

**Assessment of Current Surveillance System of Anemia among Children 9-12-months
old in Armenia**

Master of Public Health Integrating Experience Project

Utilizing Professional Publication Framework

by

Marianna Koshkakaryan, MD
MPH Candidate

Advisor: Tsovinar Harutyunyan, MD, PhD candidate

Reader: Sarah H. Kagan, PhD, RN

College of Health Sciences
American University of Armenia

Yerevan, Armenia
2011

Table of Contents

Abbreviation List	3
Acknowledgements	4
Study purpose and specific aims	7
Introduction.....	7
Background and Significance	7
Anemia Prevalence	7
Causes of anemia	8
Impact of anemia.....	8
Control of anemia	9
Anemia screening and Hb cutoff level.....	9
Situation in Armenia	10
Prevalence of anemia	10
Anemia screening and surveillance.....	11
MIDAS system.....	12
The need for a new or improved anemia surveillance system	13
Methods	14
Design	14
Sampling	14
Human Subjects Protection.....	15
Data Collection, Management, Analysis and Rigor.....	15
Results.....	17
Focus Groups	17
In-depth interviews	17
Main findings	17
1. Burden of anemia	17
2. Anemia screening performance	19
3. Existing and potential resources for identifying anemia prevalence.....	21
4. Current information flow on anemia prevalence	23
5. Obstacles for well-functioning surveillance system	24
Discussion	27
Anemia burden.....	27
Anemia screening performance	28

Criteria for anemia screening tests.....	29
Existing and potential resources for anemia prevalence	30
MIDAS system as a source of data on anemia prevalence	30
Information flow from primary health care facilities.....	31
Obstacles for well-functioning surveillance system	31
Suggestions for improvements.....	32
Study Strengths and Limitations	32
Conclusion and Recommendations	33
Tables	39
Table 1	39
Appendices.....	40
Appendix 1.....	40
Appendix 2.....	42
Appendix 3.....	44
Appendix 4.....	46
Appendix 5.....	47
Appendix 6.....	49
Appendix 7.....	50

Abbreviation List

WHO	World Health Organization
MOH	Ministry of Health
AUA MPH	American University of Armenia Master of Public Health
ADHS	Armenia Demographic and Health Survey
DHS	Demographic and Health Survey
PHC	Primary Health Care
UNICEF	United Nations International Children’s Emergency Fund
RA	Republic of Armenia
IDA	Iron Deficiency Anemia
SHA	State Health Agency
NIAC	National Information Analytic Center
NSS	National Statistical Service
PHCR	Primary Health Care Reform
Hb	Hemoglobin
IMCI	Integrated Management of Childhood Illnesses
NGO	Non-Governmental Organization

Acknowledgements

I would like to express my sincere gratitude to my advisor Tsovinar Harutyunyan and reader Sarah H. Kagan for their essential contribution, valuable comments and continuous support during the whole process of my work. I certainly benefited from their critical eye and expert insight that guided me throughout the thesis.

I would like to thank Public Health faculty of American University of Armenia and CHSR staff for their assistance and skills they generously shared during the study in MPH program. I am also thankful to my peers for their support and cooperation. I am very grateful to the study participants for their contribution to the study.

Finally, I would like to express my special gratitude to my family and friends for their patience and encouragement since it would have been impossible to complete the MPH program without their understanding and support.

Abstract

Aims: The specific aims of the study were (1) to explore perceptions of health care workers and administrators at different levels about analysis and utilizations of anemia screening data, (2) describe and analyze the chain of information flow on anemia from primary health care facilities where the screening is performed, and (3) to develop recommendations for a system which will give an opportunity to systematically calculate periodic prevalence of anemia in 9-12 month old children.

Background: Anemia is a significant public health problem in Armenia. According to Armenia Demographic and Health Survey of 2005, 67.9% of children 9-11 months of age suffer from anemia: 20.9% of them have mild, 39.5% have moderate, and 7.5% have severe anemia. Anemia screening and the effective use of surveillance data is necessary and important to control its rates. According to the Ministry of Health order, in Armenia screening of anemia in children is done at 9(up to 12) months old, at 12 (up to 15) years old, and at the time of applying for kindergartens and schools. Despite the anemia screening performed at Primary Health Care (PHC) facilities, country does not have well functioning surveillance system, and it only relies on the data collected by the Demographic Health Surveys which are conducted once per five years. The data on anemia prevalence are not processed properly in order to have anemia prevalence, which hinders informed decision making in this sphere.

Method: Qualitative cross sectional study design matches the purposes of the study by providing an in-depth assessment of perceived value and need for the proper analysis and use of anemia screening data in Armenia. Purposive and snowball sampling strategy were utilized to select the participants of the focus group and in-depth interviews. Conventional content analysis using single semi-structured interviews with a variety of stakeholders who have perspectives on surveillance policy, implementation, and outcomes was used to describe the current surveillance system for anemia in children and to propose a new or improved system.

Findings: Six primary categories emerged while describing the current system of anemia surveillance. Almost all participants considered anemia as a significant problem in Armenia. Different respondents had different assessments of specific anemia prevalence rates. According to most of the respondents, many children up to 5 years old are affected by anemia, and 9-12 months old children are the most vulnerable. Anemia screening at PHC facilities is considered as a very useful tool to detect anemia. Contradicting opinions were expressed by experts and PHC facilities' physicians on anemia screening coverage levels. The majority of polyclinics perform Sahli method for Hb testing. Some use analyzers, and some use Photoelectric Color Match method. Participants identified numerous problems with anemia screening tests performed in polyclinics that inhibit timely detection of anemia in children. Although anemia data are reported from primary health care facilities to the health care administrators/policy makers, and are presented in the Statistical yearbooks, these data incorporate both diagnoses of children based on their active visits (at the moment of taking medical advice) and diagnoses that come from some prophylactic visits (i. e. screening). However, these data are not separated from each other and cannot reflect anemia prevalence in children precisely. Besides, there is no anemia as a separate category in the Statistical yearbook: anemia data are combined with other blood diseases and are presented in the

section of morbidity of children 0-14 and 15-17 years old as “blood diseases and other hematogenic disturbances”. Moreover, data are not categorized into the specific age groups and cannot depict anemia in specific age group we are interested. All participants identified that existing financing is not sufficient for well-functioning anemia surveillance system. Insufficient patient-provider communication leads to poor population coverage with screening. There is a need to set up a new surveillance system that could better reflect anemia prevalence in the children.

Conclusion and recommendations: Given the limited resources of the country’s health care system, the use of anemia screening data for specific age groups, performed at primary health care facilities according to the Ministry of Health (MOH) order, is the most feasible way of obtaining anemia prevalence in 9-12 months old children. MIDAS database system which currently generates systematic reports to the State Health Agency on the specific performance indicators linked to primary health care financing is equipped with appropriate software/databases for collecting and calculating anemia prevalence and could therefore serve a basis for the anemia surveillance system. High coverage level of anemia screening is the most important condition for having reliable data. The adequate performance of physicians at PHC facilities is another important condition for appropriate anemia diagnosis and management. This study is the first conducted in Armenia that explores the obstacles for well-functioning anemia surveillance system and provides recommendations for a new or improved surveillance system.

Study purpose and specific aims

The study's purpose is to describe and analyze current anemia surveillance system in children 9-12 months old in Armenia in order to develop recommendations for establishing the surveillance system with systematic and quality data collection on the prevalence of anemia in this age group. The study aims to explore the perceptions of health care workers and administrators who are involved in anemia screening and data analysis at different levels of health care system about analysis and utilization of anemia screening data, to describe the flow of information on anemia from Primary Health Care (PHC) facilities where the screening is performed, and to develop recommendations for the surveillance system which could provide accurate and timely information on the periodic prevalence of anemia in the 9-12 months age group.

Introduction

Background and Significance

Anemia Prevalence

According to World Health Organization (WHO), anemia is a condition with hemoglobin below normal levels for the given age, gender, and physiological conditions due to the deficiency of one or more basic nutrients - iron, folic acid, zinc, vitamin B12 and proteins (1). Hemoglobin is responsible for transport of oxygen to tissues and organs (2). According to the United Nations Children's Fund (UNICEF) iron deficiency contributes to 90% of all types of anemia in the world (1;3). Iron deficiency anemia is the most prevalent nutritional problem in the world (4-8). Over 2 billion individuals are affected by iron deficiency anemia worldwide (9). Due to children's rapid growth and high need for iron, infants and young children are at higher risk for iron deficiency (7;10;11). According to the

survey of the literature regarding the occurrence of iron deficiency anemia in Brazil, 59.1% of infants under 24 months old and 40.9% of children 6-59 months old have anemia (1). Because anemia is considered the most common indicator of iron deficiency, the terms anemia, iron deficiency and iron deficiency anemia (IDA) are sometimes used interchangeably (4).

Causes of anemia

IDA may be triggered in intra-uterine period. The causes are associated with the deficiency of iron in the mother, as physiological reserves of iron in the fetus are formed in the last trimester of pregnancy (3). Breastfed babies need less iron as it is absorbed three times better when it is in the breast milk (12). During/after the weaning period children start consuming other foods that might not have sufficient iron concentration, and therefore they are more likely to have iron deficiency anemia than breastfed children (12).

