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## A Two-Day Virtual Workshop on the Micronutrient-Directed Nutrition-Focused Physical Exam for Ghanaian Nutrition Professionals: Examining Perceived Self-Efficacy and Innovation

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### **Cover Page Footnote**

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## Research Brief

# A Two-Day Virtual Workshop on the Micronutrient-Directed Nutrition-Focused Physical Exam for Ghanaian Nutrition Professionals: Examining Perceived Self-Efficacy and Innovation

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### ABSTRACT

Micronutrients are key components of various physiological processes. In Ghana, micronutrient deficiencies are common and medical resources are limited. Biochemical markers of nutrition status are costly and require specialized medical equipment. In the absence of available biochemical markers of nutrition status, the micronutrient-directed nutrition-focused physical exam is a viable tool. This mixed-methods research aimed to determine whether a two-day virtual workshop for Ghanaian nutrition professionals ( $N=131$ ) would improve perceptions regarding the usefulness and self-efficacy of the micronutrient-directed nutrition-focused physical exam. Quantitative data were collected via a virtual pretest (immediately prior to the workshop) and a virtual posttest (immediately following the workshop). Qualitative data were gathered via focus groups, which were conducted in virtual breakout rooms on the second day of the workshop. Total posttest scores were significantly higher ( $M=70.15$ ,  $SE=.703$ ),  $t(130)=-7.357$ ,  $p<.001$ ) than total pretest scores ( $M=64.85$ ,  $SE=.165$ ),  $t(130)=-7.357$ ,  $p<.001$ ). Participants improved their feelings of self-efficacy in performing the NFPE and felt the micronutrient-directed NFPE is an innovative strategy to assess their patient population for MNDs. The success of this virtual workshop speaks to the safety and efficacy of virtual clinical skills training programs.

**Keywords:** Nutrition-focused physical exam, micronutrient deficiency, Ghana, virtual training

## INTRODUCTION

Micronutrient deficiencies (MNDs) affect many Ghanaian children under age five, as well as Ghanaian women.<sup>1</sup> Ghana's location in Africa is shown in Figure 1, as represented by the Central Intelligence Agency.<sup>2</sup> MNDs are most prevalent in the Northern region of Ghana.<sup>3</sup> These data are concerning, as 90% of the dietitians who practice in Ghana are located in the southern area of the country.<sup>4</sup> Moreover, medical infrastructure in rural Ghana is lacking.<sup>5</sup> Therefore, dietitian-led interventions which require minimal medical equipment might be impactful.

### The Nutrition-Focused Physical Exam

Biochemical markers of nutrition status are the gold standard for assessing micronutrient status because they are more objective than other forms of nutrition assessment (e.g., dietary recall).<sup>6,7</sup> However, biochemical markers are not available in certain settings where medical infrastructure is lacking.<sup>8</sup> Financial restraints may also limit availability, even when infrastructure is sufficient. Furthermore, biochemical markers of nutrition status are heavily influenced by inflammation, infection, hydration status, age and kidney function.<sup>8,9</sup> The nutrition-focused physical exam (NFPE) is an effective tool for identifying MNDs and does not require any specialized equipment.<sup>10-12</sup>

The NFPE is a skill RDNs should be qualified to conduct.<sup>13-14</sup> In fact, one of the Accreditation Council for Education in Nutrition and Dietetics (ACEND) competencies for entry-level RDNs is "conduct nutrition focused physical exams."<sup>13,14</sup> However, when 367 RDNs were surveyed, only 34.6% reported

