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Factors Correlated with the Competency of Barangay Nutrition Scholars in Cabuyao, Laguna in the Implementation of the Family MUAC Approach

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Abstract

With COVID-19 disrupting basic health services, the Family MUAC approach was recognized as a "reduced physical contact" method for detecting malnutrition among children aged 6-59 months old. The mid-upper arm circumference (MUAC) is an anthropometric measure taken at the midpoint of the upper arm, between the tip of the shoulder (olecranon process) and the tip of the elbow (acromion). While this approach is already being implemented in 26 countries worldwide, there is a research gap in the implementing strategies of the Family MUAC approach in the Philippines. As of 2021, there were only a few documented barangay-level activities involving this approach; a pilot implementation in Samar, Northern Samar, and Zamboanga Del Norte, and a virtual training in Cagayan Province.

This quantitative study was conducted to correlate factors with the competency of the Barangay Nutrition Scholars in the implementation of the Family MUAC approach. The study surveyed all 18 Barangay Nutrition Scholars in Cabuyao, Laguna using a pretested structured questionnaire. Descriptive statistics were used to describe the socioeconomic and demographic characteristics, supportive systems, resources, and level of competency of the respondents. On the other hand, Spearman and Cramer's V coefficients were calculated to identify factors correlated with the competency of the respondents.

With the majority of the respondents having a moderate level of competency (72.2%), results showed that competency was negatively correlated with age and positively correlated with household size, monthly family income, last MUAC training, supervisory visits, refresher training, and availability of selected supplies. In conclusion, the variables above were factors correlated with competency, and knowledge, experience, and motivation were sufficient measures of the Barangay Nutrition Scholars' level of competency.

The study recommends reinforcing strategies on the identified positively-influencing factors related to family support, training, supervision, and supplies to improve the competency of the Barangay Nutrition Scholars in the implementation of the Family MUAC approach.

Keywords— acute malnutrition, barangay nutrition scholars, Family MUAC Approach, MUAC measurement, Philippine Integrated Management of Acute Malnutrition (PIMAM)

1 Introduction

A Barangay Nutrition Scholar (BNS) is a barangay-based volunteer that is tasked to identify and locate malnourished children (underweight, wasted and stunted, or obese) through an annual weight and height measuring activity, Operation Timbang (OPT) Plus. However, interim guidelines in nutrition screening were revised during the pandemic to reduce physical contact with the children, and the use of the mid-upper arm circumference (MUAC), to detect acute malnutrition arose. The mid-upper arm circumference (MUAC) is taken at the midpoint of the upper arm, between the tip of the shoulder (olecranon process) and the tip of the elbow (acromion). This anthropometric measure is used in the detection of malnutrition since it measures the upper arm which is composed of subcutaneous fat and muscle mass. Since the increase or decrease of food intake is directly proportional to the amount of subcutaneous fat and muscle mass, the value of the MUAC measure can reflect the nutritional status of children [1].

In 2020, a pilot implementation of the Family-MUAC approach was conducted by World Vision in the provinces of Samar, Northern Samar, and Zamboanga del Norte, Philippines [2]. In 2021, virtual training on the family-MUAC approach was also conducted at a barangay level in Alcala, Cagayan Province [3]. These activities were spearheaded by community health workers like the Barangay Nutrition Scholars, who will play a significant role in the implementation by training caregivers to assess the nutritional status of their children aged 6-59 months old using a MUAC strip and the MUAC measurement.

The National Nutrition Council stated that the Family MUAC approach was introduced to address the same issues in nutrition programs, particularly in the Philippine Integrated Management of Acute Malnutrition (PIMAM). These include late diagnosis and limited coverage of acute malnutrition treatment services in children [3]. In 2020, UNICEF found that only 13% of children below five years old have consulted in a health facility since the COVID-19 crisis; hence, there is a strengthened call for the Family MUAC approach and a strengthened role for Barangay Nutrition Scholars to implement this approach successfully. In relation to this, studies show the potential of trained caregivers in improving the community-based management of acute malnutrition. With proper resources and training, mothers and community health workers can learn the correct use of MUAC tapes and MUAC measure in nutrition screening for the timely detection, diagnosis, and treatment of moderate and severe acute malnutrition in children aged 6-59 months [4, 5, 6].

One of the assets of the approach relevant to community health workers is saving valuable time, allowing them to carry out other similarly essential tasks. Since the approach shifts the screening from community health workers to caregivers after adequate training, the family MUAC approach will allow the Barangay Nutrition Scholars to save time from taking measurements during screening and monitoring the population of children aged 6-59 months [7]. This will ensure that children aged 6-59 months in every household are screened and monitored consistently, thus improving community and public health nutrition.

Albeit the advantages of this approach, there are also issues needed to be addressed. In a systematic review by Hayes et al. [8] of the MUAC measurement usage among children with disabilities, the researchers found inconsistencies with the MUAC measurement methods, references, and cutoffs indicating the need for further research on the appropriateness of using the MUAC measure for nutritionally high-risk children compared to other measure. GOAL also revealed challenges encountered by community health workers in embarking on the project. The training of caregivers requires the implementers (i.e., Barangay Nutrition Scholar) to be well-prepared with visual aids, tools, and MUAC tapes to distribute to participating mothers and caregivers. However, studies in varying operational contexts across three countries: Malawi, South Sudan, and Ethiopia, revealed that logistical constraints of obtaining the MUAC tapes from UNICEF caused the project to be delayed despite the three-month lead time of arranging the acquisition through import with UNICEF. To resolve this, GOAL has funded a head office stock of MUAC tapes for Malawi, South

Sudan, and Ethiopia, limiting the perceived reasons for delays in transportation and in-country customs [7]. From this study, it is recognized that the competency of a community health worker to implement the family MUAC approach does not only depend upon intrinsic factors such as personal background, knowledge, and skills but also on extrinsic factors such as resources, funds, and political support.

In a study by Edrina-Ignacio [9], the researcher found the following factors contributing to the positive outcome of the Barangay Nutrition Action Plan (BNAP) implementation which also involves the service of Barangay Nutrition Scholars: the BNS' previous positions (e.g., BHW, ML), BNS' perception of political support, functional nutrition committees, MNAO's support, and personal credibility. With this, the study aims to correlate factors with the competency of the Barangay Nutrition Scholars in Cabuyao, Laguna, in implementing the Family-MUAC approach. Specifically, this study aims to describe the socioeconomic and demographic characteristics of Barangay Nutrition Scholars in Cabuyao, Laguna, to identify the supportive systems and resources of the Barangay Nutrition Scholars in Cabuyao, Laguna, to determine the competency of the Barangay Nutrition Scholars in the implementation of the Family MUAC approach, and finally to correlate factors with the competency of the Barangay Nutrition Scholars in the implementation of the Family MUAC approach. Knowing the factors associated with the competency of the BNS can help in planning and reinforcing strategies for the effective and efficient implementation of the Family MUAC approach in the city by helping the local government plan interventions to address insufficiencies and provide more significant support in identifying and locating malnourished children, thus contributing to the country's goal of reducing the prevalence of malnutrition.