Impact of anemia

Anemia is considered a global Public Health problem in both developing and developed countries with considerable impact on human health as well as on social and economic development (13;14). Iron deficiency anemia is among the highest public health priorities for governments and international organizations globally due to the irreversible damage of brain and physical capacities it may cause (15). It is a serious health problem in children as it leads to impaired mental and physical development (2;7). In the recent years, the focus of active research has been on the relationship between iron status and cognitive development of younger children. Children with iron deficiency anemia have poorer psychomotor development as compared to iron sufficient children (16). According to some studies which explored short-term iron therapy, there is a positive effect of the treatment on the cognitive function of children with anemia. The data coming from longer-term studies show that moderately severe anemia can lead to irreversible damage of the cognitive function

(16). Low Hb concentrations (<95g/l) in 8 month old children are associated with poor developmental outcomes at 18 months (17). Although mild anemia is not accompanied with serious health disorders, the moderate level anemia leads to the reduction of oxygen-carrying capacity and affects the aerobic function. Severe anemia is associated with increased childhood and maternal mortality and may be listed as an underlying cause of death (16). Deaths associated with severe anemia generally occur at increased physiological stress, for example, during an acute febrile illness, when worsening hemoglobin level compromises the oxygen delivery and cardiovascular function (16).

Control of anemia

Despite the disease eradication efforts by the WHO, anemia is still a public health problem that is not eliminated in most of the countries (1;7). In Asian countries intermittent iron supplementation is often utilized as a method of controlling anemia. Wheat and corn flour fortification is another approach for reducing anemia burden in some countries (1). The public health approach using iron fortified foods resulted in substantial success in United States, reducing anemia prevalence in young infants and women of reproductive age (18). Iron fortification of staple foods was shown to be a cost-effective and feasible strategy. However, routine monitoring is necessary to ensure the effectiveness of food fortification (19).

Anemia screening and Hb cutoff level

Because iron deficiency is the common cause of anemia, the presence or absence of anemia can be used as a screening tool for iron deficiency (20). Worldwide, the most common indicators for anemia used in anemia screening are hemoglobin (Hb) and/or hematocrit levels (4;21). These methods are relatively cheap and easy to implement (20). A major limitation of these two tests is that anemia is not a specific indicator of iron deficiency (4;8;21;22). Hb is sensitive for IDA, but it's not sensitive for iron deficiency (21).

Sometimes the change in these indicators is observed when iron deficiency is already severe (4). Often in facilities with adequate resources other indicators are used to confirm anemia – serum ferritin, transferrin saturation, and others (4). However the sensitivity and specificity of these tests as primary screening tools for IDA are not well studied yet (21). To identify whether or not anemia is caused by iron deficiency, monitoring the response in hemoglobin /hematocrit levels after 1 or 2 months of iron supplementation is done (4). Although there is some disagreement in cutoff values of iron deficiency anemia diagnosis, the most common value of hemoglobin recommended by WHO is Hb<110g/l in children 6-12 months old (mo) (11). According to criteria developed by WHO and the level of hemoglobin in the blood, anemia is classified as mild (Hb – 10.0-10.9g/dl), moderate (Hb – 7.0-9.9g/dl), and severe (Hb level is less than 7.0g/dl) (2). Another alternative value for low hemoglobin level is Hb<105g/l in 4-6 mo children, and Hb<100g/l in 9 mo children (11).

Situation in Armenia

Prevalence of anemia

Anemia is a significant public health problem in Armenia as well (12;13). Armenia can be classified as a country of “moderate” public health significance of anemia with the estimate of 39 (13) (Table 1). According to Armenia Demographic and Health Survey (ADHS) of 2005, 67.9% of children 9-11 months of age suffer from anemia (Hb<11g/dl). About 21% of them have mild anemia (Hb 10.0-10.9 g/dl), 39.5% have moderate anemia (Hb 7.0-9.9g/dl), and 7.5% have severe anemia (Hb below7.0g/dl) (2). Moreover, there has been an increase in child anemia rates in Armenia in 2005 compared to 2000 (2).

Nationally representative trend data of anemia in 6-59 months old children from 8 countries showed a reduction in anemia rates in five of the examined countries (Cambodia, Bolivia, Haiti, Peru, Kazakhstan), and increase in anemia rates in Armenia, Egypt and Uganda (7;22).

Anemia screening and surveillance

According to the Ministry of Health order, in Armenia the screening of anemia in children is done at PHC facility (the same as polyclinic) based on Hb at 9(up to 12) months old, at 12(up to 15) years old and at the time of applying for kindergartens and schools (23).

In Armenia childhood disease control and prevention is done based on Integrated Management of Childhood Illnesses (IMCI) strategy (24). It is a global WHO/UNICEF strategy to combat the leading causes of childhood morbidity and mortality in children under the age of 5 through immunization, nutrition, and maternal health promotion efforts (24). In Armenia it has been included in the national policy since 1999 (24). The IMCI strategy was conducted in three pilot cities, and according to the MOH order, it is implemented in all health care facilities of Armenia since 2008 (25). Anemia control and prevention is carried out by pediatricians at PHC facilities based on this strategy requirements (25). According to IMCI strategy, the lowest Hb/hematocrit cutoff level for 6-24 mo children is 105g/l and 33 accordingly (26). If Hb level below normal at given cutoff level is detected, a child is treated by an iron-containing drug for 1 month (26). In case of successful increase in Hb by 10 g/l, iron deficiency anemia is confirmed, and the treatment is continued for another 1-2 months after normalization of Hb. If there is still no improvement in Hb, other tests are performed in order to identify the nature of anemia (26).

PHC facilities present yearly manually generated reports on different diseases (immunization rates, infectious disease incidents, morbidity reports, visits and referral statistics, etc.) to the National Information Analytic Center (NIAC) (27). Yearly statistics, generated by each PHC facility manually are based on statistical slips that have information on patients' demographics, diagnoses, and the date of diagnosing. The annual reports are

completed and reported as yearbooks based on data presented by the NSS of Republic of Armenia (28).

MIDAS system

Anemia screening is among performance indicators that are linked to primary care financing as defined by the State Health Agency (SHA) (29). The information for performance indicators is collected through the computerized encounter forms that were developed by the MOH of Armenia with the support of the Primary Health Care Reform (PHCR) project (29). Multiple visits of patients for continuous monitoring and treatment are recorded in encounter forms. The encounter forms incorporate the information through coding of different activities such as prophylactic visits, visits due to acute conditions, the diagnosis, treatment, and dispensary. With the support of the Yerevan Computer Research and Development Institute (also known as the Mergelyan Institute) PHCR project created a database of the encounter forms known as MIDAS 3 system (29). The database generates systematic reports to the SHA on the specified performance measures at PHC facilities. Anemia indicator included in the MIDAS database is the percentages of children 9-12 months old, and 12-15 years old, screened at each facility, and is reported annually. The optimal level for anemia screening coverage in children constitutes to 80%. The database incorporates also the list of free enrollment data at each primary health care facility (29). So it has the number of children of 9-12 months old from the free enrollment list and the number of anemia confirmed cases entered into the system through encounter forms. Besides reporting on the performance indicators, MIDAS 3 can also be used to report some additional monitoring measures (29). It can generate a variety of statistics and some of the routine reports that are done manually by each PHC facility. The system automates the whole chain of information flow about patients and medical services from the source of information up to the national-level database (29).

The need for a new or improved anemia surveillance system

According to the resolution of Armenian Government stated in the “Approval of the 2003-2015 Strategy of Maternal and Child Health Protection”, anemia prevalence in children and pregnant women should be decreased by 50% by 2015 (30).

Public Health Surveillance of anemia is a continuing, ongoing, systematic data collection, analysis and interpretation of the data in order to inform those who are responsible for disease prevention (31). Effective surveillance system for decision making is critically important to control anemia in Armenia. Once prevalence levels of anemia are known, further decisions can be made about the type, frequency, and locations of anemia screening activities and future actions (for example, iron-supplementation for at risk groups) (32).

All surveillance systems involve similar functions. The core functions in surveillance of any disease are case detection, reporting, investigation and confirmation, analysis and interpretation, and actions (control, and policy feedback) (33). Simplicity, flexibility, sensitivity, timeliness, representativeness and good communications are all critical for effective surveillance (34). One of the critical factors which determines the performance of a surveillance system is the demand for information by policy makers and managers (34). It is important to have a well-functioning surveillance system that could serve as an instrument in order to inform public health specialists, policy makers, administrators, and health care workers about the distribution and determinants of health conditions (35).

Current surveillance activities in Armenia incorporate anemia screening, anemia management (diagnostics and treatment) in children based on MOH protocol, SHA’ reports of anemia screening coverage as a performance indicator linked to PHC facilities’ financing, and NAIC’s yearly statistics generated manually by each PHC facility. However, current surveillance activities are not adequate enough in order to reflect the prevalence of anemia in

children. There is no anemia as a separate category in the Statistical yearbooks: data are incorporated in the category of the “Blood diseases and other hematogenic disturbances” for children 0-14 and 15-17 years old. (36). Moreover, the age categorization is not detailed enough in order to detect specific age groups. ADHS is the only source for anemia prevalence in Armenia; however some apparent increase in anemia rates in Yerevan and Gegharkunik raises some concerns about the reliability of anemia data from ADHS, 2005 (2). So, there is a need to explore how the current anemia surveillance system is functioning, what are the weaknesses and gaps of the system, and possible solutions for improvements in order to have a system which can accurately reflect the situation in the country, and be a reliable tool to prevent and control anemia.

