitment from both; supervision team at Kafr El-Dawar health office and indexed nurses who attended the three sessions (122 nurses). Evaluation of the educational program success was based on the improvement of nurses' knowledge scores. Each answer was assigned score of 2 if correct and 0 if incorrect.

The total knowledge score was classified as:

- Poor knowledge if the score was < 50% (i.e. less than score 25).
- Fair knowledge if the score ranged from

50% – 74% (i.e. score ranged from 25– 36)

- Good knowledge if the score was  $\geq$  75% (i.e. score 37 and more)

#### **Pilot study:**

A pilot study was done on 8 nurses (distributed on three randomly selected health units, affiliated to Kafr El-Dawar Health District, namely El-Wastania, El-Omara and King Osman) to test clarity and practicability of the tool. Necessary modifications were done. The results of the pilot study were included in the final results.

#### **Data analysis:**

The collected data were revised, coded and computed. Data was then transferred to Statistical Package for Social Sciences (SPSS). Data was analyzed using PC with SPSS version 13.0 and Epi-info program version 6. Statistical analysis included frequency, percentages, cross tabulation, mean, standard deviation, chi square and one way analysis of variance (ANOVA). The 0.05 level was used as the cut off value for

statistical significance.

#### **Ethical considerations:**

The anonymity of participants and confidentiality of their responses was assured. Their consent to participate in the study was taken. The nurses were informed that their performances would be observed, but they did not know the items to be evaluated or the time of observation.

#### **RESULTS:**

Table 1 shows the distribution of nurses collecting samples in the NSP for CH according to their adherence to program guidelines at Kafr El-Dawar Health District. Adherent nurses' performance was observed in all health centres (100%) regarding the following items: the use of an appropriate filter paper in collecting samples, the accuracy in writing card information, disinfection of the heel, putting the used lancet in the safety box and sending sampling cards to lab on the same day (5 items out of 20 items). On the other hand, washing hands before every sampling was not done in 100% of

observations. The use of gloves during sampling was found in only 58.2% of observations and it was changed with every sample in 27.2% of observations. The lancet was used in the appropriate site in nearly three fourth of observations (74.6%). The sample cards were kept in its special rack in 73.8 % of observations. The cards were left to dry at room temperature in 76.2% and its contamination was avoided in 72.6% of observations. The screening cards were put in their envelope after drying in 81.1% of observations. Health education of mothers about CH in general was done in 57.4% of cases, while that related to complications was done in only 28.7% of case. Educational messages related to symptoms of CH were absent in 100% of observations.

**Table 1. Distribution of nurses collecting samples in the NSP for CH according to their adherence to program guidelines at Kafr El-Dawar Health District (2010)**

| Performance items (n =122)                         | Adherent        |      | Not adherent |      |
|--|-----------------|------|--------------|------|
|  | No.             | %    | No.          | %    |
| The use of appropriate filter paper                | 122             | 100  | 0            | 0    |
| Accuracy in writing card information               | 122             | 100  | 0            | 0    |
| Washing hands before every sampling                | 0               | 0    | 122          | 100  |
| Use of gloves during sampling                      | 71              | 58.2 | 51           | 41.8 |
| Changing gloves every time                         | 33              | 27.2 | 89           | 72.8 |
| Disinfection of the heel                           | 122             | 100  | 0            | 0    |
| Use of lancet in appropriate place                 | 91              | 74.6 | 31           | 25.4 |
| Leaving the first blood drop                       | 109             | 89.3 | 13           | 10.7 |
| Correct sampling technique                         | 98              | 80.3 | 24           | 19.7 |
| Putting sample cards in its rack                   | 90              | 73.8 | 22           | 26.2 |
| Leaving screening cards to dry at room temperature | 93              | 76.2 | 19           | 23.8 |
| Putting the used lancet in the safety box          | 122             | 100  | 0            | 0    |
| Avoiding contamination of screening cards          | 89              | 72.9 | 33           | 27.1 |
| Putting screening cards in its envelope            | 99              | 81.1 | 23           | 18.9 |
| Sending sampling cards to lab in the same day      | 122             | 100  | 0            | 0    |
| Health education about what is CH                  | 70              | 57.4 | 52           | 42.6 |
| Health education about complication of CH          | 35              | 28.7 | 87           | 71.3 |
| Health education about the symptoms of CH          | 0               | 0    | 122          | 100  |
| Health education about treatment of CH             | 57              | 46.7 | 65           | 53.3 |
| Health education about the early treatment         | 17              | 13.9 | 105          | 86.1 |
| <b>Total score<sup>a</sup> (mean ± SD)</b>         | <b>14 ± 4.5</b> |      |              |      |

NSP, newborn screening program; CH, congenital hypothyroidism

<sup>a</sup> Total performance score = 20

Table 2 shows nurses' knowledge about CH and procedures of sample collection before and after the educational program at Kafr El-Dawar Health District. The table reveals statistically significant ( $P \leq 0.05$ ) improvements in nurse's knowledge regarding all items except for sample collection (sending samples to central laboratory on the same day of collection). The items that has improved significantly were related to definition, causes, and treatment of CH as well as items related to sample collection namely; hand washing and drying of the filter paper.