1.1 Scope and Limitations

In this study, competence is defined based on the definition by Gilbert [10] as an entity of theoretical and applicable knowledge, ability, behavior, and motivation structured to master a specific situation. With this, the competence of the Barangay Nutrition Scholars will be determined based on the following measures: knowledge, experience, and motivation. This study will not include actual measuring of MUAC by the barangay nutrition scholars to children aged 6-59 months to measure the ability due to the health risks and ethical approval for the involvement of children; thus, experience is used. Nonetheless, previous experience using MUAC tapes for children is not a stand-alone proxy for the actual measurement of the MUAC; the researcher will also measure the participants' knowledge in taking MUAC measurements to determine how they obtain the MUAC. Field realities, such as the virtual conduct of data collection, may affect the respondents' responses. With this, the researcher will conduct key informant interviews with the municipal nutrition action officers to validate the data gathered from the Barangay Nutrition Scholars.

2 Methodology

2.1 Research Design and Instrumentation

The study used the complete enumeration method among the eighteen (18) Barangay Nutrition Scholars (BNS) in Cabuyao, Laguna. A cross-sectional research design was used to gather data from the population and identify correlations between competency and selected variables.

The study used a pretested structured survey questionnaire consisting of four parts: socioeconomic and demographic characteristics, supportive systems (supervision, training, incentive), availability of resources, and competency (knowledge, experience, motivation). The questions were adapted and modified based on the following sources: Rapid Survey Tool: Lot quality assurance sampling (LQAS) community health worker (CHW) questionnaire developed by UNICEF and Liverpool School of Tropical Medicine [11] for questions regarding supportive systems, availability of resources, and experience, Integrated Management of Childhood Illness: Distance Learning Course

published by the World Health Organization [12] for questions to measure the knowledge level, and Multi-dimensional Motivation Scale developed by Gottert et al. [13] for questions regarding the motivation of community health worker. Modifications also include translating the questions into the Filipino language for better comprehension of the respondents.

The modified questionnaires were pretested among three (3) Barangay Nutrition Scholars in selected barangays in Quezon City, Manila to ensure the soundness of the research instrument. Both Quezon City and Cabuyao City are urban cities and have Compliance to National Directives scores of 1.60 and 1.57, respectively which reflects their Government Efficiency including compliance with the directives of the National Nutrition Council [9, 10].

Furthermore, the participants were perceived to have similar characteristics with the Barangay Nutrition Scholars in Cabuyao, Laguna in terms of age (i.e., majority of 50-59 years old), gender (i.e. female), occupation (i.e., full-time BNS), educational attainment (i.e. majority of high school graduates), and length of service as a BNS (i.e. majority of more than three years in service).

2.2 Data Collection

Data collection was mainly through Google Forms. Informed consent forms were required and obtained from all respondents before accessing the online survey through Google Forms. Respondents who could not use technology and participate virtually in the study were assisted by the researcher through an in-person interview using the same questions from the Google Form. Furthermore, respondents who had trouble completing the online survey were also assisted by the researcher through a phone interview using the same set of questionnaires. Key informant interviews were then conducted with the three (3) Barangay Nutrition Scholar supervisors to validate the data gathered from the respondents. Discrepancies with answers were again validated with the Barangay Nutrition Scholars before proceeding to data processing and analysis.

2.3 Data Processing and Statistical Analysis Knowledge Scores

The knowledge questionnaire consists of 14 multiple-choice questions valued at one point each for the correct answer. The total scores were obtained, and Bloom's cut-off point was used to categorize the overall knowledge scores of the Barangay Nutrition Scholars as good if the score was 80 to 100% (12 to 14 points), moderate if the score was 60 to 79% (9 to 11 points), and poor if the score was below 60% (8 points or lower).

2.4 Experience scores

Questions regarding experience were answerable by Yes or No and had corresponding points of 1 and 0, respectively. With a total score of three, scores were summed up and classified, based on a third split, as good if the respondent answered Yes to all questions (3 points), moderate if the respondent answered Yes to two questions (2 points), and poor if the respondent answered Yes to one or none of the questions (0-1 point).

2.5 Motivation scores

The motivation scale consists of four sub-dimensions: Quality of supervision, Feeling valued and capacitated in your work, Peer respect and support, and Compensation and workload. Each sub-dimension has a total score ranging from -6 to 6. Respondents used a Likert scale to rate their satisfaction and perceived importance of the sub-dimensions. A final scale score ranging from -24 to 24 points was constructed based on the sum of the four sub-dimension scores. Bloom's cut-off was used to categorize the full-scale motivation scores of the Barangay Nutrition Scholars as good if the score was 80 to 100% (14 to 24 points), moderate if the score was 60 to 79% (4 to 13 points), and poor if the score was below 60% (3 points or lower).

Table 1. Cut-off points for Knowledge, Experience, and Motivation

Level	Knowledge (points)	Experience (points)	Motivation (points)
Good (+3 points)	12 to 14	3	14 to 24
Moderate (+2 points)	9 to 11	2	4 to 13
Poor (+1 point)	0 to 8	0 to 1	-24 to 3

2.6 Competency scores

The categorized levels of knowledge, experience, and motivation have the following corresponding points: good = 3 points, moderate = 2 points, and poor = 1 point. The scores of the three measures of competency were summed up with a total score ranging from 0 to 9, which were then categorized based on Bloom's cut-off as good if the score was 80 to 100% (8 to 9 points), moderate if the score was 60 to 79% (6 to 7 points), and poor if the score was below 60% (5 points or lower). The table below shows an example of the computation and categorization of competency scores.

Table 2. Cut-off points for competency

Competency Level	Total Score	Percentage
Good	8 to 9	80-100%
Moderate	6 to 7	60-79%
Poor	0 to 5	Below 60%

The table below shows a sample computation and categorization of competency scores based on the score and level of knowledge, experience, and motivation of the Barangay Nutrition Scholars.