Methods

Design

The project employed a cross sectional conventional content analysis design and approach. Individual and group semi-structured interviews with a variety of stakeholders who have different perspectives on surveillance policy, implementation, and outcomes were used to collect data. The informants from the different levels of the surveillance system were involved in the study to ensure the diversity of the opinions and professional knowledge. The informants at higher administrative levels of the system were chosen to provide an insight into the advantages and disadvantages of the current system in general, while healthcare providers were expected to explain the routine of the screening at the facility level and related limitations.

Sampling

Purposive and snowball sampling were used to recruit potential participants. These participants were considered key informants or stakeholders in positions of authority and

ability to comment on anemia surveillance. Key informants included laboratory physicians and laboratory heads at PHC facilities, pediatricians and heads of pediatric departments at PHC facilities, and representatives from the National Information Analytic Center (NIAC), Statistical Bureau, Ministry of Health (MOH), and State Health Agency (SHA). Laboratory physicians and pediatricians were selected from all pediatric PHC facilities in Yerevan. Other key informants were suggested by participants in the interview process.

Human Subjects Protection

The study was approved by the Institutional Review Board of the American University of Armenia. All participants provided oral informed consent. Participants were informed about anonymity and confidentiality and their right to refuse the participation to protect their rights. Participants were reminded not to use names or other identifiers during interviews. All participants, save three, consented to audio-recording.

Data Collection, Management, Analysis and Rigor

Data were collected through in-depth interviews and focus group discussions with open-ended questions (Appendix 1-7). Semi-structured approach to data collection was chosen in order to focus each interview session on particular topic areas while providing an opportunity for broader participant insights to be expressed during the course of the dialogue. Interview guides were developed in a semi-structured format to address the aims of the study. Interview questions were targeted to the position of the participants with regard to their screening investment's responsibility. Probes were open-ended and reflected participants' comments to develop their comments further.

Focus group discussions were conducted at the American University of Armenia (AUA) by the interviewer. The focus groups were audio-recorded. In addition, completeness was further bolstered by having two AUA Master of Public Health (MPH) graduate students

taking notes on the process and content during each focus group. Only one of in-depth interviews was conducted at the AUA. The rest of the interviews were conducted at the participants' work place. Three participants did not permit audio-recording of their interviews. Data were collected in these interviews by the interviewer who took notes during the interviews and then transcribed and detailed these notes immediately after each interview. All recorded interviews were taped and transcribed from Armenian to English.

All transcribed data were read carefully, highlighting words, key words, and phrases that seemed to relevant to the research question. After coding and seeking initial confirmation of the ideas in the narratives of participants, specific codes emerged and were categorized. Some categories were collapsed and others identified as subcategories of more dominant codes. Definitions of categories and subcategories were developed and confirmed in review of codes. Specific codes within categories were reviewed to insure reliability and truthfulness. Data saturation was achieved in all major categories. Analysis concluded with organization of categories and subcategories into a hierarchical structure to describe the current surveillance system structure and information flow from health care facilities to healthcare system administration. The analysis was then used as a foundation to posit possible solutions and improvements to the surveillance system. Rigor was maintained throughout data collection and analysis using several processes. Member checks with a few key informants assured veracity of transcribed data and truthfulness and credibility – or validity in quantitative terms - of initial analysis. Data analysis was also audited by the student investigator's advisor and reader. Triangulating the perspectives of participants and the format for data collection enhanced rigor in both data collection and analysis.

Results

Four focus groups with laboratory physicians and laboratory heads and pediatricians and heads of pediatric departments and six in-depth interviews with health care administrators/policy makers (experts) were completed in the scope of the study. Demographic information on the participants is presented below.

Focus Groups

Several prospective focus group members refused to participate. Overall, there were 5 laboratory physicians in the FG1, 11 pediatric physicians in the FG2, 4 laboratory and 6 pediatric physicians in the FG3 and FG4 respectively. All participants were females. Work experience varied between 3 and more than 35 years. Age varied between 27 to 63 years old.

In-depth interviews

All experts were females except two. Work experience varied between 13 and 40 years. Age varied between 42 to 71 years old.

Main findings

Six primary categories emerged while describing the current system of anemia surveillance. The categories included (1) burden of anemia, (2) anemia screening performance, (3) existing and potential resources for identifying anemia prevalence, (4) current information flow on anemia prevalence, (5) obstacles for well-functioning surveillance system, and (6) suggestions for improvements. In the context of each category some themes and patterns that contribute to the findings were identified.

1. Burden of anemia

Almost all participants considered anemia as a significant problem in Armenia. The majority of them identified it as a number one problem, and the one that has multiple

contributing factors. According to these participants, the problem is not as important to policy makers as it should be today.

1.1 Anemia prevalence and the most affected age group

Almost all participants emphasized the high prevalence of anemia in children. The physicians talked about the different anemia prevalence in different age groups.

Almost all laboratory physicians identified 4 month-old to 4 year-old age group as the most affected by anemia. Pediatricians and experts espoused the view that anemia is more prevalent in children up to 5 years of age. Almost all of them separated 9-12 months old children as the most vulnerable. Some of the participants emphasized limited control of anemia in 12-15 year-old children. The pediatricians were bothered that parents don't bring their children to perform anemia screening because of their mentality: if they bring a child to polyclinic it means that a child has serious health problems.

FGIP2: ...some parents just don't bring their 15 years old girls to polyclinics as they are bothered about others' opinions.....if you bring your girl-child to polyclinic it means that she has a problem...

There were some controversial opinions in pediatricians and experts on the trends in anemia prevalence rates. Some heads of pediatric departments noted a decline in anemia rates in 2010 and 2011 as compared to previous years. Most participants attributed this improvement to better breastfeeding practices. Two participants suggested they might be explained by "some laboratory problems", meaning incorrect diagnostics. But some experts noticed the increase in anemia rates since 2000.

EXP3: ...prevalence is high in children up to 5 years old. According to ADHS, we see an increase in anemia rates from 2000 to 2005...I am sure anemia is even more prevalent today.

1.2 Risk factors of anemia...

Most participants agreed upon a common group of risk factors for anemia. The factors included 1) vaccination as a trigger for anemia 2) not appropriate breastfeeding practices of mothers, 3) poor eating habits of school children, 4) helminthiasis, especially ascariidosis as the first cause of anemia in children up to 5 years old, and 5) low socioeconomic status of families that affect the knowledge level, feeding practices and behavior of mothers.

Participants also agreed that risk factors differed by age and socioeconomic status. The risk factors discussed by almost all participants were generally those expected when discussing anemia risk. However, the belief that vaccination triggers anemia – though it lacks any scientific or clinical evidence – was among those most discussed. Also some contradictory findings were revealed by some of the participants related to breastfeeding practices. Although inadequate breastfeeding practices were mentioned as anemia risk factor, successful breastfeeding was also stressed by one of the experts as a risk for anemia.

EXP5: “ Some mothers with successful breastfeeding practices continue to exclusively breastfeed their child up to 10-12 months of age without any other food supplements, which leads to micronutrient deficiencies, and consequently to anemia.”

Risk factors less emphasized by participants comprised a long and diverse list. It included low-birth weight, twin births, some diseases that lead to suppression of immune status which in its turn lead to disproteinemias and triggers anemia, smoking and lead intoxication in teenagers, antibiotic therapies, Rh-factor conflict, stress, intestine abnormalities, dysbacteriosis, and menstruation in pubertal girls.

2. Anemia screening performance

All participants agreed that anemia screening is very important and useful tool to detect anemia. The majority of them indicated that screening ages are not defined by health care policy makers appropriately which is one of the reasons of underestimation of anemia problem in children.

2.1 Children's participation and screening coverage

According to all pediatricians' perception, coverage of anemia screening in their polyclinics is very high and 9-12 months old children are the most active participants in screening.

However, the experts' opinion was quite different. According to them, anemia screening coverage is low in all polyclinics which is related to either physicians' inaccurate filling in encounter forms, or MIDAS system's operators' inaccurate data entry. Laboratory physicians linked the screening coverage to physicians' performance. If a child has a designated procedure that should be performed at a specific age, pediatricians/nurses must call them and invite to screening, because mothers might not be aware of that requirement.

FG1P1: *children more actively participate in anemia screening if they have some obligatory examinations... pediatricians should call them to come to PHC facility for blood examination. Otherwise they don't come by themselves.*

2.2 Anemia diagnosis test and Hb cutoff level...

All participants identified the problems with anemia screening tests performed in polyclinics that inhibit timely detection of anemia in children. The majority of polyclinics perform Sahli method for Hb testing. Some use analyzers, and some use Photoelectric Color Match method - Cyanmethemoglobin method for Hb testing. All of them consider Sahli method as very subjective and not reliable; however, although some of laboratory physicians said that they have an analyzer at the polyclinic and some have Photoelectric Color Match method, they still screen by Sahli method.

