



ORIGINAL ARTICLE

Evaluation of Preschool Screening Program in the Kingdom of Bahrain: A Survey in Primary Healthcare Centers

Muna Al Mohri^{1*}, Hala Al Asoomi², Batool Hasan³

¹Consultant Family Physician, Chief of Mother and Child Health Services in Primary Healthcare Centers.

²Consultant Family Physician in Primary Healthcare Centers

³Family Physician in Primary Healthcare Centers

*Corresponding author:

Dr. Muni Al Mohri, Consultant Family Physician, Chief of Mother and Child Health Services in Primary Healthcare Centers, Bahrain; Tel. No.: (+973)-39676748; Email: MMohri@health.gov.bh

Received date: October 13, 2021; **Accepted date:** April 06, 2022; **Published date:** September 30, 2022

Abstract

Background: Preschool screening is one of the services provided by primary healthcare centers, in the Kingdom of Bahrain, for children aged 5 to 6 years. This service includes assessing growth and development parameters, which includes measuring hemoglobin levels, conducting vision examinations, and administering Purified Protein Derivative (PPD) tests.

Objectives: To evaluate the prevalence of anemia, reduced visual acuity, and positive PPD tests, in children's preschool screening.

Methodology: This survey was conducted in 25 primary healthcare centers, between the period of January to March 2020, with a total sample size of 2,637 children. Electronic preschool screening visit sheets, of children who attended the health centers for screening, were reviewed and evaluated.

Results: Out of the 2,637 records reviewed; anemia, reduced visual acuity, and positive PPD tests, were found in 19.9%, 4.7%, and 0.45% of children, respectively.

Conclusion: The overall prevalence of reduced visual acuity and positive PPD tests was low. On the other hand, although the overall prevalence of anemia was also low, at about 20%, this can be reduced further by raising physicians' adherence to anemia management guidelines, at earlier ages. Moreover, further studies are needed to assess the causes and risks of anemia in this age group.

Keywords: Bahrain, Preschool, Screening, Primary Healthcare Centers, Prevalence

Introduction

The Kingdom of Bahrain has a well-established health care system composed of primary, secondary, and tertiary facilities. Primary health care is the cornerstone of healthcare services in the Kingdom, which are provided through a network of 27 hospitals and health centers distributed all over the country.¹ It aims to promote and reinforce

healthy behavior, early detection and diagnosis, and effective treatment of diseases. This is achieved through the provision of numerous curative and preventive services.¹

Child screening services include periodic comprehensive examinations of children, at specific stages of their lives, aiming to monitor their nutrition, physical and psychological development,

and enhance early detection and management of diseases.² As part of these periodic examinations, a preschool screening is required for children aged 5 to 6 years old. This screening includes three main tests: hemoglobin, visual acuity, and Tuberculin Purified Protein Derivative (PPD).

Preschool screening is an internationally observed practice and is not limited to the Kingdom of Bahrain. In the United Kingdom (UK) for instance, children go through screening at the Reception level, at 4 to 5 years of age, which is carried out to review their general health and readiness for school.³ During this screening, children's height, weight, vision, and hearing are checked, as required.³ Similarly, in the United States (US), a School Entry Health Exam is administered for children. The screening tests involved differ by state, and may include the examination of weight, height, blood pressure, hemoglobin levels, lead levels, vision, and hearing, as well as PPD testing for specific target populations.^{4,5}

In the case of hemoglobin testing, anemia screening is conducted for preschool children in some states in the US.^{4,5} On the other hand, a study conducted in Kenya found that 71.8% of preschool children had anemia.⁹ While another study carried out in rural China found that 19% preschool children had anemia.¹⁰