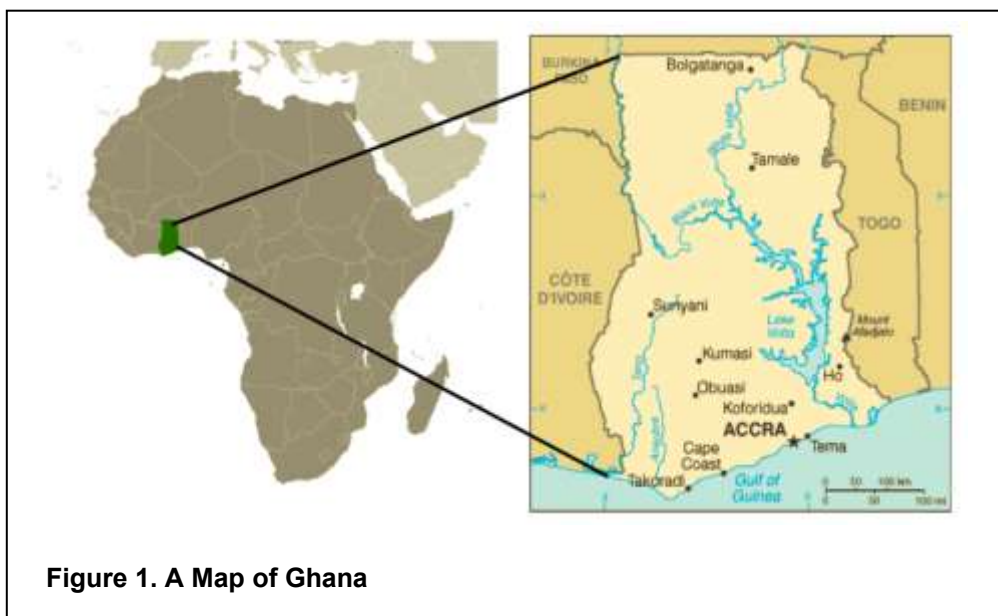


Figure 1. A Map of Ghana

they had received training in the NFPE.<sup>15</sup> Barriers to conducting the NFPE include a lack of training,<sup>15</sup> limited time, and discomfort touching patients,<sup>16</sup> whereas facilitators include adequate training, recognition of the NFPE value, and having confidence in NFPE proficiency.<sup>17</sup> The RDN training program at the University of Ghana in Accra is similar to training programs the U.S.,<sup>18</sup> suggesting Ghanaian RDNs may be experiencing some of the same feelings about NFPE training. Former workshops for Ghanaian nutrition professionals effectively bolstered nutrition knowledge<sup>19</sup> and feelings of self-efficacy when conducting the NFPE.<sup>20</sup> Prior training programs suggest additional training is warranted and has strong educational potential.<sup>19, 20</sup>

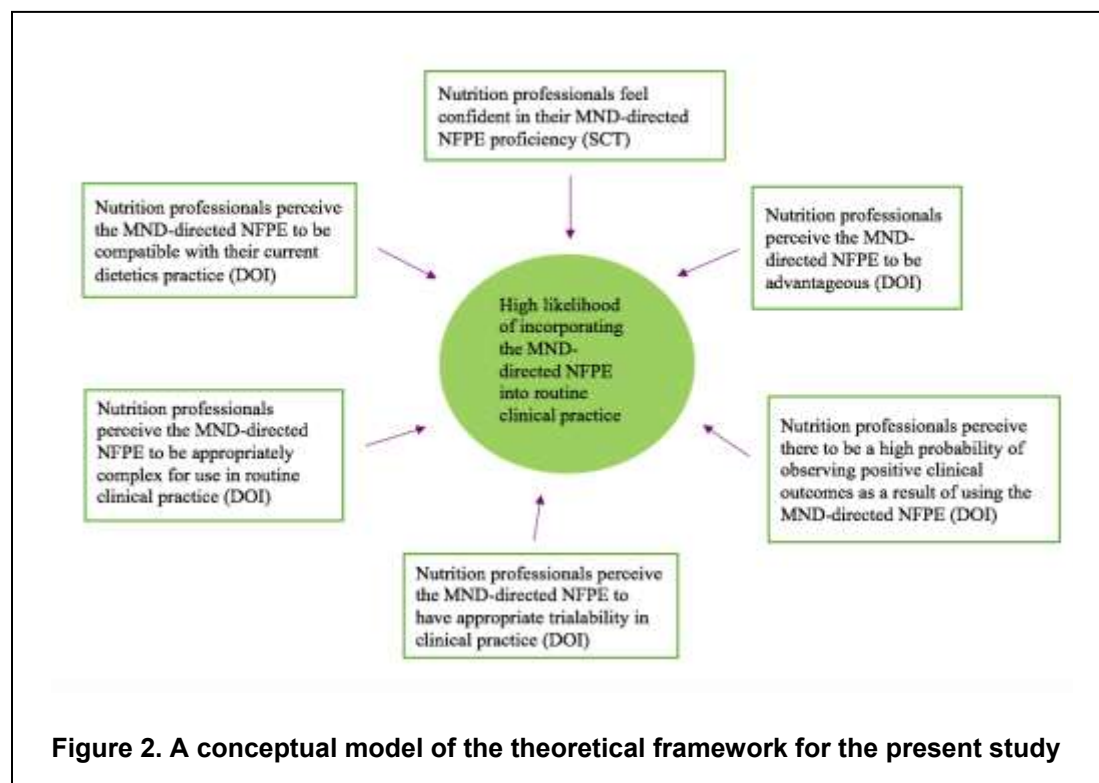
Although hands-on training may be the most effective manner to deliver training on the MND-directed NFPE to nutrition professionals, this modality may not always be feasible. The COVID-19 pandemic posed a unique challenge to international collaborations. In fact, the pandemic has dramatically impacted medical training worldwide.<sup>21</sup> However, during the pandemic, medical students had positive responses to virtual training on conducting a physical exam.<sup>22</sup> Moreover, virtual training allowed

medical students to continue their coursework, and resulted in positive training outcomes pertaining to the bedside exam.<sup>23</sup> Furthermore, online learning may be a useful tool when providing education for community-based nutrition professionals, particularly in the areas of knowledge and self-efficacy pertaining to clinical skills.<sup>24</sup>

### Theoretical Framework

The diffusion of innovations theory (DOI) lends helpful global health intervention guidance, as it encompasses the cross-cultural component of global health interventions.<sup>25</sup> Five main factors or constructs have been identified that influence the adoption of an innovative idea: relative advantage, compatibility, complexity, trialability, and observability.<sup>26</sup> The DOI was used to inform the present study. Confidence in performing the NFPE has been recognized as a facilitator in conducting the NFPE by practicing RDNs.<sup>17</sup> Therefore, the social cognitive theory (SCT) construct of self-efficacy<sup>27</sup> was also used. Figure 2 outlines the theoretical foundation for the present study.

The aims of this study were to determine whether a two-day virtual workshop for Ghanaian nutrition professionals 1) improved perceptions that using the micronutrient-focused NFPE is an innovative strategy to assess patients/clients for MNDs and 2)



**Figure 2. A conceptual model of the theoretical framework for the present study**

improved feelings of self-efficacy in conducting the NFPE to identify MNDs.