Table 3 shows the distribution of nurses according to their CH related knowledge score before and after the educational program. This noticed improvement in knowledge score was in the form of increased percentage of nurses recording good scores from 2.4% in the pre-test to 16.4% in the post-test and decreased percentage of those with poor scores from 34.4% in the pre-test to reach 9.8% in the post-test. These differences were statistically significant ( $p=0.001$  and  $0.0021$  respectively).

**Table 2. Nurses' knowledge about CH and procedures of sample collection before and after the educational program (Kafr El-Dawar Health District, 2010)**

| Nurses' knowledge  | Pre test |      | Post test |      | $\chi^2$<br>P-value |
|--|----------|------|-----------|------|---------------------|
|  | No.      | %    | No.       | %    |                     |
| <b>Definition of CH:</b>   |          |      |           |      |                     |
| Thyroid hormone Deficiency <sup>(a)</sup>                                      | 99       | 81.0 | 122       | 100  | 0.001**             |
| Thyroid hormone excess <sup>(b)</sup>  | 23       | 29.0 | 0         | 0    | 0.001**             |
| <b>Causes of CH:</b>   |          |      |           |      |                     |
| Genetic causes <sup>(a)</sup>  | 20       | 16   | 122       | 100  | 0.0017**            |
| Mother drug intake <sup>(a)</sup>  | 60       | 49.2 | 109       | 89.3 | 0.046*              |
| Mother's age <sup>(b)</sup>  | 14       | 11.5 | 89        | 72.9 | 0.004**             |
| Iodine deficiency <sup>(a)</sup>   | 10       | 8.2  | 111       | 90.9 | 0.027*              |
| Unknown cause <sup>(b)</sup>   | 18       | 14.7 | 15        | 12.3 | 0.112               |
| <b>Drug of treatment:</b>  |          |      |           |      |                     |
| Eltroxine tablet <sup>(a)</sup>  | 97       | 79.5 | 122       | 100  | 0.519               |
| Thyroid hormone injection <sup>(b)</sup>                                       | 25       | 20.5 | 0         | 0    | 0.068               |
| <b>Treatment starting time:</b>  |          |      |           |      |                     |
| As early as possible <sup>(a)</sup>  | 27       | 22.1 | 113       | 92.6 | 0.0021**            |
| During first 12 days <sup>(a)</sup>  | 58       | 47.5 | 6         | 4.9  | 0.001**             |
| During first 2 months <sup>(b)</sup>   | 37       | 30.3 | 3         | 2.4  | 0.001**             |
| <b>Duration of treatment:</b>  |          |      |           |      |                     |
| Lifelong <sup>(a)</sup>  | 12       | 9.8  | 115       | 94.2 | 0.0175*             |
| For one month <sup>(b)</sup>   | 39       | 31.9 | 0         | 0    | 0.01*               |
| For one year <sup>(b)</sup>  | 71       | 58.2 | 7         | 5.7  | 0.001**             |
| <b>Hand washing:</b>   |          |      |           |      |                     |
| Should be done before every sample <sup>(a)</sup>                              | 13       | 10.6 | 118       | 96.7 | 0.0031**            |
| Before first sample only <sup>(b)</sup>  | 89       | 72.9 | 4         | 3.3  | 0.001**             |
| Not needed at all <sup>(b)</sup>   | 10       | 8.5  | 0         | 0    | 0.793               |
| <b>Sample collection :</b>   |          |      |           |      |                     |
| Collected sample should be sent to central lab on the same day. <sup>(a)</sup> | 120      | 98.4 | 122       | 100  | 0.420               |
| Send sample on the next day to central laboratory <sup>(b)</sup>               | 2        | 1.6  | 0         | 0    | 0.089               |
| <b>The filter paper :</b>  |          |      |           |      |                     |
| Dry by exposure to air <sup>(b)</sup>  | 39       | 31.9 | 13        | 10.6 | 0.051*              |
| Dry by blowing <sup>(b)</sup>  | 15       | 12.3 | 4         | 3.4  | 0.671               |
| Dry by hand shaking <sup>(b)</sup>   | 51       | 41.0 | 0         | 0    | 0.0001**            |
| Air dry at its special rack <sup>(a)</sup>                                     | 17       | 14.9 | 105       | 86.0 | 0.0017**            |

CH, congenital hypothyroidism

<sup>(a)</sup>True knowledge <sup>(b)</sup>False knowledge\*Significant at  $p \leq 0.05$ \*\*Significant at  $p < 0.01$