Similarly, testing visual acuity in preschool children is also another international standard practice in many countries. A 1999 study conducted in Jeddah, Kingdom of Saudi Arabia, concluded that among children attending public kindergartens, 69% were found to have refractive vision errors.⁶ As a result, administering a vision acuity test during the periodic examination of preschool children was strongly recommended, as it is an easy and cost-effective examination.⁶ Likewise, another study was conducted in the US, to investigate preschool vision testing carried out by healthcare service providers. Improving the population-level observation of visual acuity in preschool children was recommended, due to deficiencies found in the administration of preschool vision screening.⁷ In Denmark, vision screening in preschool children has been a standard practice since 1965. This has contributed to decline

in prevalence of amblyopia in adults, down to 0.5%.⁸ Generally, the international emphasis on vision screening for preschool children, is aimed at detecting and preventing vision disorders, as they interfere with daily life functions and education.⁸

In contrast, PPD testing is not considered as an international standard practice in children's preschool screening. In fact, it is not listed among the tests recommended for preschool children by the UK's National Health Service (NHS).³ Furthermore, in the US, some states perform PPD testing only for preschool children at risk of tuberculosis.^{4,5} Additionally, no studies addressing PPD testing in preschool children in the Arabian Gulf region were found.

Generally, there were no studies found evaluating preschool screening in Bahrain; therefore, this survey was undertaken to identify the outcomes of preschool screening tests conducted in the population. The findings of this study will support primary healthcare decision-makers further improve preschool screening services.

Material and Methods

In the Kingdom of Bahrain, nurses, dental hygienists, and family physicians deliver preschool screening services in health centers. The nursing team initially records the child's growth parameters such as weight, height, head circumference, and body mass index, and asks their caregivers about achieving age-specific milestones. A stereotyping test is carried out and the results are recorded on an electronic sheet. The child's vaccination records are also examined to ensure their completion. Next, vision, blood pressure, PPD, and hemoglobin levels are checked. Additionally, a dental checkup is carried out by a dental hygienist. Lastly, a family physician carries out a final assessment. All screening details are documented on I-Seha: Bahrain's National Health Information System.

This survey was conducted at 25 primary healthcare centers in the Kingdom of Bahrain, which are spread over five health regions all around the Kingdom, with the exclusion of Zallaq Health Center and Jaw Askar Clinic. Preschool children falling under Shaikh Salman Health Centre were reassigned to Halat Bu Maher Health Centre. All preschool

electronic visit sheets created in the months of January, February, and March 2020 were reviewed. No visit sheets were excluded from the period, summing up to a sample size of 2,637 children.

The three main components being surveyed were hemoglobin level, visual acuity, and PPD tests. Hemoglobin levels were tested using capillary blood sampling, and a level of ≥ 11 gm/dl was considered normal, according to the World Health Organization (WHO) cut-off points.¹² Furthermore, visual acuity was tested using Snellen charts, and was regarded to be normal at up to 6/9 acuity.¹¹ In the case of PPD Skin tests, readings of less than 10 mm were considered negative.¹³

Mother and Child Health (MCH) coordinators collected data using a unified Excel spreadsheet, which was designed for this survey. It was used to

document and review the results of the hemoglobin level, visual acuity, and PPD tests. The data was also reviewed and verified by the authors for accuracy.

Results

A total of 2,637 electronic records were collected and reviewed from the 25 healthcare centers. The total sample comprised of 50.2% (n=1,325) male and 49.7% (n=1,312) female participants.

Firstly, out of the 2,616 children tested for hemoglobin levels, 19.9% (n=520) (95% CI = 18.3 to 21.4) had low hemoglobin levels, while 0.9% (n=23) (95% CI = 0.5 to 1.3) did not have their hemoglobin levels tested. The highest prevalence of anemia was found in health region 4 at 23.9% (n=179) (95% CI = 29.1 to 40.3), followed by health region 3 at 23.6% (n =163) (95% CI = 20.4 to 26.8) (Table 1).