### METHODS

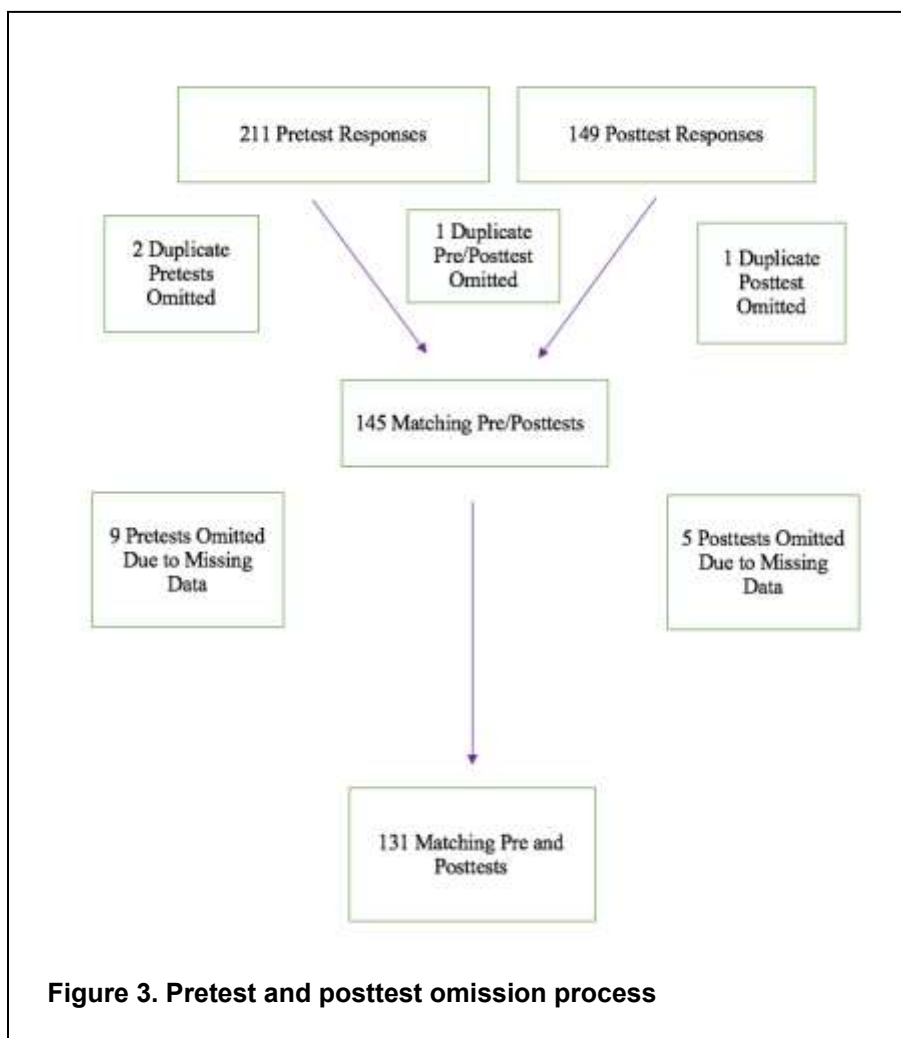
A mixed-methods study design was employed to address the study aims. Quantitative methods included use of a pretest (immediately prior to the workshop) and a posttest (immediately following the workshop) for all workshop participants. Qualitative methods included conducting focus groups on the second day of the workshop.

### Study Participants

The workshop was open to all Ghanaian nutrition professionals. To ensure the workshop was maximally beneficial for the study participants, the investigators worked to approve the workshop for four continuing education hours. Moreover, to ensure that live-streaming the five-hour virtual workshop would not financially strain the workshop participants, the investigators secured funding for data cards that would cover the data costs associated with virtual workshop participation.

A data card was given to every registered participant.

To recruit study participants, an email and a flyer were sent through a Listserv of Ghanaian nutrition professionals. The email contained a link to the webinar flyer, and a link to register for the webinar. When clicking on the link, participants were directed to an electronic informed consent document. Upon registering for the webinar, participants were then directed to six demographic questions, followed by the 18-question pretest. Participants registered for the workshop from December 8, 2020 to January 13, 2021. The workshop was held on January 20<sup>th</sup> and 21<sup>st</sup>, 2021. All data collection was conducted through electronic surveys created using the Qualtrics platform.



### Quantitative Methods

Quantitative data were collected in the form of an identical electronic pretest and posttest developed by the investigators. The test was comprised of 18 questions; three questions represented each of the aforementioned six theoretical constructs as outlined in Table 1. Each of the 18 knowledge-based test questions were answered on a five-point Likert scale. Therefore, the highest possible score for each construct was 15, and the highest possible score for the entire test was 90. Some questions were worded in such a way that a Likert score of “1” indicated a more negative answer and a “5” indicated a more positive answer, while the opposite was true for others. All questions were coded during data analysis to account for this difference. As data was normally distributed and measured at

the interval level of measurement, parametric statistical tests were used to assess variable relationships.<sup>28</sup> An a priori power test was conducted to diminish the chance of committing a type II error to 20%. The a priori power calculation was based on scores obtained from a pilot questionnaire administered to 20 individuals. To calculate the number of participants needed to conduct dependent t tests, a confidence interval of 95% and a corresponding z score of 1.96 was used, as well as an effect size of 25%. The a priori power test showed that a minimum of 128 nutrition professionals were needed for quantitative data analysis.