**Table 3. Distribution of nurses according to their CH related knowledge<sup>(a)</sup> score before and after the educational program (Kafr El-Dawar Health District, 2010).**

| Knowledge score | Pre-test (n=122) |      | Post-test (n=122) |      | $\chi^2$<br>P-value |
|-----------------|------------------|------|-------------------|------|---------------------|
|                 | No.              | %    | No.               | %    |                     |
| Good            | 3                | 2.4  | 20                | 16.4 | 0.001*              |
| Fair            | 77               | 63.2 | 90                | 73.8 | 0.251               |
| Poor            | 42               | 34.4 | 12                | 9.8  | 0.0021*             |

<sup>(a)</sup> Included: definition, causes and treatment of congenital hypothyroidism (CH) and procedures of sample collection

\* Significant at  $p$ -value<0.01

## DISCUSSION

Thyroid hormones have been shown to be absolutely necessary for foetal brain development. Screening for thyroid hormone level in the first week of life is extremely important to identify infants with CH. Worldwide screening programs have been successful in decreasing childhood mental and physical retardation related to CH by early detection, treatment and proper nursing intervention.<sup>(12)</sup>

In the current study, health education of mothers about CH in general was done in only 57.4% of cases and in 28.7% of cases it was done about its complications. It was not done about the symptoms of CH in 100% of observations. However, there is

no previous study of note that has evaluated the NSP for CH at El-Behaira to compare our findings with.

A study conducted in the United States concluded that nurses who work with mothers and infants need to be aware of the laws and policies regarding newborn screening, become familiar with the conditions screened, their inheritance pattern, and their early symptoms. The study also emphasized that they should understand what parents need to be told so that they become able to make informed decisions about their newborns.<sup>(14)</sup> This finding supports the hypothesis of the importance of the educational program

related to health problems on nurses' performance,<sup>(15)</sup> and reflects the impact of training courses that enhance nurses' technical knowledge and skills.<sup>(16)</sup>

The observation of nurses' performance during collection of samples revealed defect in adherence to guidelines of MOHP policy regarding hand washing before every sample collection, changing gloves before every sample, mothers' health education about symptoms and treatment of CH. In observational studies of the adherence of healthcare workers to recommended hand hygiene procedures, it was revealed that hand hygiene adherence was poor, with mean baseline rates of 5%-81% (overall average 40%).<sup>(17,18)</sup> The present study raises questions about possible barriers to hand washing before each sample collection. This issue could be investigated using qualitative methods such as focus groups or nurses' in-depth interviews.

The American academy of pediatrics recommended that the filter paper spots

should not be handled, placed on wet surfaces, or contaminated by coffee, milk, or any other substances.<sup>(1)</sup> Scoring of nurses' performance during screening for CH showed that 72.9% of them avoided contamination of filter paper, while 27.1% didn't. These findings support the hypothesis that an educational program related to health problems impact health knowledge and care, and it is easier to modify specific knowledge than to change attitude or behaviour during a limited time.<sup>(16)</sup>

Nurses' knowledge showed marked improvement after the educational program where 22.1% of nurses responded correctly at the pre-test compared to 92.6% at post-test.

While, 79.3% of nurses in the current study knew the treatment of CH before the implementation of the educational program, all of them did in the post-test. Eltroxine is the drug of choice which was mentioned by all nurses in the post-test. The British Paediatric association has suggested a series of outcome measures for child health. One of them is about "the ages at

which all children with CH begin their treatment". Failure to start treatment before the age of one month should be treated as a sentinel event. Performance up to this standard has to be monitored at district level within the national NSP.<sup>(19)</sup> In the present study only 22.1% of nurses in the pre-test answered the question about the age of starting treatment correctly compared to 92.6% at post-test.

## CONCLUSION

The observation for nurses' performance during collection of samples revealed defect in adherence to guidelines of MOHP policy including hand washing before every sample collection, changing gloves before every sample, health education about symptoms of CH, health education about treatment of CH, mothers' education about CH (0%, 57.4%, 28.7% and 0% respectively). While there was complete adherence (100%) as regard presence of safety boxes, putting used lancet in the safety boxes, accuracy in writing information and sending collected samples to

lab in the same day. The mean score of performance of nurses was  $14 \pm 4.5$  (the total score for observational checklist was 20 grades). Nurses' knowledge was improved after the educational program as 65.6% of nurses had good and fair knowledge before the program, while the majority of them (90.2%) had fair and good knowledge after the program.

## RECOMMENDATIONS

There is a need for continuous quality assessment and quality management for National Screening Program at El-Behaira governorate in order to improve knowledge and performance of health workers. Educational program should be mandatory and continuous for nurses who are collecting samples for NSP for CH. In addition, adequate supervision, guidance and regular feedback by head nurses as well as availability of clinical protocols and guidelines are greatly needed to improve nurse's performance.

Provision of the health units collecting samples for CH with adequate infection

control materials as latex gloves, alcohols, lancets and cotton facilitates implementing the guidelines by nurses.

Finally, establishing a discipline to be followed in all health units so that CH sample collection should be done in a room where a water source is available would facilitate nurses' hand washing practice.

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