Table 3. Sample computation and categorization of competency scores

BNS	Knowledge	Experience	Motivation	Competency Level		
#1	Moderate (+2)	Good (+3)	Good (+3)	8 points	88.89%	Good
#2	Poor (+1)	Good (+3)	Good (+3)	7 points	77.78%	Moderate
#3	Poor (+1)	Good (+3)	Poor (+1)	5 points	55.56%	Poor

Descriptive analyses were used to describe the following: socioeconomic and demographic characteristics (e.g., age, sex, marital status, religious affiliation, ethnicity, household size, educational attainment, employment, monthly family income, and length of service), supportive systems, resources, and level of competency of the Barangay Nutrition Scholars. Correlational analysis, on the other hand, was used to correlate factors with the competency of the Barangay Nutrition Scholars in implementing the Family MUAC approach. Precisely, non-parametric Spearman correlation coefficients were calculated for ranked variables such as age, household size, monthly family income, and last MUAC training. On the other hand, Cramer's V coefficients were calculated for categorical variables answerable by yes or no, such as supervisory visits from a supervisor, supervisory visits from others, refresher training, availability of visual aids, availability

of edema mock-up model, and availability of referral slips. The tables below show the guidelines for interpreting Spearman and Cramer's V coefficients [14].

Table 4. Guidelines for interpretation of the Spearman's correlation coefficient

Range	Strength of Association
0.00 to 0.20	Negligible/Very Weak
0.21 to 0.40	Weak
0.41 to 0.60	Moderate
0.61 to 0.80	Strong
0.81 to 1.00	Very Strong

Table 5. Guidelines for interpretation of the Cramer's V correlation coefficient

Range	Strength of Association
Less than 0.10	Low
0.10 to 0.30	Moderate
More than 0.30	Strong

3 Results

3.1 Socioeconomic and Demographic Characteristics

The socioeconomic and demographic characteristics of the Barangay Nutrition Scholars in Cabuyao, Laguna were obtained, including their age, sex, marital status, ethnicity, religious affiliation, household size, educational attainment, employment, and monthly family income. The study found that most BNS are 50-59 years old (44.4%), and 27.8% are above 59 years old, beyond the age requirement for a BNS. The majority of the respondents were female (94.4%), Roman Catholic (83.3%), and married (72.2%), while all the respondents were Tagalog people (100%). For the household size, 61.1% of the respondents have 3-5 family members, while only one (5.6%) has a larger household size of 9 and above. Most respondents were high school graduates (83.3%), while only 11.1% were college graduates. All the respondents worked full-time (100%), and 66.7% had a monthly family income ranging from 5,000 to 10,000 PHP. Based on the survey, 88.9% of the respondents have worked as a Barangay Nutrition Scholar for over three years.

Table 6. Frequency and percentage distribution of socioeconomic and demographic characteristics of the Barangay Nutrition Scholars in Cabuyao, Laguna

Characteristics	Frequency	Percentage
Age		
19-29 years old	2	11.1
30-39 years old	1	5.6
40-49 years old	2	11.1
50-59 years old	8	44.4
Over 59 years old	5	27.8
Sex		
Male	1	5.6
Female	17	94.4
Marital Status		
Married	13	72.2
Never married	5	27.8
Religious affiliation		
Roman Catholic	15	83.3
Iglesia ni Cristo	1	5.6
Born Again	2	11.2
Ethnicity		
Tagalog	18	100.0
Household size		
1-2	3	16.7
3-5	11	61.1
6-8	3	16.7
9-above	1	5.6
Educational attainment		
Elementary graduate	1	5.6
Highschool graduate	15	83.3
College graduate	2	11.1
Employment		
Working full time	18	100.0
Monthly Family Income		
5,000-10,000	12	66.7
11,000-15,000	5	27.8
16,000-20,000	0	0.0
21,000-above	1	5.6
Length of Service as a Barangay Nutrition Scholar		
1 to 2 years	1	5.6
2 to 3 years	1	5.6
More than 3 years	16	88.9

3.2 Barangay Nutrition Scholars' Supportive Systems and Resources Supervision

Based on the survey, all the Barangay Nutrition Scholars in Cabuyao, Laguna have supervisors (100.0%) who have the following designation in the city: City Nutrition Action Officer (CNAO) and City Nutrition Program Coordinators (CNPC) ND III and ND IV. Fifteen (83.3%) BNS reported receiving a supervisory visit from their supervisors in the last three months, while eight (44.4%) reported receiving a visit from other community personnel in the last three months including visits from their Barangay Captain, Barangay Midwife, Head of City Population Office Cabuyao, and the Chairman on Nutrition.

Table 7. Supervision received by the Barangay Nutrition Scholars in Cabuyao, Laguna

	Frequency	Percentage
Do you have a supervisor?		
Yes	18	100.0
Supervisory visit from your supervisor in the last three months?		
Yes	15	83.3
No	3	16.7
Supervisory visit from others in the last three months?		
Yes	8	44.4
No	10	55.6

3.3 Training

Based on the survey, all the Barangay Nutrition Scholars in Cabuyao, Laguna had formal training in MUAC measurement (100.0%). However, results show that most respondents reported their last training was over 12 months ago (72.2%). On the other hand, 66.7% of the respondents reported receiving refresher training.

Table 8. Training received by the Barangay Nutrition Scholars in Cabuyao, Laguna

	Frequency	Percentage
Do you have formal MUAC training?		
Yes	18	100.0
When was your last MUAC training?		
3-6 months ago	2	11.1
6-12 months ago	3	16.7
More than 12 months ago	13	72.2
Have you received any "refresher training" since then?		
Yes	12	66.7
No	6	33.3

3.4 Incentives

Based on the survey, all the Barangay Nutrition Scholars in Cabuyao, Laguna receive financial incentives or allowances. The respondents reported receiving a monthly allowance from the City of Cabuyao and a small incentive from the Municipality of Laguna. In addition, some barangays also provided extra incentives for their Barangay Nutrition Scholars on the prerogative of the Barangay Captain. Results show that most respondents received their allowance within the last month (77.7%).