Table 1: Hemoglobin tests of preschool children in primary health care centers in the Kingdom of Bahrain

Health Center	Sample Size	No. of Hemoglobin Tests Done	No. of Low Hemoglobin (%)	95% CI
Region 1				
Muharraq	76	76	4 (5.3)	1.5 to 13.1
Halet Bu Maher	62	62	9 (14.5)	6.9 to 25.8
BBK Hidd	112	111	16 (14.4)	7.9 to 20.9
NBB Arad	57	57	9 (15.8)	7.5 to 27.9
NBB Dair	24	24	3 (12.5)	2.7 to 32.4
Total	331	330	41(12.4)	8.8 to 15.9
Region 2				
Bilad Qadeem	111	111	24 (21.6)	14.0 to 29.3
Shaikh Sabah AlSalem	95	95	17 (17.9)	10.8 to 27.1
Ibn Sinna	27	27	0 (0)	0
Jid Hafs	69	69	10 (14.5)	7.2 to 25.0
Al Hooraa	40	40	2 (5.0)	0.6 to 16.9
Naim	110	109	15 (13.8)	7.3 to 20.2
Total	452	451	68(15.0)	11.7 to 18.3
Region 3				
Yousif Engineer	194	194	39 (20.1)	14.5 to 25.7
Isa Town	141	140	43 (30.7)	23.1 to 38.4
Budaya Costal	31	31	0 (0)	0
Budaya	156	155	43 (27.7)	20.7 to 34.08
Shaikh Jaber AlSabah	169	169	38 (22.5)	16.2 to 28.8
Total	691	689	163(23.6)	20.4 to 26.8

Table 1 (Contd.): Hemoglobin tests of preschool children in primary health care centers in the Kingdom of Bahrain

Health Center	Sample Size	No. of Hemoglobin Tests Done	No. of Low Hemoglobin (%)	95% CI
Region 4				
Aali	105	104	32(30.8)	21.9 to 39.6
Ahmed Ali Kanoo	287	277	96(34.7)	29.1 to 40.3
Sitra	181	181	38 (21.0)	15.1 to 26.9
Sh. Abdulla Bin Khaled	98	98	6 (6.12)	2.3 to 12.8
Hamad Kanoo	93	86	7 (8.7)	4.8 to 14.7
Total	764	746	179(23.9)	20.4 to 26.4
Region 5				
Hamad Town	138	138	12 (8.7)	4.8 to 14.7
Kuwait	116	115	11 (9.6)	4.9 to 16.5)
Moh'd Jassim Kanoo	145	145	46 (31.7)	24.1 to 39.3
Total	399	398	69(17.3)	13.6 to 21.0
All Regions' Total	2637	2614	520 (19.9)	18.3 to 21.4

Next, a total of 2,465 children had their visual acuity tested; the results showed that 4.7% (n=116) had reduced visual acuity (95% CI = 3.9 to 5.6), whereas 6.6% were not tested (n=173) (95% CI = 5.7 to 7.6). The highest prevalence of reduced visual acuity was seen in health region 2 at 6.8% (n=30) (95% CI = 4.62 to 9.5), followed by health region 1 at 5.3% (n=17) (95% CI = 3.1 to 8.3) (Table 2).

Table 2: Vision acuity tests of preschool children in primary health care centers in the Kingdom of Bahrain

Health Center	Sample Size	No. of Vision Tests Done	No. of Low Vision (%)	95% CI
Region 1				
Muharraq	76	74	7 (9.5)	3.9 to 18.5
Halat Bu Maher	62	59	8 (13.6)	6.04 to 25.0
BBK Hidd	112	110	1 (0.91)	0.018 to 4.96
NBB Arad	57	56	1 (1.8)	0.04 to 9.6
NBB Dair	24	24	0 (0)	0
Total	331	323	17 (5.3)	3.1 to 8.3
Region 2				
Bilad Al Qadeem	111	111	4 (3.6)	0.995 to 8.97
Shaikh Sabah AlSalem	95	91	4 (4.4)	1.2 to 10.9
Ibn Sinna	27	26	3 (11.5)	2.45 to 30.2
Jid Hafs	69	67	1 (1.5)	0.04 to 8.0
Al Hooraa	40	40	1 (2.5)	0.07 to 13.2
Naim	110	108	17 (15.7)	8.9 to 22.6
Total	452	443	30 (6.8)	4.62 to 9.5