Duplicate tests, tests without a corresponding pre or post counterpart, as well as tests with more than 20% of data missing (more than 4 of 18 questions) were removed

(Figure 3). The knowledge-based pretest and posttest questions were coded and organized by the theoretical construct used to inform the question. Each theoretical construct represented three test questions. A total score was given for each three-question set. Total scores were also given to each pretest and posttest. Dependent t tests were used to compare pre and posttest scores. All data were analyzed using SPSS statistics 26 software and statistical significance was established at  $p < 0.05$ .

**Qualitative Methods**

Qualitative data were collected via focus groups on the second day of the virtual workshop. It is estimated that roughly 100 participants actively participated in the focus groups; this number is an estimation due to inconsistent internet connection among certain participants. The number of study participants in qualitative research is generally between 5 and 50.<sup>29</sup> Studies that use more than one method of data

**Table 5. Test Questions and Theoretical Basis**

Question	Theoretical Construct
The nutrition focused physical exam (NFPE) can be used to detect signs and symptoms of micronutrient deficiencies (MNDs).	Observability
MNDs that are common in Ghana can be detected by using the NFPE.	Observability
Identification of MNDs using the NFPE and subsequent treatment of MNDs promotes positive clinical outcomes.	Observability
I have adequate time during my work day to incorporate the NFPE into practice.	Compatibility
I have adequate resources at work to incorporate the NFPE into practice.	Compatibility
MNDs are common in my workplace, and utilizing the NFPE will help me better identify MNDs.	Compatibility
Using the NFPE to detect signs and symptoms of MNDs is challenging.	Complexity
The complexity of the NFPE will limit my use of the NFPE to detect MNDs.	Complexity
Certain components of the NFPE seem too complex for routine use in my work setting to identify MNDs.	Complexity
Using the NFPE to identify MNDs is safe, and is associated with few risks.	Trialability
I predict that using the NFPE to identify MNDs will be associated with risks in my workplace.	Trialability
Potential risks associated with use of the NFPE in my workplace will limit my use of the NFPE to identify MNDs.	Trialability
I feel adequately trained to conduct the NFPE to identify MNDs.	Self-Efficacy
I feel confident in my ability to conduct the NFPE to identify MNDs.	Self-Efficacy
I feel comfortable with the aspects of the NFPE that require me to touch the patient.	Self-Efficacy
Using the NFPE to detect signs and symptoms of MNDs is especially relevant in settings where medical infrastructure is lacking.	Relative Advantage
Using the NFPE to detect signs and symptoms of MNDs is especially relevant in the setting of inflammation when the accuracy of biochemical markers of nutrition status may be compromised.	Relative Advantage
Using the NFPE to detect signs and symptoms of MNDs is especially relevant when cost prohibits the use of biochemical markers of nutrition status.	Relative Advantage

collection are thought to require fewer study participants<sup>29</sup>; therefore, data saturation was highly likely.

Focus group leaders were recruited to lead each group, which included two investigators of the present study who are RDNs and have



terminal degrees in the field of nutrition and dietetics, as well as practicing RDNs, Doctorate of Clinical Nutrition students, and dietetic interns. All 13 focus group leaders were currently practicing, teaching, or training in the United States. The focus group guide was developed by the investigators, and consisted of open-ended questions aimed to elicit responses from participants about barriers and facilitators to using the MND-directed NFPE in clinical practice. Each question represented one topic only.

Transcripts were developed from recordings of the focus groups. AlSense Otter.ai version 2.1.65 transcription software was initially used to transcribe the recordings. However, there were a myriad of errors in the transcripts likely related to the variety of accents represented in the audio file. Therefore, the recordings were largely free transcribed. Codes were identified within the transcripts and were organized into a codebook utilizing a thematic approach. A total of 14 codes were developed. Of these codes, 11 were deemed deductive and three were deemed inductive. The differentiation between deductive and inductive codes was made due to the fact that inductive codes represent topics not broached by the focus group leader. After the codebook was developed, each transcript was coded. As coding qualitative data is a subjective process,<sup>30</sup> qualitative data were analyzed prior to quantitative data analysis in an effort to avoid bias associated with knowledge of the quantitative results. To further acknowledge and account for the subjective nature of the coding process, a second coder was included to enhance the reliability and allow for a more systematic and transparent process.<sup>30</sup> Two researchers independently coded the data and reviewed coding decisions and differences. Interpretation discrepancies were addressed and resolved by further refining the codebook criteria to eliminate ambiguities.

## Workshop Outline

A total of 211 individuals registered for the virtual workshop. Each individual was sent a Zoom link for each workshop day, as well as two articles deemed relevant by the investigators.<sup>12,31</sup> The inclusion of supplemental reading materials was intended to bolster the educational capacity of the workshop as well as add variety to the teaching style. About 190 participants attended the three-hour session on day one; however, numbers varied from around 180 to 200 participants due to inconsistent internet connection.

The educational portion of the workshop consisted of one, one-hour lecture and two, 45-minute lectures which were each followed by a 10-minute question and answer portion. The lectures presented during day one of the virtual workshop were uploaded to YouTube, and the YouTube link was sent to individuals who expressed interest in participating asynchronously. The second day of the virtual workshop took place using the Zoom meeting function for two hours. Day two participant numbers varied from about 150 to about 180 participants due to inconsistent internet connection.