Table 9. Incentive received by the Barangay Nutrition Scholars in Cabuyao, Laguna

	Frequency	Percentage
Do you receive any form of incentive?		
Yes	18	100.0
When did you last receive any form of payment?		
Within the last 1 week	1	5.6
Within the last 1 month	14	77.7
Within the last 3 months	2	11.1
More than 3 months ago	1	5.6

3.5 Resources

Data on the availability of resources such as MUAC tape/strip supplies, visual aids, edema mock-up models, referral slips, height charts, length boards, and a functional weighing scale in the barangay of the Barangay Nutrition Scholars were also gathered (Figure 1). Based on the survey, all the Barangay Nutrition Scholars in Cabuyao, Laguna have MUAC tapes/strips (100.0%), length boards (100.0%), and functional weighing scales (100.0%) in their barangay. Only 61.1% of the respondents have visual aids for training in their barangay, and only 22.2% have referral slips. Some barangays do not have height charts (16.7%), and most do not have an edema mock-up model (94.4%), which can be used when training caregivers to detect edema in their children.

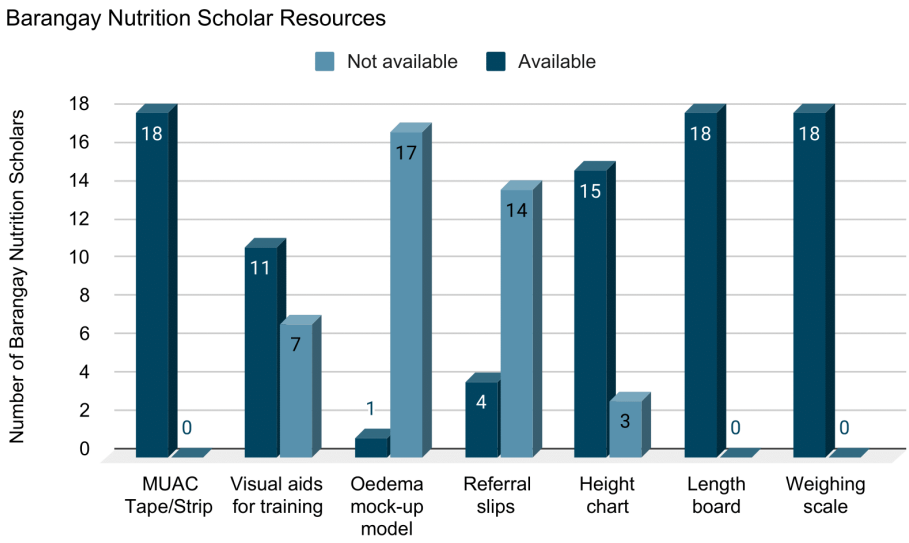

Figure 1.
Availability of Resources of the Barangay Nutrition Scholars in Cabuyao, Laguna

3.6 Barangay Nutrition Scholars' Competency Knowledge

Results show that half of the BNS in Cabuyao have a moderate level of knowledge (50.0%), while 22.2% have a poor level of understanding. Only 27.8% of the respondents were able to score at least 12 points and were categorized as having a good level of knowledge in MUAC Measurement and Acute Malnutrition.

3.7 Experience

Results show that all respondents reported knowing how to use a MUAC tape (100.0%) and have experience using a MUAC tape to screen children for severe malnutrition (100.0%). On the other hand, only 83.3% have experience referring a child to the clinic. With this, the majority have a good level of experience, and none of them were categorized as poor.

3.8 Motivation

Descriptive statistics for the final scale and sub-dimension scores are shown in Table 10. The mean for each sub-dimension ranges from 2.57 to 3.01, with the highest mean for Feeling valued and capacitated in your work.

Table 10. Final Motivation scale scores of Barangay Nutrition Scholars in Cabuyao, Laguna

	Mean	Bloom's Cut-off
Sub-dimensions (Possible range for each: -6 to 6):		
Quality of supervision	2.85	Moderate
Feeling valued and capacitated in your work	3.01	Moderate
Peer respect and support	3.00	Moderate
Compensation and workload	2.57	Moderate
Full scale (Possible range: -24 to 24)	11.9	Moderate

The distribution of scale scores for the four sub-dimensions is shown in Figure 2. Note that the possible range is -6 to 6.

On the other hand, the distribution of scale scores for the full scale of motivation is shown in Figure 3. Note that the possible range is -24 to 24, and the results show that all the scores are positive.

All in all for motivation level, results show that more than half of the Barangay Nutrition Scholars in Cabuyao, Laguna have a moderate level of motivation (66.7%). Only 27.8% have a good level of motivation, while one of the respondents has a poor level of motivation (5.6%) as shown in Figure 4.

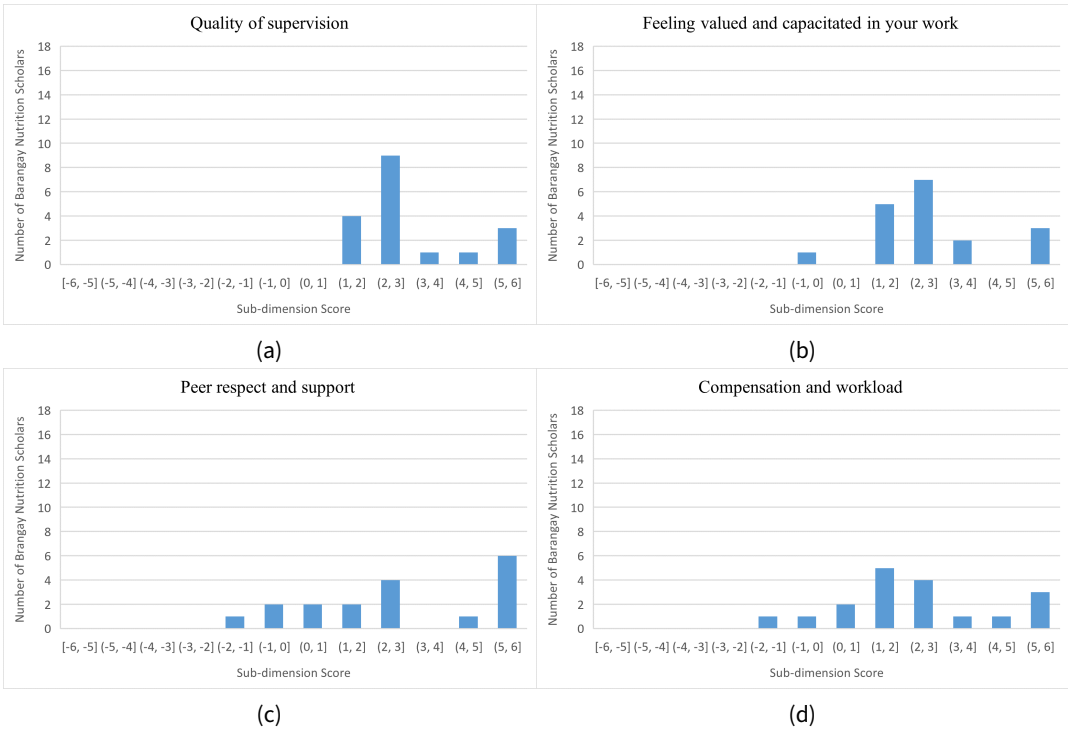

Figure 2.
Scale score distribution of the subdimensions, namely (a) Quality of supervision, (b) Feeling valued and capacitated in your work, (c) Peer respect and support, and (d) Compensation and workload.