Table 2 (Contd.): Vision acuity tests of preschool children in primary health care centers in the Kingdom of Bahrain

Health Center	Sample Size	No. of Vision Tests Done	No. of Low Vision (%)	95% CI
Region 1				
Yousif Engineer	194	187	7 (3.7)	1.5 to 7.6
Isa Town	141	139	3 (2.16)	0.45 to 6.2
Budaya Costal	31	31	0 (0)	0
Budaya	156	150	10 (6.7)	3.24 to 11.9
Shaikh Jaber AlSabah	169	167	3 (1.8)	0.37 to 5.2
Total	691	674	23 (3.4)	2.2 to 5.1
Region 4				
Aali	105	102	8 (7.8)	3.45 to 14.9
Ahmed Ali Kanoo	287	186	15 (8.1)	4.6 to 13.0
Sitra	181	177	0 (0)	0
Sh. Abdulla Bin Khaled	98	97	2 (2.06)	0.25 to 7.24
Hamad Kanoo	93	78	8 (10.3)	4.53 to 19.2
Total	764	640	33 (5.2)	3.6 to 7.2
Region5				
Hamad Town	138	135	4 (2.96)	0.8 to 7.42
Kuwait	116	109	4 (3.7)	1.0 to 9.1
Moh'd Jassim Kanoo	145	140	5 (3.6)	1.2 to 8.1
Total	399	384	13 (3.4)	1.8 to 5.7
All Regions' Total	2637	2464	116 (4.7)	3.9 to 5.6

And finally, PPD test results showed that out of the 2,456 children tested, only 0.45% (n=11) (95% CI= 0.2 to 0.8) tested positive for Tuberculosis. No PPD test results were found for 6.9% of the children (n=

181) (95% CI = 5.9 to 7.9). The highest prevalence of positive PPD tests was recorded in health region 4 at 1.5% (n=8) (95% CI = 0.5 to 2.4) (Table 3).

Table 3: PPD tests of preschool children in primary health care centers in the Kingdom of Bahrain.

Health Center	Sample Size	No. of PPD Tests Done	No. of Positive PPD (%)	95% CI
Region 1				
Muharraq	76	76	0	0
Halat Bu Maher	62	60	0	0
BBK Hidd	112	111	0	0
NBB Arad	57	55	0	0
NBB Dair	24	20	0	0
Total	331	322	0	0

Table 3 (Contd.): PPD tests of preschool children in primary health care centers in the Kingdom of Bahrain.

Health Center	Sample Size	No. of PPD Tests Done	No. of Positive PPD (%)	95% CI
Region 1				
Bilad Al Qadeem	111	111	0	0
Shaikh Sabah AlSalem	95	92	0	0
Ibn Sinna	27	25	1 (4.0)	0.1 to 20.4
Jid Hafs	69	68	0	0
Al Hooraa	40	35	0	0
Naim	110	109	2 (1.8)	0.2 to 6.5
Total	452	440	3 (0.7)	0.14 to 1.9
Region 3				
Yousif Engineer	194	193	0	0
Isa Town	141	140	0	0
Budaya Costal	31	31	0	0
Budaya	156	153	0	0
Shaikh Jaber AlSabah	169	169	0	0
Total	691	686	0	0
Region 4				
Ahmed Ali Kanoo	287	185	1 (0.54)	0.02 to 3.0
Sitra	181	181	1 (0.6)	0.02 to 3.0
Sh Abdulla Bin Khaled	98	98	3 (3.06)	0.64 to 8.7
Hamad Kanoo	93	75	3 (4.0)	0.84 to 11.2
Total	659	539	8 (1.2)	0.5 to 2.4
Region 5				
Hamad Town	138	108	0	0
Kuwait	116	114	0	0
Moh'd Jassim Kanoo	145	145	0	0
Total	399	367	0	0
All Regions' Total	2637	2456	11 (0.5)	0.2 to 0.8