As there were 13 focus group leaders, study participants were divided into 13 breakout rooms. Each focus group contained 10-15 participants. Based on feedback from the focus group leaders, many individuals were not able to actively participate in the discussion due to being in public or work settings. Focus group leaders also reported that some participants within the breakout rooms chose to maintain their anonymity and therefore were passively involved in the group. Therefore, actively participating member numbers were less than 10-15 in most groups.

The focus groups were 45 minutes in duration. Each focus group was encouraged to select a spokesperson during the breakout session that would provide a summary of the focus group discussion after the breakout session was complete. During the time in the



breakout rooms, the focus group engaged in a discussion on the application of the information provided during the first day of the workshop. Specifically, the discussion focused on barriers and facilitators to using the MND-directed NFPE to identify micronutrient deficiencies in the workplace. After the 45-minute breakout sessions were complete, the entire group engaged in discussion. Each focus group spokesperson provided about a five-minute summary about their focus group discussion for the large group. The posttest was sent to participants immediately after the workshop and remained open for one week after the workshop.

## RESULTS

The pretest had 211 responses, while the posttest had 149 responses. After missing data and duplicate tests were addressed a total of 131 matching pre and posttests remained. Table 2 outlines the demographic characteristics of the workshop attendees ( $N=131$ ). Total posttest scores were significantly higher ( $M=70.15$ ,  $SE= .703$ ),  $t(130)= -7.357$ ,  $p= <.001$  than total pretest scores ( $M= 64.85$ ,  $SE= .165$ ),  $t(130)= -7.357$ ,  $p= <.001$ . These quantitative data correlate with the qualitative data analyzed in several ways. “Cultural leader influence” and “dietetic leader influence” were codes identified in the qualitative data. The “cultural leader influence” code was less frequently noted. Study participants discussed that physical exams are, in some ways, part of the Ghanaian culture.

In addition to cultural leaders, leaders of the dietetics community were also determined to be influential figures for Ghanaian nutrition professionals. Study participants very frequently discussed how dietetic leaders shape their dietetics practice.

**Table 6. Demographic characteristics of Ghanaian nutrition professionals who attended a two-day virtual workshop about using nutrition-focused physical exam to identify micronutrient deficiencies (N=131).**

Characteristic	Frequency (%)
Registered Dietitian Nutritionist (RDN)	
Yes	85 (64.9%)
No	18 (13.7%)
No response	1 (0.9%)
Years of Practice (RDN)	
Less than 1 year	1 (0.9%)
0-3 years	47 (35.8%)
4-6 years	18 (13.7%)
7-9 years	14 (10.7%)
10+ years	4 (3.1%)
Dietetic Intern	1 (0.9%)
No Response	1 (0.9%)
Registered Nutritionist	
Yes	34 (26.0%)
No	18 (13.7%)
Years of Practice (RN)	
Less than 1 year	1 (0.9%)
0-3 years	12 (9.2%)
4-6 years	6 (4.6%)
7-9 years	4 (3.1%)
10+ years	9 (6.9%)
No response	2 (1.5%)
Highest level of nutrition education	
Undergraduate (BsC)	76 (58.0%)
Postgraduate (MSc/MPhil/PhD)	55 (42.0%)
Practice setting	
Private	21 (16.0%)
Public/Government	83 (63.4%)
Freelance	23 (17.6%)
No Response	4 (3.1%)

One participant, when referring to using the NFPE to identify micronutrient deficiencies, stated: “there could be a call to make that part of the standard of care.” When discussing facilitators to incorporating the MND-directed

NFPE into clinical practice, additional MND-directed NFPE training within the didactic curriculum was emphasized. Specifically, participants mentioned it may be especially instructive for preceptors to showcase use of the MND-directed NFPE within clinical rotations for dietetics students. The discussion around facilitating the use of the exam in clinical practices circled closely around practical application. Additional continuing education opportunities were also cited as opportunities to bolster use of the exam. Another code noted in the qualitative data analysis was “knowledge.” Throughout the qualitative transcripts, the topic of knowledge associated with conducting the MND-directed NFPE was frequently addressed in a positive manner. One study participant mentioned “we have learned a lot and we are grateful to you.”

Posttest scores for questions pertaining to the observability construct were significantly higher ( $M=13.47$ ,  $SE=.165$ ),  $t(130)=-3.423$ ,  $p<.001$  than pretest questions pertaining to the observability construct ( $M=12.77$ ,  $SE=.155$ ),  $t(130)=-3.423$ ,  $p<.001$ . The “observability” code identified in the qualitative data reflects the results of this inferential statistical result. Study participants frequently alluded to the fact that using the MND-directed physical exam would likely yield observable, and desirable, patient outcomes.

Often, when “observability” was addressed, it was in the context of a larger discussion about the incidence of micronutrient deficiencies in the participants’ workplace. “Micronutrient deficiencies” was another frequently-encountered topic within the qualitative data. Iron was the most commonly-addressed micronutrient deficiency and was noted on 15 occasions. This may be especially noteworthy, as the focus group leaders did not inquire about iron specifically. One participant mentioned “I think that most of the micronutrient deficiencies will be iron.” Certain medical conditions were discussed in the context of iron deficiency, including burns and pregnancy.