FG3P4: *The situation in polyclinics is critical as we are working with Sahli method. It is too subjective as it depends on personal interpretations of the results. Besides, other technical capabilities and other characteristics of clinics, such as solution keeping time, working conditions, etc., can affect the tests' results. I know how Russia is dealing with diagnostics, how fully they are equipped...they make sure everything is reliable including a diagnostic*

method and a type of device used. But we don't have any means to meet even the minimum requirements.

According to participants, there is some inconsistency in anemia diagnosis when utilizing different methods - Sahli, analyzers, and Photoelectric Color Match method.

All participants indicated that there is no standardized protocol on anemia screening tests.

Each polyclinic performs according to the available resources. All participants identified a need for revision of anemia screening protocols for screening ages and diagnostic tests.

Majority of experts emphasized the importance of having one reliable method for anemia screening in all polyclinics in order to have a clear understanding of anemia prevalence in different age groups. The criteria for screening tests mentioned by almost all participants were the following: information accuracy, speed, feasibility, safety, ability to serve a large number of patients, cost, and availability to all polyclinics. Some physicians acknowledged analyzer and Photoelectric Color Match method as a good fit to these criteria.

All participants except two experts stressed that it is not enough to diagnose anemia based on just Hb level. The lowest cutoff level of Hb for detecting anemia was not clearly identified by participants. Just 12 out of all participants indicated that the lowest level for Hb in 9-12 months old children is 105g/l. The rest, including some experts, considered 110g/l as the lowest level for anemia diagnosis.

3. Existing and potential resources for identifying anemia prevalence

Opinions differed regarding the current anemia surveillance at PHC facilities. None of laboratory physicians or pediatricians said anything about ADHS as a source of information. However, all experts identified ADHS as the main source for anemia prevalence. All participants espoused the view that taking into consideration the available resources, the use of anemia screening data at PHC facilities is the only possibility to calculate anemia prevalence. Some experts emphasized the importance of having valid and reliable data that

are obtained during the same period of time using a comparable method by the appropriately trained personnel.

Exp4: I think even if we don't have a system...at least we should be consistent in anemia diagnostic method. We are planning National Food Fortification program and I think we will need some assessment of anemia prevalence...

3.1 MIDAS system as a potential tool...

All participants considered MIDAS system as potentially useful tool for having anemia prevalence using the existing capacity of PHC system. Sufficiently high screening coverage level was identified as an important condition for reliable data. All experts identified some problems the system faces based on inconsistency between polyclinics' and MIDAS' data on anemia screening coverage levels. According to pediatricians, anemia screening is quite high, but according to MIDAS system's recent assessment of screening, coverage level is too low. Some experts revealed potential opportunities of the system to provide with the information on the prevalence of certain diseases as it has the corresponding tools/databases for it. The system would facilitate the transfer of information from medical records to electronic cards as was stated by some experts. However, the system still needs considerable improvements.

Exp6: MIDAS system is intended to analyze disease prevalence too... We don't have data yet, but we are planning to obtain it in the near future...as soon as we handle other problems with the system's performance. We will have yearly prevalence (on anemia)...

Yet the majority of pediatricians complained about extra paper work brought by this system. Although there was some awareness about a bonus system based on MIDAS (performance-based payment), none of the physicians were able to explain how it functions.

3.2 Other data collection sources

The majority of laboratory physicians see laboratories as potential data collection sources. They suggested having a special section in their journals for anemia screening data. Almost all pediatricians see chiefs of pediatric departments as potential data reporters as all anemia diagnoses are reported to the chiefs of pediatric departments by pediatricians. However, some pediatricians were not sure about consistency of data between laboratories and pediatricians referring to the fact that some anemia cases are not reported to the chiefs of pediatric departments. Either a physician or a well trained nurse was considered as potential data collectors through extracting anemia tests' results from registration journals for calculating anemia prevalence. However, none of potential data collection sources were supported by experts. Collecting data electronically was considered as the best alternative.

4. Current information flow on anemia prevalence

The information flow through the different levels of anemia screening system was explored.

4.1 Laboratory level

According to all participants, anemia screening is done based on pediatricians' referrals. Laboratory physicians identified themselves as just performers of screening. However, after performing blood analysis data are entered into a journal alongside with the results of other tests; the data on anemia are not separated from other data.

4.2 Pediatric department level

After performing blood analysis anemia data are analyzed at pediatric department level. According to pediatricians, the anemia data are entered into MIDAS system through the encounter forms. Confirmed cases of anemia are reported to the chiefs of pediatric departments or deputy chiefs of polyclinics through statistical slips that contain the information on patients' demographics, diagnoses, date of diagnosing, after which the summary of the data goes either to a polyclinic statistician or to the Statistical Bureau directly as yearly reports. Thus, anemia diagnosed through screening are not separated from anemia

diagnosed through active admissions based on patients' complaints. However, not all polyclinics use similar procedures. As was stated by some physicians, after occurrence of the MIDAS system, they don't fill in the statistical slips at all.

4.3 Information flow from polyclinics to other instances

The next level is Statistical bureau. Statistical bureau collects the data from those public primary health care facilities of Yerevan that are under the authority of the Municipality. Those PHC facilities that are not under the Municipality's authority report data directly to the NIAC. Absolute numbers are transformed into the relative indexes (number of cases per 100000 of population) and are submitted to the NIAC. Data from NIAC are presented on their website as yearly reports. NIAC submits data to the NSS of RA where they are summarized and presented in Statistical yearbooks. Anemia data are not presented separately and are included in the composition of the "blood diseases and other hematogenic disturbances" in the main public health indicators' report. The indicators are presented by absolute numbers and number of cases per 100000 children of 0-14 and 15-17 years old.

5. Obstacles for well-functioning surveillance system

According to participants, well-functioning surveillance system needs adequate human and financial resources to produce reliable data. The main findings on possible obstacles are summarized in a few subcategories: financial resources and communication problems.

5.1 Financial resources...

All participants identified that existing financing is not sufficient for well-functioning anemia surveillance system. There are many problems which could be solved by additional financing. Problems included the method of diagnosis, working conditions, and physicians' performance. Some physicians indicated the necessity of having higher number of free of charge examinations needed for appropriate diagnostics. Most physician participants indicated the need for improved conditions in laboratories that will improve the work

performance and data reliability. All pediatricians stressed that lack of appropriate reimbursement is a disincentive for good performance. Some mentioned that physicians' performance could be significantly enhanced with appropriate computer software which would decrease the extra paper work of physicians. Experts identified lack of financing as the main obstacle for having appropriate anemia surveillance system.

Exp4: Anemia prevalence should be obtained at one point in time with the same method and the same working team...like DHS...the only problem for not performing ADHS in 2010 for anemia was financing...We applied to some donors but did not get any commitment...the only advice they gave was not to overemphasize such kind of studies, and try to improve existing system...use existing capacities...

Taking into account the lack of existing resources, almost all experts didn't identify any other alternative to calculating anemia prevalence, except the MIDAS system that has the corresponding tools/databases that could be utilized for that purpose.

5.2 Communication problems

The other problem identified by all interviewed physicians was insufficient communication between pediatricians and mothers. The mothers are not well-informed about the importance of anemia screening, health outcomes of anemia, and its prevention and treatment. All physicians mentioned that insufficient patient-provider communication leads to poor population coverage with anemia screening.

Another problem is the lack and inconsistency of communication between laboratory physicians and pediatricians. According to laboratory physicians, sometimes pediatricians underestimate the contribution of laboratory physicians in the interpretation of anemia test results. Besides, lack of trust of pediatricians to the PHC facilities' laboratory physicians was mentioned as a barrier to good communication, which leads to an increase of referrals to

other private laboratories by pediatricians and supposed some profit for them from these tests' referrals.

6. Suggestions for improvement

Much emphasis was placed by participants on non-governmental organizations (NGO), international donors, and Government as supporters of improved system. There were three major areas of improvement suggested by participants.

6.1 Trainings for physicians

Training on anemia screening performance for health care personnel was the most commonly suggested improvement. Participants with laboratory experience indicated that training is necessary for laboratory physicians as well as for pediatricians and other physicians. Some participants emphasized the necessity of trainings on compliance to anemia management protocol. Some experts stressed the need for training on how to fill in the encounter forms correctly.

6.2 Anemia diagnostic method

All participants indicated that there is a need for a new protocol for anemia diagnosis test.

All of them agreed on a need of one but reliable method of anemia diagnosis.

FGIP2: the same diagnostic method of anemia diagnosis is needed...also feritin analysis is needed for confirming anemia. I even did some calculation...for FEKs that is much more reliable than Sahli it is estimated that we need 15 drams per patient for each examination...is it expensive?

6.3 MIDAS system

All experts suggested MIDAS as an ideal tool for having anemia prevalence with existing resources available. However, they also mentioned it has some serious problems that need to be addressed. It was difficult for them to identify precisely whether physicians are in error or not; however, some experts did state that pediatricians do not fill in encounter forms

appropriately. Therefore, incorrect or not complete information is transferred into the system. .