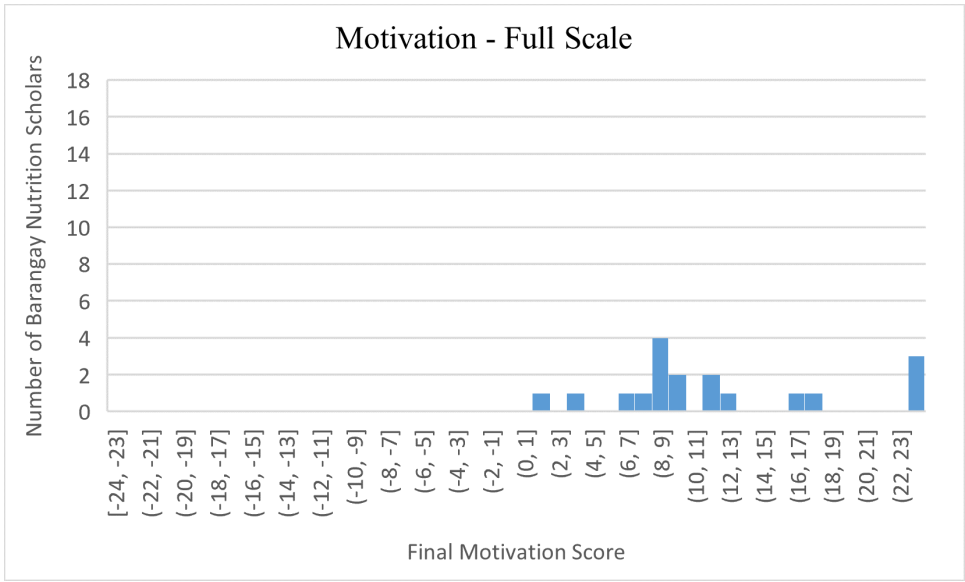

Figure 3.
Scale score distribution of the final score

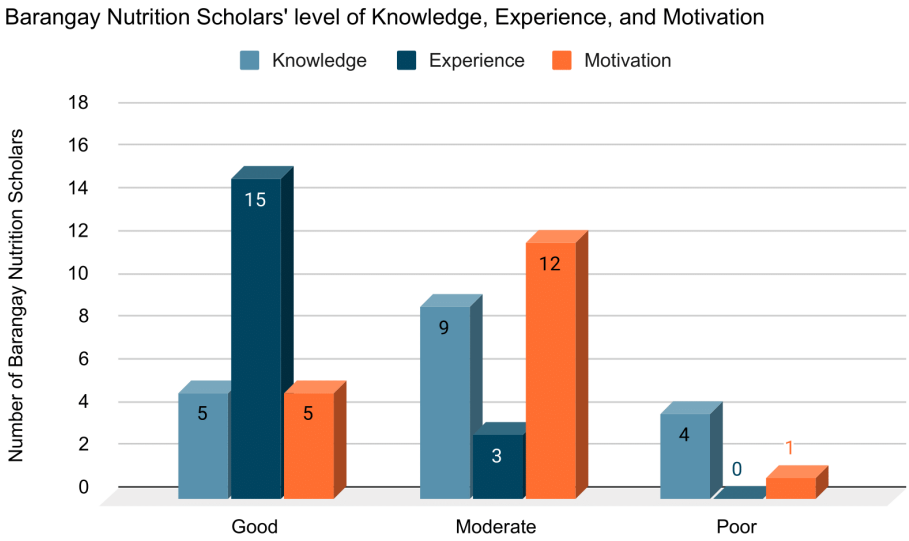

Figure 4.
Level of Knowledge, Experience, and Motivation on the Barangay Nutrition Scholars in Cabuyao, Laguna

3.9 Overall Competency

Finally, the respondents' level of competency was determined using their level of knowledge, experience, and motivation. Results show that only one respondent has a good competency level (5.6%) and the majority have a moderate level (72.2%). Meanwhile, four of the respondents have a poor level of competency in the implementation of the Family-MUAC approach (22.2%).

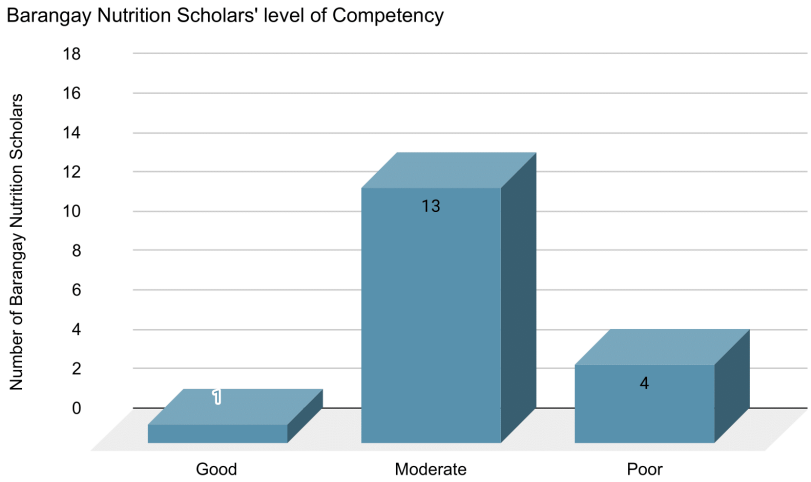

Figure 5.
Barangay Nutrition Scholars' level of competency

3.10 Factors Correlated with the Competency of the Barangay Nutrition Scholars in Cabuyao, Laguna

As previously discussed, competency is measured based on the knowledge, experience, and motivation of the Barangay Nutrition Scholars in Cabuyao, Laguna. To achieve this, the Barangay Nutrition Scholars should be appropriately supervised, trained, compensated, and equipped as an output from extrinsic factors such as adequate supervision, training, incentives, and resources available for the BNS. In a systematic review of the use of the mid-upper arm circumference (MUAC) by caregivers and community health workers for the detection and diagnosis of severe acute malnutrition in children aged 6-59 months, the study found that community health workers just like the Barangay Nutrition Scholars are able to perform correct nutrition screening using the MUAwhen there is adequate training, supervision, and motivation [5]. Intrinsic factors were also considered including socioeconomic and demographic characteristics.