Posttest scores for questions pertaining to the compatibility construct were not significantly different ( $M=10.86$ ,  $SE=.201$ ),  $t(130)=-2.246$ ,  $p<.026$  than pretest scores for questions pertaining to the compatibility construct ( $M=10.38$ ,  $SE=.171$ )  $t(130)=-2.246$ ,  $p<.026$ . Qualitative data pertaining to the deductive “compatibility” code were varied. For example, while one participant mentioned “I think it could be very feasible in my workplace” another mentioned “some of the barriers we heard were time constraints—too many patients.” Overall, whether the MND-directed NFPE was compatible in the workplace was a very frequently-addressed topic.

When addressing compatibility, participants were encouraged about incorporating the exam into their practice on three occasions, one comment was neutral, and most comments regarding compatibility occurred in the context of barriers to conducting the exam. Of those who were encouraged about incorporating the exam into practice, one mentioned that organization and time management were important considerations, and one mentioned that it may be especially feasible to incorporate in the pediatric setting. The remaining instances could be described as the study participant explaining ways in which conducting the MND-directed NFPE may not be compatible with their workplace.

Study participants mentioned several specific barriers to conducting the MND-directed NFPE in the context of whether this practice was compatible with their work life. Barriers mentioned were inadequate lighting to physically assess the patient, communication issues among the health care team, a lack of awareness about the MND-directed NFPE, prioritization of macronutrient deficiencies and/or other medical conditions over micronutrient deficiencies, the fact that the MND-directed NFPE is not currently considered part of the standard of care, a lack of motivation, and insufficient time, space and privacy.

“Religious or cultural barriers” was identified as code in the qualitative data. Religious or cultural barriers were cited on four occasions in the context of being barriers to conducting the MND-directed NFPE. For example, one participant mentioned: “He couldn’t even touch some of his clients, due to religious reasons because they came in gowned from head to toe, you can’t even see the skin.” “COVID-19” was also a code established in the qualitative data that spoke to barriers. Specifically, a desire to socially distance from the patient and a lack of personal protective equipment were cited as barriers to conducting the MND-directed NFPE.

Posttest scores for questions pertaining to the complexity construct were significantly higher ( $M= 9.99, SE= .202, t(130) = -5.174, p= <.001$ ) than pretest scores for questions pertaining to the complexity construct ( $M= 8.88, SE= .173, t(130) = -5.174, p= <.001$ ). Several participants referred to how complex they perceived the MND-directed NFPE to be. The complexity of the MND-directed NFPE appeared to be the most-discussed topic. One theme identified within the “complexity” code was the fact that utilizing the MND-directed NFPE was somewhat outside of the participants’ comfort zone. Approaching the patient, touching the patient, and being comfortable recognizing the myriad of signs and symptoms of MNDs were all cited as reasons for this discomfort.

Posttest scores for questions pertaining to the self-efficacy construct were significantly higher ( $M= 11.51, SE= .156, t(130)= -7.781, p= <.001$ ) than pretest scores for questions pertaining to the self-efficacy construct ( $M= 9.96, SE= .195, t(130)= -7.781, p= <.001$ ). Feelings of self-efficacy were heavily discussed among participants. The overarching message from participants closely mirrors the quantitative results. One participant mentioned that “this webinar will help embolden me to look out for MNDs anytime I assess a patient.” In all instances that participants mentioned feelings of self-efficacy, participants discussed enhanced feelings of

self-efficacy after attending the virtual workshop.

Posttest scores for questions pertaining to the trialability construct were not significantly different ( $M= 11.05, SE= .192, t(130)= -1.269, p=.207$ ) than pretest scores for questions pertaining to the trialability construct ( $M= 10.83, SE= .159, t(130)= -1.269, p=.207$ ). The topic of whether participants felt the MND-directed NFPE was a trialable clinical skill was frequently mentioned. Study participants largely reported they felt as though the MND-directed NFPE had high trialability in their workplace. Therefore, the qualitative data does not appear to directly reflect the qualitative results related to trialability. This finding may be due to the fact that many participants also reported that they currently use the MND-directed NFPE in their practice. Participants that incorporated this exam into their practice prior to the virtual workshop likely would not have different pretest and posttest scores on questions pertaining to trialability. Use of the MND-directed NFPE in the community setting was often discussed alongside the trialability of this exam. Application of the MND-directed NFPE in the community setting was broached on several occasions by study participants. The rationale provided by participants for why the exam may be especially useful in the communities was that in more rural settings, MNDs may be more common, and that medical infrastructure may be lacking.

Posttest scores for questions pertaining to the relative advantage construct were significantly higher ( $M= 13.26, SE= .148, t(130)= -7.608, p= <.001$ ) than pretest scores for questions pertaining to the relative advantage construct ( $M= 12.05, SE= .159, t(130)= -7.608, p= <.001$ ). When study participants were asked about how micronutrient deficiencies are identified in their workplace, laboratory tests were the subject of most ensuing discussion. For example, one participant stated “right now, in order to find these micronutrient deficiencies, they’re really relying on lab work.” Participants described that biochemical markers of

**Table 3. Total and construct-specific dependent t test results**

Variable	Pretest Mean	SE	Posttest Mean	SE	P-value <sup>1</sup>
<b>Total</b>	64.85	.165	70.15	.703	<0.001
<b>Observability</b>	12.77	.155	13.47	.165	<0.001
<b>Compatibility</b>	10.38	.171	10.86	.201	0.026
<b>Complexity</b>	8.88	.173	9.99	.202	<0.001
<b>Self-Efficacy</b>	9.96	.195	11.51	.156	<0.001
<b>Trialability</b>	10.83	.159	11.05	.192	0.207
<b>Relative Advantage</b>	12.05	.159	13.26	.148	<0.001

<sup>1</sup> The p-value was derived from a paired t-test where  $p < 0.05$  was considered statistically significant.

nutrition status are often ordered in the inpatient setting, and are used by the nutrition professional to develop a nutritional plan of care.