Exp4: ...at least we have screening data and MIDAS system as a potential tool that have all needed database for anemia prevalence...but MIDAS system needs considerable improvements...Trainings for health care workers and system's coordinators and operators are needed for the system to perform well.

Discussion

The study helped to understand the perceptions of health care workers and administrators at different levels of health care system. The study explored how the anemia screening is currently performed and how the data are analyzed and utilized. This study is the first conducted in Armenia that explores the problems and challenges, faced by the current system, and provides recommendations for a new or improved surveillance system on anemia in children.

Anemia burden

The study findings suggest that anemia is a significant problem in Armenian children. 9-12 month old children were considered to be the most affected. The opinions of study participants are confirmed by the ADHS 2005 findings, which showed that 37% of 6-59 mo children have anemia with excess of 67.9% in 9-11 mo children (2). However, there were some controversial opinions on anemia prevalence rates among pediatricians and experts. Some experts noticed an increase in anemia since 2000, while most of the pediatricians thought that anemia rates decreased from 2010 to 2011. ADHS 2005 data show the increase in anemia rate in children from 2000 to 2005 especially in Yerevan and Gegharkunik (2). The proportion of children with any anemia had tripled in Yerevan from 2000 to 2005, and doubled in Gegharkunik, although it was explained by some facts like migration of poorer

families from rural areas to the city. Besides, other factors also could influence such inconsistent increase in anemia data, like data collection errors(2). However, the absence of ADHS data on anemia prevalence in 2010 does not allow making any conclusions about the recent trends.

The majority of risk factors identified by our participants are supported by the literature review (37-39). It is well-documented in the literature that breastfeed babies are less affected by anemia than those who are on supplementary feeding (12). However, some interesting findings were revealed by some experts about the relationship of breastfeeding practices and anemia development. According to these experts' experiences, sometimes when mothers have succeeded in breastfeeding they continue to breastfeed their child up to 10-12 months without any other supplemental foods, while the children who are older than 6 months need more iron than can be supplied by breast milk only (12). That is why the risk of anemia in these children is higher. Poor socioeconomic conditions were also mentioned by almost all participants as a risk factor for anemia. Some studies indicate that low socio-economic status has been considered as an important predisposing risk factor for developing of iron deficiency anemia in children 1-2 years old age (40). An interesting finding which has not been documented in the literature was that according to some of the physicians, vaccination, especially pentavaccine, may be a provocative/triggering factor for anemia in children. This finding warrants further research.

Anemia screening performance

All physicians considered anemia screening at PHC facilities as an important tool of detecting anemia in children. However they suggested revising the screening age currently prescribed by the MOH protocol to include children of other ages who are also vulnerable to anemia. Some studies suggest that hemoglobin screening at 9-12 months old is inappropriate

as there is no adequate time to develop anemia. The screening at later ages, 15-18 months of age, would allow to detect anemia in children as there would be sufficient time to develop it as a child has been weaned off breast milk and iron-fortified formulas (41). The participants listed a number of factors affecting screening coverage in children. Physicians' inadequate performance, mothers' low knowledge levels about anemia, and communication problems are the key determinants of inadequate screening coverage level. Although physicians reported high screening coverage at PHC facilities, health care administrators indicated low coverage due to variety of reasons.

Criteria for anemia screening tests

Our participants revealed that the majority of Yerevan polyclinics perform the Sahli method of anemia detection, based on Hb, which is not accurate and reliable which is consistent with the literature. The criteria for screening tests mentioned by almost all participants were the following: information accuracy, speed, feasibility, safety, ability to serve a large number of patients, cost, and availability to all polyclinics. Some methods identified by participants as more appropriate and reliable screening, i.e. Photoelectric Color Match method, are supported by the corresponding literature as accurate, precise, easy to operate, and appropriate to PHC level (32). The importance of having uniform anemia diagnosis protocols to be able to generate consistent and reliable data was also emphasized by all participants. What refers to insufficiency of anemia diagnosis based on just Hb level, our findings could not be supported as the sensitivity and specificity of using other single tests (e.g., serum ferritin, transferrin saturation, and erythrocyte protoporphyrin) as primary screening tools for iron deficiency anemia have not been well studied yet (21). Pediatricians use different cut-off points in anemia detection: some of them diagnose anemia at $Hb < 105g/l$, while others diagnose it at $Hb < 110g/l$. Both of them are accepted cut-off points for detecting iron deficiency and IDA as indicated by the clinical literature (11). However,

according to Integrated Management of Childhood Illnesses guide for anemia management in Armenia, the lowest Hb level for 6-24 mo children is 105g/l(26). Apparently not all physicians follow this guideline which further complicates the collection of consistent data on anemia prevalence.

Existing and potential resources for anemia prevalence

None of the laboratory physicians or pediatricians identified ADHS as a source of information on anemia prevalence seeing PHC facilities as the only appropriate source of data based on their knowledge and experience. However, all experts identified ADHS as the main source for anemia prevalence data and regretted not having 2010 data due to financial constraints. NIAC was also considered as the source of anemia prevalence; however absence of anemia as a separate category and not enough detailed age categorization of children do not allow obtaining anemia prevalence reliable data from NSS yearbook.

Having valid and reliable data that show anemia prevalence obtained during the same period of time using a comparable method by the appropriately trained personnel was considered by participants as the most important prerogative for the adequate surveillance system.

MIDAS system as a source of data on anemia prevalence

The MIDAS system has been incorporated into primary health care facilities by State Health Agency for primary health care financing reimbursement system since 2010 (29). The current study indicates that MIDAS system could be a useful tool for having anemia prevalence using the existing capacity of PHC system. Some of the participants indicated that the system might be useful in future since it has the necessary software/databases to process the information on all enrolled patients and those screened for anemia; however, the analytical part of the system is not completely developed yet and the system in general needs some improvements.

Information flow from primary health care facilities

Anemia screening is performed at PHC facilities according to pediatricians' referrals. After performing anemia tests, the results are analyzed at pediatric department level. Collecting anemia data through statistical slips and summarizing annually within each PHC facility by either head of pediatric department or polyclinic statistician, data are submitted to the Statistical Bureau, where they are analyzed and transferred to relative indexes, and reported to the NIAC of the National Institute of Health of the MOH. Here data are incorporated into the "blood diseases and other hematogenic disturbances" category and are reported to the NSS, where they are presented by absolute numbers and number of children per 100000 population of 0-14 and 15-17 years old children in Statistical yearbooks. However, not all polyclinics perform in the same way. Some of them don't have this reporting system after the occurrence of the MIDAS system which means that data from some polyclinics are missing.

Obstacles for well-functioning surveillance system

Our findings suggest that anemia surveillance system needs adequate human and financial resources for successful functioning. The study suggested that limited financing leads to many problems in this field, the most important of which are unreliable diagnostic tests. Quality laboratory testing is important for appropriate clinical diagnosis, accurate surveillance system, and direct public health care policy (42). Other problems included lack of communication between physicians and mothers which inhibit appropriate coverage, and lack of communication between pediatricians and laboratory personnel.

Suggestions for improvements

Participants emphasized the role of NGOs, international organizations and government in overcoming current challenges faced by PHC facilities. The role of government is crucial in disease prevention and control at population level in achieving health equity(43). However, it should be accompanied by the organized efforts and informed choices of society, different organizations, and individuals(43). Trainings for physicians to ensure high screening coverage through making calls to mothers of children in order to inform them about timely anemia screening, and increase of mothers' awareness about anemia were suggested by all participants as the necessary components of the successful surveillance system. Development of a new anemia diagnosis protocol that includes a uniform reliable anemia test in all PHC facilities is needed to assure the consistency of anemia diagnoses.

Study Strengths and Limitations

This is the first study conducted in Armenia that explores the obstacles for well-functioning anemia surveillance system and provides recommendations for a new or improved surveillance system. Although the study sample is small, it is derived based on the purposive sampling approach and involves participants from all levels of care who have diverse but essential roles in anemia screening in Armenia. All pediatric PHC facilities in Yerevan were included in the study which increases the representativeness of the sample.

The time and budget constrains did not allow for more detailed analysis of the problem areas identified in the scope of the study. However, the study provided a good snapshot of current problems with anemia surveillance in Armenia, and identified several ways for improving the system based on the opinions of study participants and the literature analysis.

Conclusion and Recommendations

The study's findings suggest that the existing anemia surveillance system is inadequate and has numerous flaws that need improvement and/or complete overhaul. First, the system is based on anemia data from both active admissions and anemia screening, that are not separated from each other and thus cannot reflect anemia prevalence in the children. Second, anemia data are combined with other blood diseases and are presented in the yearly reports as "blood diseases and other hematogenic disturbances". Third, there is no detailed age categorization; data are presented for 0-14 and 15-17 years old children which does not allow detecting specific age groups.