Discussion

The overall prevalence of anemia among the surveyed population was about 20%. This indicates a general improvement, as compared to the results of a 2017 study that was conducted among three-year-old children, screened at primary healthcare facilities in Bahrain. Here, the prevalence of anemia was recorded at 30%.¹⁴ Similarly, data published in 2016, reviewing anemia among children under the age of five in Bahrain, indicated an overall prevalence of 30%.¹⁵ Moreover, a 2019 study conducted in Saudi Arabia, concluded that the prevalence of anemia in

children aged 6 to 59 months was 26.4%.¹⁶ There were no studies found in our region on anemia in 5 to 6-year-old children. Due to the repercussions of anemia on general health, this prevalence should be addressed and mitigated through an emphasis on appropriate anemia management practices at the early stages of development.

Reduced visual acuity was recorded in 4.7% of the preschool children included in the survey. A study in Malaysia, which involved methods and criteria for vision testing similar to those in primary

healthcare in Bahrain, found that the prevalence of impaired vision was at 5%, which is comparable to this survey's findings.¹⁷ While, a study conducted in Riyadh, Saudi Arabia, concluded that 13% of preschool children who were involved in the study had reduced visual acuity.¹⁸ Additionally, another study conducted in Sydney, Australia focusing on preschool children, found that the prevalence of visual impairment was at 6.4%.¹⁹ These two studies examined children falling under age groups and testing criteria that vary from those highlighted in this survey.

PPD Skin tests were positive in only 0.45% of preschool children. This prevalence is remarkably low when compared to the conclusions of the sole other study reviewed. The study was conducted on primary school children in Kermanshah, Iran, where the rate of positive cases reported was 8.15%.²⁰ This reflects the low occurrence of tuberculosis in Bahrain's community, which can be attributed to the robust efforts that are being directed toward early detection and treatment.

The proportion of children who did not have their hemoglobin level, visual acuity, and PPD tests recorded on the electronic file, was 0.9%, 6.6%, and 6.9%, respectively. This might be due either to a failure to document the results or to the tests not being carried out. Nevertheless, these rates need to be reduced further, in order to boost the quality of care.

Conclusion

Preschool screening is a vital preventive service that is provided by primary healthcare centers. In this survey, the overall prevalence of reduced visual acuity and positive PPD tests was low in preschool children. Additionally, although the overall prevalence of anemia at 20% is lower than it was in previous studies, it can be reduced further by reinforcing physicians' adherence to anemia management guidelines at earlier stages. Additional studies are needed to assess the risks and causes of anemia in this age group. Hemoglobin level, vision acuity, and PPD tests should be performed on all preschool children, and thorough documentation of results in the electronic file is essential, in order to ensure early intervention and management.

Conflict of Interest

The authors of this study have no conflict of interest to declare.

Acknowledgments

We extend our appreciation to the MCH coordinators in the primary healthcare centers for their contribution to data collection. We would also like to thank Dr Mohammed Mandil for his assistance with the statistics used in this survey.

References

1. Kingdom of Bahrain, Ministry of Health, Primary Healthcare [Internet]. Kingdom of Bahrain Ministry of Health; [cited 2022 Mar 13]. Available from: <https://www.moh.gov.bh/Services/primaryHealthCare?lang=en>.
2. Kingdom of Bahrain, Ministry of Health, Mother and child health and reproductive health [Internet]. Kingdom of Bahrain Ministry of Health; [cited 2022 Mar 13]. Available from: <https://www.moh.gov.bh/Services/MC>.
3. National Health Service. Children and health reviews in primary school [Internet]. National Health Service; [cited 2022 Mar 13]. Available from: <https://childrenshealthsurrey.nhs.uk/services/school-nursing-general/health-screening-reception>.
4. State of Florida School Entry Health Exam [Internet]. State of Florida; 2013 Jul [cited 2022 Mar 13]. Available from: <https://sss.usf.edu/resources/format/pdf/schoolentryexam.pdf>
5. State of Delaware. Delaware student health form children PreK-Grade 6 [Internet]. State of Delaware; [cited 2022 Mar 13]. Available from: https://www.crk12.org/site/handlers/filedownload.ashx?moduleinstanceid=1496&-dataid=1115&FileName=DE_Student_Health_Form_english%20.pdf
6. Bardisi WM, Bin Sadiq BM. Vision screening of preschool children in Jeddah, Saudi Arabia. *Saudi Med J*.2002;23(4):445-9.
7. Kemper AR, Wallace DK, Patel N, Crews JE. Preschool vision testing by health providers in the United States: findings from the 2006-2007 Medical Expenditure Panel Survey. *J AAPOS*. 2011;15(5):480-3.