Results show that knowledge, experience, and motivation positively correlate with competency. In terms of the factors, spearman correlation analysis revealed a very weak negative correlation between competency and age. On the other hand, a positive correlation was found between competency and the following factors: household size, monthly family income, and last MUAC training. Among these positive correlations, only the monthly family income was classified as moderate in correlation strength. The rest were weak (= 0.21 to 0.40) and very weak (<0.20). Cramer's V correlation analysis revealed a positive correlation between competency and the following factors: supervisory visits from supervisors, supervisory visits from others, refresher training, availability of visual aids, availability of edema mock-up model, and availability of referral slips. Among these factors, refresher training and the availability of visual aids were strongly correlated with competency (c >0.30). The rest were classified as moderate (c >0.10 to 0.30).

Table 11. Measures of correlation with competency

Factors	Correlation Coefficient
Spearman Correlation	
Knowledge	**0.355**
Experience	**0.458**
Motivation	**0.361**
Age	-0.287
Household size	0.137
Monthly Family Income	0.447
Last MUAC training	0.113
Cramer's V Correlation	
Supervisory Visit from Supervisor	0.152
Supervisory Visit from Others	0.219
Refresher Training	0.416
Availability of Visual aids	0.421
Availability of Oedema mock-up model	0.150
Availability of Referral slips	0.131

4 Discussion

The selected factors that underwent correlational analysis had variability among the Barangay Nutrition Scholars in Cabuyao, Laguna. Knowledge, experience, and motivation are all positively correlated with competency (= 0.355, 0.458, 0.361, respectively) meaning more knowledgeable, experienced, and motivated BNS tend to be more competent. Furthermore, the researcher also checked the correlation between each factor and measures of knowledge, experience and motivation better to understand the correlation of the measure with competency. Significant findings to explain the factors' correlation with competency were then discussed. Shown in the table below is the correlation matrix.

Table 12. Measures of correlation of knowledge, experience, and motivation with selected factors using Spearman Correlation

	Age	Household Size	Monthly Family Income	Last MUAC Training
Competency	**-0.287**	**0.137**	**0.447**	**0.113**
Knowledge	*-0.435*	*0.240*	*-0.103*	*0.259*
Experience	*0.152*	*-0.246*	*0.017*	*0.018*
Motivation	*0.000*	*0.118*	*0.623*	*-0.048*

4.1 Age

Results of the study revealed an overall negative relationship between the age of the BNS in Cabuyao, Laguna and their competency (= -0.287). Among knowledge, experience, and motivation, a moderate negative correlation between age and knowledge was found (= -0.435), meaning that most BNS with a poor level of knowledge were older. This could explain why older BNS in Cabuyao, Laguna tend to be less competent, and updating their knowledge on acute malnutrition and MUAC measurement could be an intervention. In a study by Clark et al. [15], they found that although older adults (mean = 66.5 years) have similar rates of learning to younger adults (mean = 24 years), the older adults demonstrated lower performance characterized by slow reaction time and low accuracy during the configural learning task. Concerning this, the BNS supervisors stated that the older BNS and BNS in communities with larger populations are provided with BNS aid to help them with their duties and responsibilities.

4.2 Household size

An overall positive relationship was found between household size on the BNS in Cabuyao, Laguna and competency (= 0.137). In addition, household size was found to have a positive correlation with motivation (= 0.118) and knowledge (= 0.240). Data show that BNS with moderate to good motivation levels has a household size of 3-5 and 6-8 people. Meaning, more motivated BNS tend to be more competent which could be related to the support provided by the family in terms of household responsibilities. Since most BNS in Cabuyao, Laguna are women and married, the distribution of household tasks and valuation of women's work outside the home are key factors in their assumed roles as BNS [16]. In addition, the meta-synthesis review by Ogutu et al. [17] stated that family support was one of the positively influencing factors that enhanced the performance of community health workers since they are more likely to remain in their positions. Moral support and assistance with household tasks were found to be significant to the success of the community health worker in terms of retention, especially for females [18].

4.3 Monthly Family Income

The monthly family income of the BNS in Cabuyao, Laguna was found to have an overall positive correlation with competency (= 0.447). As previously discussed, John et al. [19] found a strong financial motive for assuming duty rooted in the need to support their families. With this, a BNS with a higher monthly family income will have greater motivation to take duty. This is supported by the finding of this study that monthly family income has a strong positive correlation with motivation (= 0.623). This means respondents with higher monthly family income tend to be more motivated and competent.

4.4 Last MUAC Training

While all BNS in Cabuyao, Laguna was found to have had formal training in MUAC measurement, an overall positive relationship was found between the last MUAC training and competency (= 0.113). In addition to this, MUAC training has a positive correlation with knowledge (= 0.259). The concept of practice supports the finding that as time passes, trained workers' competence increases. According to authors Green and Levy [20], competence is fluid. It takes place as one learns to do things. With this, time is the greatest variable. This implies that the longer the time since training, the longer the time that a worker is practicing what he or she has learned, thus developing from a lower level of the proficiency scale to a higher level. Since this is only indirect reasoning to the result, additional data regarding the relationship of refresher training with competency was also gathered for a better view of BNS training.

4.5 Refresher Training

The availability of refresher training was found to have a strong positive relationship with competency. According to the data, six BNS in Cabuyao, Laguna have not yet received refresher training which can be due to their length of service as BNS. Based on the interview with the BNS Supervisors, an orientation was held involving the BNS in 2009 during the Rapid Nutrition Assessment. In 2021, they also had an orientation on acute malnutrition, which covers MUAC measurement as a refresher for those in the 2009 orientation. This year, they are looking forward to having an orientation for the BNS in Cabuyao, Laguna about implementing the Family MUAC approach, which will serve as their training activity. As stated by Ogutu et al. [17], training is one of the positively influencing factors that enhance the performance of community health workers like our Barangay Nutrition Scholars. Training would also freshen the BNS knowledge and experience for better competence.

4.6 Availability of Resources and Supervisory Visit

The availability of resources (e.g., visual aids, edema mock-up models, and referral slips) and supervisory visits were found to have a positive relationship with competency of the BNS in Cabuyao, Laguna. These findings were similar and are supported by the study of Mambulu-Chikankheni et al. [21]. They found that appropriately skilled, equipped, motivated, and supervised community health workers are a factor in their success in managing severe acute malnutrition in their community. In addition, Ogutu et al. [16] also found that supportive supervision and availability of supplies and resources positively influence community health workers' performance.