Thus, the use of anemia screening data at PHC facilities is the only opportunity to calculate anemia prevalence with the existing resources. The exploration of alternative ways for collecting and analyzing reliable data on anemia prevalence led to conclusion that MIDAS system currently used for financial reimbursement of primary health care facilities might be the best option, as it is already established in the PHC facilities and has all the necessary tools for calculating anemia prevalence. It has the free enrollment list that could provide the number of children 9-12 months old that are screened for anemia, and anemia confirmed diagnoses that are filled in the encounter forms and are entered into the system. The system should be improved to be able to provide the necessary data; particularly, the analytical tools used in the system, as well as the quality and completeness of the information entered into the system at PHC facilities should be enhanced. However, having an operational MIDAS system cannot ensure the successful functioning of the surveillance system. Other factors such as high population coverage with anemia screening at PHC facilities, the saturation of PHC facilities with appropriate tests and equipment, and physicians' compliance to screening protocols are essential for establishing a well-functioning system.

The following recommendations are suggested based on the findings of the study:

- Conduct trainings for health care personnel and MIDAS operators on accurate handling, processing, and entry of encounter forms
- Conduct trainings for health care personnel on anemia management based on current MOH protocol/guidelines
- Conduct trainings for health care personnel on patient-provider communication to ensure high screening coverage
- Increase mothers' awareness of the importance of timely anemia screening
- Improve MIDAS analytical tools to allow calculation of anemia prevalence based on the data obtained from PHC facilities
- Set up a new protocol for anemia screening test at all PHC facilities with the use of a uniform, reliable, and inexpensive anemia diagnostic tests, i. e. analyzers or Photoelectric Color Match method.

These innovations and improvements offer potential first steps in the process of establishing a modern and reliable anemia surveillance system in Armenia.

- (1) Coutinho GG, Goloni-Bertollo EM, Bertelli EC. Iron deficiency anemia in children: a challenge for public health and for society. *Sao Paulo Med J* 2005; 123(2):88-92.
- (2) National Statistical Service (Armenia), Ministry of Health (Armenia), and ORC Macro. Armenia Demographic and Health Survey 2005. 2006. Calverton, Maryland: National Statistical Service, Ministry of Health, and ORC Macro.
- (3) dos Reis MC, Nakano AM, Silva IA, Gomes FA, Pereira MJ. Prevalence of anemia in children three to 12 months old in a health service in Ribeirao Preto, SP, Brazil. *Rev Lat Am Enfermagem* 2010; 18(4):792-799.
- (4) Iron Deficiency Anemia: Assessment, Prevention and Control: A Guide for Program Managers. 2001. World Health Organization-Geneva.
- (5) Carter RC, Jacobson JL, Burden MJ, Armony-Sivan R, Dodge NC, Angelilli ML et al. Iron deficiency anemia and cognitive function in infancy. *Pediatrics* 2010; 126(2):e427-e434.
- (6) Szarfarc SC dSSB. Prevalence and risk factors in iron deficiency and anemia. *Arch Latinoam Nutr* 1997 47(2 Suppl 1):35-38. 1997.
- (7) Lutter CK. Iron deficiency in young children in low-income countries and new approaches for its prevention. *J Nutr* 2008; 138(12):2523-2528.
- (8) Schneider JM, Fujii ML, Lamp CL, Lonnerdal B, Dewey KG, Zidenberg-Cherr S. Anemia, iron deficiency, and iron deficiency anemia in 12-36-mo-old children from low-income families. *Am J Clin Nutr* 2005; 82(6):1269-1275.
- (9) Lindsay Allen et al. Guidelines on Food Fortification with Micronutrients. Geneva, World Health Organization. 2006.
- (10) Berard R, Matsui D, Lynch T. Screening for iron deficiency anemia in at risk children in the pediatric emergency department: a survey of Canadian pediatric emergency department physicians. *Pediatr Emerg Care* 2007; 23(5):281-284.
- (11) Domellof M, Dewey KG, Lonnerdal B, Cohen RJ, Hernell O. The diagnostic criteria for iron deficiency in infants should be reevaluated. *J Nutr* 2002; 132(12):3680-3686.
- (12) Aznauryan A. Risk Factors of Iron Deficiency Anemia in Infants under 2 years of age in Yerevan: A Case-Control Study. Center of Health Services Research and Development, College of Health Sciences, American University of Armenia. 1999.
- (13) Bruno de B.et.al. Worldwide Prevalence of Anemia. 1993-2005 WHO Global Database on Anemia. 2008. Spain.

- (14) Crawley J. Reducing the burden of anemia in infants and young children in malaria-endemic countries of Africa: from evidence to action. *Am J Trop Med Hyg* 2004; 71(2 Suppl):25-34.
- (15) National Food and Nutrition Surveillance System: methods and procedures. Ministry of Health, Directorate General of Health Affairs, Sultanate of Oman. 2009.
- (16) Yip R. Iron deficiency: contemporary scientific issues and international programmatic approaches. *J Nutr* 1994; 124(8 Suppl):1479S-1490S.
- (17) Sherriff A, Emond A, Bell JC, Golding J. Should infants be screened for anaemia? A prospective study investigating the relation between haemoglobin at 8, 12, and 18 months and development at 18 months. *Arch Dis Child* 2001; 84(6):480-485.
- (18) Beard JL. Effectiveness and strategies of iron supplementation during pregnancy. *The American journal of clinical nutrition* 2000; 71(5):1288S.
- (19) Yip R, Ramakrishnan U. Experiences and challenges in developing countries. *The Journal of nutrition* 2002; 132(4):827S.
- (20) Khusun H, Yip R, Schultink W, Dillon DH. World Health Organization hemoglobin cut-off points for the detection of anemia are valid for an Indonesian population. *J Nutr* 1999; 129(9):1669-1674.
- (21) United States Preventive Services Task Force: Screening for Iron Deficiency anemia - Including Iron Supplementation for Children and Pregnant Women: United States Preventive Services Task Force. *The Internet Journal of Nutrition and Wellness*. Volume 3, Number 1. 2007.
- (22) MJ Kotze et al. Pathogenic Mechanisms Underlying Iron Deficiency and Iron Overload: New Insights for Clinical Application. *The Journal of the International Federation of Clinical Chemistry and Laboratory Medicine* . 2011.
- (23) Ministry of Health Order № 2001-A, ch.III, an. №1, ch. 4, an № 6. 14-12-2009. Armenia.
- (24) Thompson ME, Harutyunyan TL. Impact of a community-based integrated management of childhood illnesses (IMCI) programme in Gegharkunik, Armenia. *Health Policy Plan* 2009; 24(2):101-107.
- (25) Ministry of Health order. №1984-A . 30-12-2008. Integrated Management of Childhood Illnesses Standard's approval.
- (26) WHO/UNICEF. Integrated Management of Childhood Illnesses: quick guide of iron deficiency anemia management in children. 12-12-2008.

- (27) Ministry of Health RA. National Institute of Health, National Information Analytic Center. <http://www.healthinfo.am/Main%20functions.htm> . 2011.
- (28) Health and Health Care of Armenia 2009, Official Annual Statistical Report, Health Information Analytic Center of the National Institute of Health, Ministry of Health of Republic of Armenia. 109 p. 2010. Yerevan.
- (29) Frank Feeley. USAID/PHCR, Use and Verification of Primary Health Care Performance Indicators. 2009.
- (30) Government of RA. Approval of the 2003-2015 Strategy of Maternal and Child Health Protection. annex to Government of RA №1000-N resolution from Aug 2003. 14-8-2003.
- (31) Public Health Surveillance:the best weapon to avert epidemics. Disease Control Priorities Project. Fogarty International Center of the US National Institutes of Health. The World Bank. World Health Organization. Population Reference Bureau. 2008.
- (32) Donna Robinett HTCS. Anemia Detection in Health Services: Guidelines for Program Managers. US Agency for International Development. Second Edition. 1996.
- (33) World Health Organization. WHO Recommended Surveillance Standards. Department of Communicable Disease Surveillance and Response. Second Edition. 2010.
- (34) Djibuti M, Rukhadze N, Hotchkiss DR, Eisele TP, Silvestre EA. Health systems barriers to effective use of infectious disease surveillance data in the context of decentralization in Georgia: a qualitative study. *Health Policy* 2007; 83(2-3):323-331.
- (35) Asma A.Al-Jawadi MAA-N. Assessment of Infectious Disease Surveillance System in Mosul, Iraq. *Dohuk Medical Journal*, Volume 2, Number1 2008.
- (36) National Statistical Service. Statistical Yearbook of Armenia 2010. 179 p. 2011.
- (37) Smith JL, Brooker S. Impact of hookworm infection and deworming on anaemia in non-pregnant populations: a systematic review. *Trop Med Int Health* 2010; 15(7):776-795.
- (38) Menegassi M, Mello ED, Guimaraes LR, Matte BC, Driemeier F, Pedroso GL et al. Food intake and serum levels of iron in children and adolescents with attention-deficit/hyperactivity disorder. *Rev Bras Psiquiatr* 2010; 32(2):132-138.