When discussing laboratory tests, however, participants also discussed situations in which obtaining biochemical markers of nutrition status was not feasible. In these instances, participants described that using the MND-directed NFPE may be a valuable diagnostic alternative; comments on this topic were coded as “relative advantage.” On several occasions, the cost associated with measuring biochemical markers of nutrition status was cited as a barrier to identifying MNDs, and as the reason why the MND-directed NFPE would be a useful alternative. For example, one patient stated “lab tests can be very expensive in our country so we can rely on the NFPEs in identifying MNDs.” Participants also discussed the fact that biochemical markers of nutrition status are sometimes unavailable due to inadequate medical infrastructure. Many study participants expressed they perceived the MND-directed NFPE to be preferable than other forms of detecting MNDs, especially when barriers to other methods exist. Therefore, the qualitative data relating to the “relative advantage” theoretical construct mirrored the aforementioned quantitative results pertaining to this construct.

The aforementioned inferential statistical tests are further summarized in Table 3 below. The qualitative codes, code type, and example quotes are outlined in Table 4 below.

## DISCUSSION

The virtual workshop enhanced nutrition professionals’ feelings of self-efficacy in performing what they also perceive to be a relatively complex skill. Therefore, the virtual workshop may embolden nutrition professionals to identify MNDs. Ghanaian nutrition professionals often face financial and medical infrastructure barriers to assessing biochemical markers of nutrition status. In these frequently-encountered situations, the MND-directed NFPE offers a viable alternative to identify MNDs. Now that study participants feel confident and knowledgeable about using the MND-directed NFPE, they may be able to identify otherwise undetected MNDs. Identifying and treating MNDs can prevent devastating health outcomes such as blindness,<sup>32</sup> cognitive impairment,<sup>33</sup> and even death.<sup>34</sup> Moreover, many study participants are employed by government entities, and these entities are involved in nutrition supplementation efforts. Therefore, these professionals may be able to use the MND-directed NFPE to obtain useful data to inform their efforts.

**Table 4. Qualitative codes, code types, and example quotes**

Code	Code Type	Example Quotes
Cultural Leader Influence	Inductive	"So my group, we had a very nice discussion about the use of the NFPE in determining micronutrient deficiencies. And we realized that it's been used. In our setting, mostly our grandmothers—when a lady is pregnant—they will look around the eyes and the eyelids in order to check if she's pregnant. The main use is in order to detect pregnancy—that's according to our grandmothers. But mostly that shows if the lady is pregnant or not. So, in a way, it's being used by our grandmothers and other people."
Dietetic Leader Influence	Inductive	"I think that having more opportunities like this to, not just refresh on the theory but also talk about the need for more practical application is helpful. I think most certainly they do work hand in hand in hand, especially for those who have already gone through the training like we can't really go back too much, we can only rely on continuously getting educated, and if we find ourselves in maybe preceptor roles, or you know whatever roles in which we are mentoring others we can also draw younger people's attention—and I'm using younger just like people younger to the field, not necessarily younger than us—to draw their attention to the fact that they can use this assessment methods in their practice, I think." "There could be a call to make that [the MND-directed NFPE] part of the standard of care."
Knowledge	Deductive	"We have learned a lot and we are grateful to you" "Even if it was something you were using and you were not using it so much now, we now have more things to look out for. And then for those in academia, some shared that it's also given them the opportunity to refresh what they know."
Observability	Deductive	"And then the NFPEs are very important to our practice because it makes us more proactive, in the sense that we are able to identify certain things and quickly put an intervention which will probably have delayed hospital stay, would have increased hospital health care cost, and then also we get to tackle the root cause of the problem, like some of the skin conditions where a lot of the people go to the dermatologist and then they just solve the rash or whatever presentation they see on the skin. Meanwhile the root cause of the problem hasn't been tackled."
Micronutrient Deficiencies	Deductive	"I think most of the micronutrient deficiencies will be iron." "Vitamin A deficiency, if I recall, was also a problem." "The common one is iron deficiency. That is the most common MND in our country. But sometimes we will have goiter. It is a little common. I think, for some time now, it is reduced."
Compatibility	Deductive	"I think it [the MND-directed NFPE] could be very feasible in my workplace." "Some of the barriers [to using the MND-directed NFPE] we heard were time constraints—too many patients."
Religious or Cultural Barriers	Inductive	"He couldn't even touch some of his clients, due to religious reasons because they came in gowned from head to toe, you can't even see the skin."
COVID-19	Deductive	"Then we were able to identify the barriers that will cause a challenge in using the tool. One was mainly the COVID era, when there's social distancing and staying away from people by direct contact. We're going to have a challenge, because we need to, at one point actually touch your patient so how are we going to factor that in."
Complexity	Deductive	"The NFPEs can be very subjective in determining deficiencies. Can be very subjective, can be very tricky. Depending on your expertise and your experience it's going to be a little tricky. So we also want to use other tests to confirm our findings."
Self-efficacy	Deductive	"This webinar will help embolden me to look out for MNDs anytime I assess a patient." "And then we also talked about the impact of the webinar on our practice. And we said it had a very positive impact, it had boosted our confidence, which used to be a limitation, but as we keep hitting on it and visiting it, it is encouraging us to use it more, and it has also encouraged us to go beyond what – what I would say our comfort zone—the biomedical findings—to include the nutrition-focused physical examination in our assessment—as part of our assessment."