In GOAL's training guide on the Family MUAC approach under the Family MUAC toolkit [18], these supplies are essential for the training activities of the BNS since these will be used for explanations and demonstrations to the mothers and caregivers. Hence, adequately equipped BNS are more capable of delivering their tasks in the barangay.

In terms of supervisory visits, the survey revealed that the recent visits of the supervisors in the barangays in Cabuyao, Laguna were during a community feeding program. The BNS supervisors confirmed this during the key informant interview where they stated that there are no scheduled

or regular visits to the barangays due to logistical reasons such as transportation. Most of the time, the supervisors monitor and get updates online rather than through actual visitations since patrol cars are occupied by other committees for other activities. Community nutrition activities such as feeding programs are the chances that they can also visit each barangay for actual supervision and personal updates. This may compromise supportive supervision that can be provided for the Barangay Nutrition Scholars in Cabuyao, Laguna since visits are not prioritized.

5 Conclusion and Recommendations

In this study, factors such as age, household size, monthly family income, last MUAC training, supervisory visits, refresher training, and availability of selected supplies (e.g., visual aids, edema mock-up model, and referral slips) were found to be correlated with the competency of the Barangay Nutrition Scholars in Cabuyao, Laguna for the implementation of the family MUAC approach. Specifically, a negative correlation was found between age and competency. On the other hand, a positive correlation was found between competency and the rest of the factors identified. This implies that in this study, household size (i.e., in terms of moral support and assistance in the household), monthly family income (i.e., in terms of financial motive), last MUAC training (i.e., in terms of practice), supervisory visits, refresher training, and availability of selected supplies (e.g., visual aids, edema mock-up model, and referral slips) are among the factors that contribute to the increased competency of Barangay Nutrition Scholars in Cabuyao, Laguna, for the implementation of the Family MUAC Approach.

This study concludes that the variables mentioned earlier correlated with competency and that knowledge, experience, and motivation were sufficient measures of the Barangay Nutrition Scholars' level of competency. Additionally, knowing the correlation of some variables to each measure can lead us to the appropriate interventions to improve competency (e.g., finding out that age is negatively correlated with knowledge, monthly family income is strongly and positively correlated with motivation and others). With these findings, recommendations can be given to reinforce positively influencing factors to ensure the competency of the Barangay Nutrition Scholars in Cabuyao, Laguna in the implementation of the Family MUAC approach.

To effectively and efficiently implement the Family MUAC approach at a barangay level in Cabuyao, Laguna, the Barangay Nutrition Scholars who will play a major role in training caregivers, must be competent enough to spearhead the implementation. They must be well-knowledgeable, well-experienced, and well-motivated. With this, the study recommends the following based on the findings of which factors are correlated with the Barangay Nutrition Scholars' competency.

First, since age is negatively correlated with competency and most of the BNS in Cabuyao, Laguna is over 49 years old, it is recommended that additional BNS or BNS aid should be provided to older BNS needing assistance to manage their tasks and communication online. In communication with the BNS supervisors, they have been working on requesting additional barangay health workers to aid the Barangay Nutrition Scholars. Nevertheless, the findings of this study show the significance of reinforcing the workforce of the BNS. Moreover, the researcher recommends that the city provides adequate support to nurture the supportive systems of the BNS, which were found to be positively correlated with competency. Aside from family support, BNS should receive support from the local government, supervisors, barangay captains, and barangay council members. According to the literature, these significant points of interest can improve our Barangay Nutrition Scholars (Edrina-Ignacio, 2015). Specifically, BNS support may include scheduled supportive supervision, financial support, material support, and political support. Literature suggests that strengthening community health workers' motivation is essential to maximize their public service roles (John et al., 2020). Based on the motivation scale scores of the respondents of this study, compensation and workload scored the lowest with a mean score of 2.57, followed by quality of supervision (2.85), peer respect and support (3.00), and the feeling of being valued and capacitated in their work

(3.01). The provision of support in these dimensions shall increase their motivation scores. With this, increased compensation, supervision, and appreciation could be reinforced to improve their motivation, thus increasing their competency.

In terms of improving the Barangay Nutrition Scholars' knowledge and experience, which were also found to be positively correlated with competency, it is recommended that an up-to-date training and orientation program about the Family MUAC approach is provided for the barangay health workers in Cabuyao, Laguna for the specifics of MUAC measurement and acute malnutrition. The Barangay Nutrition Scholars in Cabuyao, Laguna should be trained and simulated with the referral system for children with acute malnutrition. Although most of the BNS reported having no experience in referrals since they rarely encounter children with acute malnutrition in their barangay, this will improve their experience, thus improving their competency for implementing the Family MUAC approach.

It is also recommended that BNS from each barangay in Cabuyao, Laguna is well-equipped with the supplies needed for the Family MUAC approach, including but not limited to visual aids for training caregivers, an edema mock-up model for the demonstration of checking if edema exists, and referral slips for referring children reported to have acute malnutrition. This is in line with the study of GOAL (2019), which initiated funding a head office stock of MUAC tapes to prevent the lack of resources. To do this, the local government of Cabuyao, Laguna could work on allocating funds for the supplies of each barangay and organize a system of monitoring and reporting the availability of stocks.

These recommendations are guided by the notion that the competency of the respondents is not only dependent on intrinsic factors (e.g., personal background, knowledge, skills, and others) but also on extrinsic factors (e.g., resources, funds, and political support). If there is political will, these recommendations may be attained and help in effectively and efficiently implementing the Family MUAC approach in Cabuyao, Laguna.

Lastly, the researcher recommends that further study be conducted, including other community health workers involved in implementing the Family MUAC approach, especially after the orientation. It is also recommended that future studies include the actual measurements of the mid-upper arm circumferences of children aged 6-59 months old obtained by the respondents (e.g., BHW, BNS, and others) to demonstrate and measure their skills instead of their experience.

Listed below are the encapsulated recommendations of this study based on the findings of which factors are correlated with the competency of the Barangay Nutrition Scholars in Cabuyao, Laguna:

1. Provide additional Barangay Nutrition Scholars or Aid to older BNS and BNS in communities in Cabuyao, Laguna with larger populations to reinforce the workforce.

2. Provide adequate support to nurture the supportive systems of the BNS in Cabuyao, Laguna, which may be in the form of scheduled supportive supervision, financial support, material support, and political support from the local government, supervisors, barangay captains, and barangay council members.