8. Sandfeld L, Weihrauch H, Tubaek G. Analysis of the current preschool vision screening in Denmark. *Acta Ophthalmol.*2019;97(5):473-7.
9. Foote EM, Sullivan KM, Ruth LJ, Oremo J, Sadumah I, Williams TN, Suchdev PS. Determinants of anemia among preschool children in rural, western Kenya. *Am J Trop Med Hyg.* 2013;88(4):757-64.
10. Wang L, Li M, Dill SE, Hu Y, Rozelle S. Dynamic Anemia Status from Infancy to Preschool-Age: Evidence from Rural China. *Int J Environ Res Public Health.* 2019;16(15):2761.
11. Ministry of Health, Public Health Directorate. Vision screening circular, PH/DSH/c- 29/2018. Kingdom of Bahrain; 2018.
12. World Health Organization. Hemoglobin Concentration for the Diagnosis of Anemia and Assessment of Severity [Internet]. World Health Organization; 2011[cited 2022 Mar 13]. Available from: <https://www.who.int/vmnis/indicators/haemoglobin.pdf>.
13. Kimberlin DW, Barnett ED, Lynfield R, Sawyer MH. Tuberculosis in Red Book: 2021-2024 report of the committee on infectious diseases, 32nd ed. American Academy of Pediatrics; 2021.
14. Al-Haddad L, Al-Dubaib R, AL-Najem W, Al-Shaikh Z, Al-Ghawi A. Iron deficiency anemia among 3-year-old children and its management in primary health care in Bahrain. *JBMS.* 2017;29(3):35-40.
15. Computer and enterprise investigations conference. Bahrain BH: Prevalence of Anemia among Children: % of Children Under 5 [Internet]. Computer and enterprise investigations conference; [cited 2022 Mar 13]. Available from <https://www.ceicdata.com/en/bahrain/health-statistics/bh-prevalence-of-anemia-among-children--of-children-under-5>.
16. Alqahtani S, Dalbough M, Asiri S, Albishri A, Asiri M. Prevalence of anemia among Preschool Age Children. *Bahrain Medical Bulletin.* 2019;41(2);67–70
17. Premseenthil M, Manju R, Thanaraj A, AbdulRahman S, Kah TA. The screening of visual impairment among preschool children in an urban population in Malaysia; the Kuching pediatric eye study: a cross sectional study. *BMC ophthalmology.*2013;13(1):16.
18. Alsaqr AM, Ibrahim G, Sharha AA, Fagehi R. Investigating the Visual Status of Preschool Children in Riyadh, Saudi Arabia. *Middle East Afr J Ophthalmol.* 2017;24(4):190-4.
19. Pai AS, Wang JJ, Samarawickrama C, Burlutsky G, Rose KA, Varma R, Wong TY, Mitchell P. Prevalence and risk factors for visual impairment in preschool children the sydney paediatric eye disease study. *Ophthalmology.* 2011;118(8):1495-500.
20. Hemmati M, Ghadiri K, Rezaei M. Tuberculin reactivity in school age children; five-year follow- up in Iran . *Iran J Pediatr.*2011; 21(1):39-44.