(Table continues on next page.)

(Table 4, continued from previous page)

Code	Code Type	Example Quotes
Community Application	Deductive	"Maybe for people who are working with communities and doing like some kind of nutrition education for people at a community level, they might be able to utilize this to catch some of these deficiencies early, especially if we think about the fact that, in the rural communities, people might not even have access to like proper hospitals. So, if, if you work in that setting that might be helpful."
Laboratory Tests	Deductive	"Right now, in order to find these micronutrient deficiencies, they're really relying on lab work." "So normally, when someone comes to the hospital in Ghana, it's a baseline—they do a baseline test, they kind of like run tests. And through that, you are able to pick out what has fallen below the normal range, and all that. So, when a patient comes to, for example, myself for consultation I would look out for the labs first."
Relative Advantage	Deductive	"Lab tests can be very expensive in our country so we can rely on the NFPEs in identifying MNDs." "They also said that lab work is not always available so they rely on NFPE a lot. Someone said NFPE is faster in detecting patients with MND than the biochemical methods. Also, it is cost efficient, like a lot of people said."

Some logistical concerns do exist, such as space and privacy concerns, when implementing this practice in the community setting. Due to the high utility of the MND-directed NFPE in Ghana, identifying strategies to overcome the aforementioned barriers is a priority. Providing a platform for discussion among Ghanaian nutrition professionals may catalyze the development of strategies to overcome these barriers. A conversational space would allow Ghanaian nutrition professionals to collaborate and conceptualize solutions to logistical concerns of implementing the MND-directed NFPE into routine clinical practice. Continuing education opportunities in Ghana could focus on this topic and could involve discussion on overcoming these barriers. Moreover, future research could focus on more systematically identifying barriers to use of the MND-directed NFPE. Qualitative research may be an especially effective tool when aiming to identify nuanced reasons for logistical concerns among Ghanaian nutrition professionals.

The Academy of Nutrition and Dietetics offers a hands-on training workshop to

strengthen practicing RDNs' clinical skills in this area.<sup>10</sup> RDNs who have completed this workshop experience increased feelings of comfort, confidence, and proficiency in performing the NFPE.<sup>10</sup> Moreover, malnutrition is more accurately identified among RDNs who have completed a hands-on NFPE workshop.<sup>35</sup> In-person NFPE training simulations have improved feelings of self-efficacy,<sup>16</sup> a known indicator of incorporating the practice into patient care.<sup>17</sup> Although training programs conducted prior the COVID-19 pandemic were effective, the methods employed have limitations in the setting of a global pandemic.

The results of the present study offer insight into virtual options for exclusively in-person clinical skills training programs. Not only did the workshop improve nutrition professionals' feelings of self-efficacy in performing what they perceive to be a complex skill, but the virtual platform may have increased the reach and accessibility of the workshop as well. Schedule flexibility and reduced commute time have been noted as benefits of virtual dietetics platforms during the COVID-19 pandemic.<sup>36</sup> Increased schedule

flexibility has also been recognized among medical students as a benefit of online medical training platforms.<sup>37</sup> An additional advantage to virtual training programs is overall efficiency.<sup>38</sup> Preparing and executing virtual dietetics training is relatively efficient when compared to its in-person counterparts.<sup>38</sup>

One limitation of the present study is the qualitative data was transcribed and largely interpreted in a cross-cultural manner which introduces the potential of missing nuances in the data. Moreover, the workshop was not limited to Ghanaian nutrition professionals who routinely assess micronutrient deficiencies. Additionally, the practice setting category “public/government” provided limited demographic specificity, especially as this pertains to the utility of this skill. Another study limitation is that an unvalidated survey tool was utilized to collect the quantitative data. The pilot test was conducted in an effort to correct for errors associated with use of an unvalidated tool, yet the tool remained unvalidated at the time of use during the study. Moreover, focus group leaders’ experience facilitating focus groups varied.

Despite these limitations, the current study furthered the relatively limited findings on the efficacy of virtual training platforms for nutrition professionals during the COVID-19 pandemic. MNDs are not unique to Ghana, nor is the feeling of unpreparedness among RDNs to conduct the NFPE. In fact, more than two billion people worldwide have at least one MND.<sup>39</sup> Virtual platforms offer a safe and effective method by which to deliver MND-directed NFPE training. Health care educators may perceive it necessary to conduct clinical skills training in person. However, circumstances may arise, such as a global pandemic, which may hinder the ability of health care educators to deliver in-person training. In the absence of safe, in-person training options, virtual platforms provide an effective, accessible alternative.

## STUDY APPROVAL

The University of North Florida IRB conducted a review of our study and declared it “exempt.”

## CONFLICTS OF INTEREST

The authors report no conflicts of interest.

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