- (39) Vendt N, Grunberg H, Leedo S, Tillmann V, Talvik T. Prevalence and causes of iron deficiency anemias in infants aged 9 to 12 months in Estonia. *Medicina (Kaunas)* 2007; 43(12):947-952.
- (40) Ali NS, Zuberi RW. The relationship of socio-demographic factors with iron deficiency anaemia in children of 1-2 years of age. *JPMA* 2001; 51(130).
- (41) Kohli-Kumar M. Screening for Anemia in Children: AAP Recommendations---A Critique. *Pediatrics* 2001; 108(3):e56.
- (42) Petti CA, Polage CR, Quinn TC, Ronald AR, Sande MA. Laboratory medicine in Africa: a barrier to effective health care. *Clinical Infectious Diseases* 2006; 42(3):377.
- (43) Lakshminarayanan S. Role of government in public health: Current scenario in India and future scope. *Journal of Family and Community Medicine* 2011; 18(1):26.

Tables

Table 1

Classification of anemia as a problem of public health significance(13)

Prevalence of anemia (%)	Category of Public Health Significance
≤ 4.9	No Public Health Problem
5.0-19.9	Mild Public Health Problem
20.0-39.9	Moderate Public Health Problem
≥ 40.0	Severe Public Health Problem

Appendices

Appendix 1

**American University of Armenia
College of Health Sciences
Master's Program in Public Health
Oral consent form**

**Assessment of the Current Surveillance System of Anemia in 9-12-month Old Children
in Armenia**

1. Who is doing the study: My name is Marianna Koshkakaryan. I am a family physician and a graduate student in Public Health at the American University of Armenia. I am working under the supervision of faculty at the University on this project.

2. Purpose: To describe and analyze current anemia surveillance in children 9-12-months old in Armenia in order to develop recommendations for establishing the surveillance system with systematic and quality data collection on the prevalence of anemia in this age group.

3. The study explores the perceptions of health care workers and administrators at different levels (facility level, MOH, SHA, AIC) who have different involvements and differential investments in anemia screening, about how the analysis of anemia screening data is performed and how the data are utilized and aims to describe and analyze the chain of information flow from primary health care facilities (of anemia diagnosed cases), the application of the screening data to develop recommendations for a system that will give an opportunity to systematically assess periodic prevalence of anemia in children 9-12-months.

4. Why you are invited to participate: You are being asked to participate in this study as an expert and key informant. Your participation in our study is important since you have expertise and experience in anemia screening. We are interested in your expert opinions and suggestions.

5. Procedures: Participation involves only one individual interview/discussion by you, depending on your availability and willingness to participate in the interview. Interview/discussion will last for one hour. Upon your permission we will tape record the interview/discussion to make sure that no idea remains out of our attention.

6. Risks: There is no risk of discussing the topic.

Benefit: There is no benefit to participating in this study beyond contributing to the Armenian Health Care System and Child Health.

7. Confidentiality and Anonymity: Your participation is confidential and anonymous. Your name and any characteristics that identify you will not be associated with your interview or with the results of this study. Brief quotes not attributable to you may be used in the results of this study.

Your name and position will not appear in reports and presentations. All your comments will be used for research purpose only.

8. Alternatives to participation: You are free to decline participation at any time even after interview.

9. Voluntary nature of the study: Your participation in this study is voluntary and you are free to refuse participation without consequences.

10. Right to withdraw at any time: You may withdraw from the study at any time and any data collected from you will be destroyed should you withdraw after interview.

11. Before we start, you should have had all your questions regarding participation in this study answered. If you have more questions about this study you can contact Dr. Varduhi Petrosyan, the Associate Dean of the College of Health Sciences at AUA calling 512592.

If you feel you have not been treated fairly or think you have been hurt by joining this study, please contact Dr. Hripsime Martirosyan, AUA Human Subjects Administrator at (374 1) 51 25 61. If you consent to participate, we can start.

Appendix 2

Focus-Group Discussion Guide

Pediatricians, Heads of Pediatric Departments, Laboratory Physicians of polyclinics

Place _____

Date _____

Time _____

Interviewer _____

Age _____

Gender _____

Work resp. _____

Work experience (years) _____

You are involved in this study as experts and key informants. We would like to ask several questions regarding Anemia Surveillance in children. Can we start?

1. What can you say about anemia prevalence in Armenian children?

To probe:

- Which age group is more affected?
- Prevalence?
- Undiagnosed and unconfirmed cases, untreated anemia?
- Are these children treated and followed-up

2. What can you say about anemia screening appropriateness?

To probe:

- Is it necessary?
- Is there any screening program going on?
- How screening data are followed?

3. What do you think how active is children's participation in anemia screening?

To probe:

- What is the coverage of anemia screening?
 - Are there any obstacles to screening? What kind of obstacles?
4. What can you say about follow-up of the screening data: are they collected and reported to other instances like MOH or Analytical-Informational Center?

To probe:

- Elsewhere?

5. Please in few words describe features of the current system.

To probe:

- How anemia screening data are collected?
- Are anemia confirmed cases reported? Where?
- How they are followed-up?
- Does current system have some problems or needs to improvement?
- What can be done?

6. How anemia screening data could be collected from the policlinics?

To probe:

- Is it possible to collect data from pediatricians? Why? Or why not?
- Is it possible to collect anemia screening data from Primary Health Care Facilities? Why? Or why not?
- Are there any potential data collection sources for anemia data collection?
- Can laboratories be more useful in this case? Why? Or why not?
- How the information should be collected – manually/electronically?

7. Finally, what would you suggest for improving Anemia Surveillance in Children in Armenia?

Are there other things that we did not discuss but you feel are important to talk about?

Thank you for participating in our study

Appendix 3

In-depth Interview guide

Ministry of Health, National Analytical Information System, Statistical Bureau

Place _____

Date _____

Time _____

Interviewer _____

Age _____

Gender _____

Work resp. _____

Work experience (years) _____

You are involved in this study as an expert and a key informant. We would like to ask several questions regarding Anemia Surveillance in children. Can we start?

1. What do you think about prevalence of anemia in children?

To probe:

- Which age group is more affected?
 - Are these children treated and followed-up properly?
 - How it is monitored and managed?
2. What can you say about current monitoring and evaluation mechanisms for anemia Control and Prevention in children (based on protocol)?
 3. As you know anemia screening is performed in all Primary Health Care facilities at specific age-group in children. In your opinion what are the benefits of the screening program from the different perspectives (population, physicians, health care decision makers)?
 4. What can you say about follow-up of the screening data: are they collected in polyclinics and reported to other instances (MOH or Analytical-Informational Center)?

To probe:

- What is the application of anemia screening data?
5. As anemia screening is among SHA health indicators and it is going to be evaluated in January 2011, what can you say about its future practice and implication? (more applicable for SHA repres.).
 6. What do you think about perceived benefits of collecting screening data?

To probe:

- How they can benefit to the anemia burden?
 - How they can be used? For what purposes?
7. As you know Armenian Demographic and Health Survey gives anemia prevalence per 5 years. Is it enough to control anemia in children based on this prevalence?
 8. Please in few words describe current Surveillance system on anemia.
 9. How do you assess current and future role of NGOs and International organizations in anemia surveillance?

To probe:

- Do we need their support?
 - How they can help?
10. Finally, what would you recommend to improve Anemia Surveillance in Children in Armenia?

Are there other things that we did not discuss but you feel it is necessary to talk about?

Thank you for participating in our study

Appendix 4

In-depth Interview guide

State Health Agency

1. I would like to ask several questions about MIDAS 3 system. What is the aim of this program?
2. Besides, financial tool, is MIDAS system used for health care quality assessment and how it is done?
3. Do you analyze disease prevalence by MIDAS 3 system. If yes, how these data are used?

To probe:

- If no, is it possible to give also prevalence as you have screening and anemia diagnoses?
 - Is it possible to separate those anemia diagnoses that are diagnosed through screening and have the prevalence in children of screening ages? How often?
4. As you have already assessed performance of health indicators in 2011, January, what would you say about anemia screening performance levels in polyclinics?

To probe:

- Are there any problems and what kind of problems? How it could be managed?
5. Are there any things that we didn't discuss or people you would suggest to interview that could help in providing information in this sphere?