3. Conduct training and orientation programs about the Family MUAC approach for up-to-date knowledge and experience of the BNS and other BHW in Cabuyao, Laguna, including training and simulation of the referral system.

4. Equip the BNS in Cabuyao, Laguna with the supplies needed for the Family MUAC approach including but not limited to visual aids for training caregivers, an edema mock-up model for the demonstration of checking if edema exists, and referral slips for referring children reported to have acute malnutrition.

5. For future studies on this subject matter, include other barangay workers involved in the implementation and have the actual MUAC measurement taken by the respondents (e.g., Barangay Nutrition Scholars).

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References

[1] Sarpong, S. A., Sarpong, A. K., & Lee, Y. (2021). A model for determining predictors of the muac in acute malnutrition in ghana. *International Journal of Environmental Research and Public Health*, *18*(7), 3792. https://doi.org/10.3390/ijerph18073792

[2] Pageone. (2020). *Pilot implementation of family MUAC approach in the Philippines*. https://pageone.ph/pilot-implementation-of-family-muac-approach-in-the-philippines/

[3] National nutrition council. (2021). *Barangay-level implementers of Alcala attend training on family MUAC!* https://www.nnc.gov.ph/regional-offices/luzon/region-ii-cagayan-valley

[4] Blackwell, N., Myatt, M., Allafort-Duverger, T., Balogoun, A., Ibrahim, A., & Briend, A. (2015). Mothers understand and can do it (muac): A comparison of mothers and community health workers determining mid-upper arm circumference in 103 children aged from 6 months to 5 years. *Archives of public health*, *73*(1), 1–7. https://doi.org/10.1186/s13690-015-0074-z

[5] Oladeji, O., Mudzongo, P., Abdulai, R., Mursel, A. F., Badel Ali, M., & Sheik Mohammed, B. (2022). Screening for acute malnutrition using family mid-upper arm circumference in somali region of ethiopia. *International Journal of Nutrition Sciences*, *7*(3), 179–185. https://doi.org/10.30476/ijns.2022.95099.1184

[6] Bliss, J., Lelijveld, N., Briend, A., Kerac, M., Manary, M., McGrath, M., Prinzo, Z. W., Shepherd, S., Zagre, N. M., Woodhead, S., et al. (2018). Use of mid-upper arm circumference by novel community platforms to detect, diagnose, and treat severe acute malnutrition in children: A systematic review. *Global Health: Science and Practice*, *6*(3), 552–564. https://doi.org/10.9745/GHSP-D-18-00105

[7] Goal. (2019). *The Family MUAC Approach: GOAL - Case Study*. https://www.acutemalnutrition.org/en/resource-library

[8] Hayes, J., Quiring, M., Kerac, M., Smythe, T., Tann, C. J., Groce, N., Gultie, Z., Nyesigomwe, L., & DeLacey, E. (2023). Mid-upper arm circumference (muac) measurement usage among children with disabilities: A systematic review. *Nutrition and Health*, 02601060231181607. https://doi.org/10.1177/02601060231181607

[9] Endrina-Ignacio, M. S. (2015). Assessment of the preparedness of the barangay nutrition scholars (bns) in implementing barangay nutrition action plan in selected municipalities in ifugao, bulacan, and siquijor. *Philippine Journal of Health Research and Development*, *19*(3), 31–40. https://www.cedefop.europa.eu/en/publications/3040

[10] Gilbert, P. (1998). The foundations of evaluation and impact research. third report on vocational training research in europe: Background report. *L'évaluation des compétences à l'épreuve des faits. Luxembourg: Entreprise et Personnel*, 275. https://www.cedefop.europa.eu/en/publications/3040

[11] Rapid survey tool: Lot quality assurance sampling (lqas) community health worker (chw) questionnaire [tool]. (2012). https://www.childhealthtaskforce.org/resources

[12] Module 6. malnutrition and anaemia. world health organization. in world health organization. (2014). *Integrated Management of Childhood Illness: distance learning course.* https://iris.who.int/handle/10665/104772

[13] Gottert, A., McClair, T. L., Hossain, S., Dakouo, S. P., Abuya, T., Kirk, K., Bellows, B., Agarwal, S., Kennedy, S., Warren, C., et al. (2021). Development and validation of a multi-dimensional scale to assess community health worker motivation. *Journal of global health*, *11*. https://doi.org/10.7189/jogh.11.07008

[14] Prion, S., & Haerling, K. A. (2014). Making sense of methods and measurement: Spearman-rho ranked-order correlation coefficient. *Clinical Simulation in Nursing*, *10*(10), 535–536. https://doi.org/10.1016/j.ecns.2014.07.005

[15] Clark, R., Freedberg, M., Hazeltine, E., & Voss, M. W. (2015). Are there age-related differences in the ability to learn configural responses? *PloS one*, *10*(8), e0137260. https://doi.org/10.1371/journal.pone.0137260

[16] George, M. S., Pant, S., Devasenapathy, N., Ghosh-Jerath, S., & Zodpey, S. P. (2017). Motivating and demotivating factors for community health workers: A qualitative study in urban slums of delhi, india. *WHO South-East Asia journal of public health*, *6*(1), 82–89. https://doi.org/10.4103/2224-3151.206170

[17] Ogutu, M., Muraya, K., Mockler, D., & Darker, C. (2021). Factors influencing the performance of community health volunteers working within urban informal settlements in low-and middle-income countries: A qualitative meta-synthesis review. *Human Resources for Health*, *19*, 1–21. https://doi.org/10.1186/s12960-021-00691-z

[18] Alam, K., Tasneem, S., & Oliveras, E. (2012). Retention of female volunteer community health workers in dhaka urban slums: A case-control study. *Health policy and planning*, *27*(6), 477–486. https://doi.org/10.1093/heapol/czr059

[19] John, A., Nisbett, N., Barnett, I., Avula, R., & Menon, P. (2020). Factors influencing the performance of community health workers: A qualitative study of anganwadi workers from bihar, india. *Plos one*, *15*(11), e0242460. https://doi.org/10.1371/journal.pone.0242460

[20] Green, D., & Levy, C. (2021). Ecampusontario open competency toolkit. https://ecampusontario.pressbooks.pub/competencytoolkit/

[21] Mambulu-Chikankheni, F. N., Eyles, J., & Ditlopo, P. (2018). Exploring the roles and factors influencing community health workers' performance in managing and referring severe acute malnutrition cases in two subdistricts in south africa. *Health & social care in the community*, *26*(6), 839–848. https://doi.org/10.1111/hsc.12595