Thank you for participating in our study

Appendix 5

Հանրային առողջապահության մագիստրատուրա Դիպլոմային աշխատանք 9-12 ամսեկան երեխաների սակավարյունության համաճարակաբանական հսկողության համակարգի վերլուծությունը Հայաստանում

Բանավոր համաձայնագիր

1. Իմ անունն է Մարիաննա Կոչկակարյան: Ես ընտանեկան բժիշկ եմ և հանդիսանում եմ Հայաստանի ամերիկյան համալսարանի Հանրային առողջապահության մագիստրատուրայի (ՀԱՄ) վերջին կուրսի ուսանող: Այս հետազոտությունը ես կատարում եմ համալսարանի երկու դասախոսների ղեկավարությամբ, և այն կլինի իմ մագիստրական դիպլոմային աշխատանքի մաս:
2. Հետազոտության նպատակն է հետազոտել 9-12 ամսեկան երեխաների Սակավարյունության համաճարակաբանական հսկողության համակարգը և առաջարկել հետագա բարելավման ուղիներ, որոնք հնարավորություն կտան ունենալ 9-12 ամսեկան երեխաների խմբում սակավարյունության վերահսկման և տարածվածության համար պատասխանատու համակարգ:
3. Հետազոտությունը ուսումնասիրում է սակավարյունության սկրինինգի պատասխանատու տարբեր փորձագետների կարծիքները ըստ իրենց աշխատանքային և կազմակերպչական մասնակցության: Հետազոտության նպատակն է ուսումնասիրել և վերլուծել սակավարյունության վերահսկման շղթան (սկսած պոլիկլինիկաներից մինչև վերադաս բուժ. հսկողության մարմիններ) և առաջարկել հետագա ուղիներ այն բարելավելու համար:
4. Մենք հրավիրում ենք փորձագետների մասնակցել այս հետազոտությանը և շատ գնահատում ենք Ձեր մասնակցությունը այս քննարկմանը, քանի որ Դուք սակավարյունության սկրինինգի գործող ոլորտում հանդիսանում եք փորձագետ և ունեք մեծ փորձառություն: Մեզ հետաքրքրում է Ձեր կարծիքը և առաջարկները:
5. Ձեր մասնակցությունը կպահանջի միայն մեկ հարցազրույց/քննարկում ըստ Ձեր ցանկության և զբաղվածության աստիճանի, որը կտևի մոտավորապես մեկ ժամ: Եթե թույլտ տաք մենք կձայնագրենք քննարկումը որպեսզի ոչինչ բաց չթողնենք: Ձեր տրամադրած տեղեկատվությունը կօգտագործվի միայն հետազոտության համար:
6. Այս հետազոտությանը մասնակցությունը չի ենթադրում որևէ ռիսկ կամ անձնական շահ: Դրանով դուք նպաստում եք ՀՀ հանրային առողջության բարելավմանը:
7. Այս հարցազրույցի/քննարկման գաղտնիությունը ապահովված է: Ձեր անունը կամ պաշտոնը չի նշվի որևէ զեկույցում կամ ներկայացման մեջ:
8. Դուք կարող եք ցանկացած հարցին չպատասխանել կամ ընդհատել հարցազրույցը/քննարկումը ցանկացած պահին:

9. Ձեր մասնակցությունը կամավոր է: Դուք կարող եք հրաժարվել և դա որևէ բանի վրա՝ այդ թվում Ձեր աշխատանքի վրա չի ազդի:
10. Մասնակցությունից հրաժարվելու դեպքում, նույնիսկ եթե Դուք ավարտել եք հարցազրույցը/քննարկումը, Ձեր տրամադրած տեղեկությունները կոչնչացվեն:
11. Հետազոտության հետ կապված հետագա հարցերի համար կարող եք զանգահարել Հայաստանի ամերիկյան համալսարանի Հանրային առողջապահության մագիստրատուրայի փոխդեկանին՝ Վարդուհի Պետրոսյան - 512564, ինչպես նաև եթե կարծում եք, որ հետազոտության ընթացքում Ձեզ հետ լավ չեն վերաբերվել և/կամ հետազոտությունը Ձեզ վնաս է հասցրել կարող եք զանգահարել Հայաստանի ամերիկյան համալսարան, Հոփսիմե Մարտիրոսյանին հետևյալ համարով՝ 512561; նա հանդիսանում է ՀԱՀ-ի Էթիկայի հանձնաժողովի ադմինիստրատորը: Եթե համաձայն, եք կարող ենք սկսել:

Appendix 6

Հայաստանի Ամերիկյան Համալսարան Հարցազրույցի վարման ուղեցույց Մանկաբույժներ, Բաժնի Վարիչներ, Լաբորատորիայի Բժիշկներ

Դուք ընդգրկված եք այս հետազոտության մեջ որպես առողջության պահպանման առաջնային օղակի փորձագետ և մենք կուզենայինք Ձեր օգնությամբ որոշ հարցեր պարզաբանել 9-12 ամսեկան երեխաների Սակավարյունության Համաճարակաբանական Հսկողության Համակարգի վերաբերյալ:
Կարող ենք սկսել?

1. Ինչ կարող եք ասել Սակավարյունության տարածվածության մասին երեխաների մոտ? Որ տարիքային խմբում է այն ավելի տարածված?
2. Ինչ էք կարծում՝ կարևոր է արդյոք Սակավարյունության սկրինինգը, որը իրագործվում է պոլիկլինիկաներում 9-12 ամսեկան երեխաների տարիքային խմբում? Ինչ էք կարծում՝ որն է դրա նպատակը?
3. Ձեր կարծիքով ինչքանով ակտիվ է երեխաների մասնակցությունը սկրինինգում? Արդյոք կան որոշ խանգարող հանգամանքներ, դժվարություններ այն իրագործելու համար?
4. Կինդրեի մի քանի խոսքով նկարագրել Սակավարյունության Համաճարակաբանական Հսկողության ներկայումս գործող համակարգը՝ ինչպես և որտեղ են սակավարյունության տվյալները գրանցվում և վերահսկվում?
5. Ինչ էք համարում ավելի նպատակահարմար՝ ինչպես կարելի է հավաքագրել սակավարյունության սկրինինգի տվյալները պոլիկլինիկաներից՝ մանկաբույժներից, բաժնի վարիչներից, լաբորատորիաներից? Ինչու?
6. Վերջում կուզենայի Ձեր կարծիքը իմանալ՝ ինչ կարելի է անել Սակավարյունության Համաճարակաբանական Հսկողության Համակարգը բարելավելու նպատակով?
7. Կան արդյոք հարցեր որի շուրջ մենք չխոսեցինք և Դուք կուզենայիք ինչ որ բան ավելացնել?

ՇՆՈՐՀԱԿԱԼՈՒԹՅՈՒՆ ՄԱՍՆԱԿՑՈՒԹՅԱՆ ՀԱՄԱՐ

Appendix 7

Հայաստանի Ամերիկյան Համալսարան Հարցազրույցի վարման ուղեցույց Առողջապահության Նախարարություն, Պետական Առողջապահական Գործակալություն, Ինֆորմացիոն-Անալիտիկ Կենտրոն

Դուք ընդգրկված եք այս հետազոտության մեջ որպես փորձագետ և մենք շատ հետաքրքրված ենք Ձեր մասնակցությամբ, և կարևորություն ենք տալիս Ձեր կարծիքին որոշ հարցեր պարզաբանելու 9-12 ամսեկան երեխաների Սակավարյունության Համաճարակաբանական Հսկողության Համակարգի վերաբերյալ:

Կարող ենք սկսել?

1. Կցանկանայի իմանալ Ձեր կարծիքը Սակավարյունության տարածվածության մասին երեխաների մոտ? Որ տարիքային խմբում է այն ավելի տարածված?
2. Ինչ կարող եք ասել երեխաների սակավարյունության մոնիտորինգի և գնահատման ներկայումս գոյություն ունեցող մեխանիզմների վերաբերյալ (ըստ արձանագրության):
3. Ձեր կարծիքով որոնք են համարվում 9-12 ամսեկան երեխաների Սակավարյունության սկրինինգի դրական կողմերը?
4. Ինչ կարող եք ասել սկրինինգների սվյալների հետագա վերահսկման մասին: Արդյոք հավաքագրվում են այդ տվյալները պոլիկլինիկաների մակարդակով և փոխանցվում վերադաս բուժ. հսկող. մարմիններին, օրինակ՝ Առողջապահության Նախարարություն?
5. Քանի որ երեխաների սակավարյունության սկրինինգը Պետական Առողջապահական Գործակալություն կողմից առաջադրված առողջության չափորոշիչների թվին է պատկանում, կցանկանայի Ձեր կարծիքը իմանալ՝ արդյոք շարունակելի բնույթ է այն կրելու հետագայում թե ոչ? (ուղ.ՊԱԳ-ի ներկ.)
6. Ինչ եք կարծում՝ ինչքանով արդյունավետ կլինեն սկրինինգների տվյալների հավաքագրումը պոլիկլինիկաներից և ինչպես այն կարող է օգտակար լինել երեխաների Սակավարյունության կանխարգելման նպատակով?
7. Կցանկանայի Ձեր կարծիքը իմանալ ներկայումս գործող Հայաստանի Ժողովրդագրության և Առողջության հարցերի Հետազոտության վերաբերյալ: Արդյոք նպատակահարմար և բավարար եք համարում հիմնվել հիվանդության տարածվածության տվյալներին հավաքագրելով այն հինգ տարին մեկ?
8. Կխնդրեի նկարագրել Սակավարյունության Համաճարակաբանական Հսկողության ներկայումս գործող համակարգը՝ ինչպես և որտեղ են երեխաների սակավարյունության տվյալները գրանցվում և վերահսկվում?
9. Ինչպես եք կարծում՝ ինչպես կարելի է Սակավարյունության Համաճարակաբանական Հսկողության Համակարգը բարելավել? Եվ ինչ դեր կարող են ունենալ հասարակական և միջազգային կազմակերպությունները այն բարելավելու գործում?
10. Կան արդյոք հարցեր որոնք մենք չքննարկեցինք և Դուք կցանկանայիք ինչ որ բան ավելացնել?

ՇՆՈՐՀԱԿԱԼՈՒԹՅՈՒՆ ՄԱՍՆԱԿՑՈՒԹՅԱՆ ՀԱՄԱՐ