

KNOWLEDGE, ATTITUDE, INTEREST, AND AWARENESS OF ONE HEALTH AMONG ENVIRONMENTAL SCIENCE, HUMAN AND VETERINARY MEDICAL STUDENTS IN KUMASI.

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ABSTRACT

The One Health concept is critical in improving preparation for and response to current and future health challenges. Therefore, One Health training must be provided to health professionals early in their careers. A survey was conducted from February to May 2022 at the Kwame Nkrumah University of Science and Technology (KNUST) among Human Medicine, Veterinary Medicine and Environment Science students to determine their awareness, knowledge, attitude and interest in the One Health concept. Online (Google forms) standard questionnaires were randomly administered to students across the three programs. Data were analysed using the IBM Statistical Package for Social Sciences (version 25). Among the 419 respondents included in the study, 123 were Environmental science students, while Human Medicine and Veterinary Medicine had equal numbers of 148 each. Results of the study revealed that although 67.3% of the respondents had good knowledge about one health, 61.3% had no awareness of the one health concept. This lack of awareness about One Health was exceptionally high in Human Medicine (80.4%) and Environmental Science (79.7%) students and this observation was statistically significant ($p = 0.001$). Notable was the fact that students from all three programs were very interested in the One Health concept ($p = 0.001$), evident by a minimum of 79.1% of total respondents recommending the teaching of One Health in their respective programs of study. Furthermore, the majority of the respondents (82.1%) indicated they would like to pursue One Health studies in the future. This study reveals the acute lack of awareness about the One Health concept among essential future workforce crucial to the One Health implementation process. The study strongly recommends including One Health courses in the university's health and environment programs curriculum.

Keywords: One Health, Human, Veterinary, Environmental Science, Students, Ghana.

INTRODUCTION

The One Health concept is an integrated, unifying approach that aims to sustainably balance and optimise the health of people, animals and ecosystems. It recognises that the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and interdependent (Sleeman et al., 2019). Recent pandemics and disease threats have illustrated the need to educate and train health personnel in a One Health approach. This is critical in improving preparation for and response to current and future health challenges. Because of this, there is a critical need to provide One Health training to health professionals early in their careers (Docherty & Foley, 2021).

Animals, especially wildlife, have been a significant source of high-impact, recently emerging pathogens affecting people (Zinsstag et al., 2012). Sixty per cent (60%) of the pathogens that cause human diseases are of animal origin (OIE, 2020). Because of the potential threat of zoonotic diseases, climate and environmental challenges, antimicrobial resistance, food safety and food security issues, international, national and local authorities have made a massive move to adopt One Health worldwide.

Sleeman et al (2021) stated that students need to be aware of their joint responsibilities in tackling diseases, supported by stronger communication between different health professionals, teamwork engagement, and understanding of their specific roles. Raising this awareness should ideally start at the university (Roopnarine et al., 2001). The

necessity for communication and teaching about the One Health concept at all levels of academia has increased due to the recent rise in zoonotic illnesses that harm humans and animals. Therefore, the One Health message must be communicated by veterinary, medical, health educators, and public health experts to their communities (Choma, 2013).

Ghana has a One Health Technical Working Group, which has produced a National One Health Policy draft to be passed by parliament into an Act (GNA, 2021). The One Health zoonotic diseases prioritised through multi-sectoral engagement in Ghana are anthrax, rabies, zoonotic avian influenza, zoonotic tuberculosis, viral haemorrhagic fevers (including Ebola, Lassa fever, yellow fever, and dengue fever, among others), and trypanosomiasis (CDC, 2018). However, there is limited knowledge about whether Health and Environmental students in Ghanaian universities are aware of the One Health Concept and the efforts to implement this approach globally and in Ghana. Hence, this study is intended as a preliminary investigation to assess the Knowledge, Attitude, Interest and Awareness of Human Medicine, Veterinary Medicine, and Environmental Science students of KNUST about the One Health Concept during the 2022 academic year. Human Medicine, Veterinary Medicine, and Environmental Science students are at the core of the One Health Concept, and their awareness and acceptance of this concept will significantly influence their work in the future.

METHODS**Study Design**

The study carried out between February and May 2022, was conducted at Kwame Nkrumah University of Science and Technology (KNUST) campus in Kumasi, Ashanti region of Ghana. It was a cross-sectional study using an online (google forms) survey questionnaire divided into two parts; part one with two sections and part two with three sections.

The first part consisted of a section for participants' demographic information, including their program of study, academic level or year, future career field and history of pet ownership. The other section assessed students' awareness of One Health. The first section of the second part evaluated the attitude, the second section assessed their interest in One Health, and the third was to assess their knowledge of the One Health Concept. To assess their knowledge in section three, 18 statements were used to identify respondents' level of agreement with concepts developed around the three domains of One Health: Animal Health and Zoonoses, Human Health and well-being, and Environmental Stewardship. The survey was designed with both positively and negatively phrased statements to minimise bias.

The questionnaire for the study was designed by the researchers after a thorough review of similar studies (Hayes et al., 2014; Roopnarine et al., 2018), and utilizing the researchers' proficiency.

Study Population

The targeted population for the study was all registered human medicine, veterinary medicine, and environmental science students

of the university for the 2022 academic session who consented to partake in the study.

Sample Size

The Yamane formula was used to calculate the sample size. Yamane's formula applies to studies where the population size is known (Madow, 1968). The formula is given below:

$$n = N / (1 + N(e)^2)$$

where n is the sample size, N is the population size, and e is the level of precision.

$$n = N / (1 + N(e)^2) = 2883 / (1 + 2883(0.05)^2) = 351 \text{ students}$$

With the total registered student population being 2,883 as obtained from the various faculty managements, Medicine and Surgery (1,708), Veterinary Medicine (317), and Environmental Science (858), the formula was applied using a 95% confidence level and a precision of 0.05 or 5% and arrived at a sample size of 351 (Akande-Sholabi et al., 2021).

Sampling Procedure

At each level in each program, a core course for the students was identified. The questionnaire was administered to the study respondents shortly before or sometimes after a lecture session of the core course. The researchers informed the participants of the study objectives. Questionnaires were disseminated electronically to all consenting students. It generally took 10 -15 minutes for them to complete and submit the questionnaire. Participation in the study was voluntary. Anonymity and confidentiality were reiterated to the respondents.

Questionnaire Validation

The content of the study was validated to establish the inclusiveness of the individual question items when compared to the study objectives.

Pretesting of the questionnaire was conducted using thirty students, ten students each from human medicine, veterinary medicine, and environmental science, to ascertain the ease of comprehension of questions or statements in the questionnaire. The response from the students led to some modifications, including reformatting some questions to eliminate duplicity and response ambiguity.

Data Analysis and Presentation

The data obtained from this work were transferred into a Microsoft Excel spreadsheet for cleansing and transported to IBM Statistical Package for Social Sciences (version 25.0) for analysis.

Descriptive statistics, including frequency counts, percentages, and mean, were used to analyse the data. Response percentages were calculated, and conclusions were drawn by analysing aggregated respondent positions to individual statements and at category level. After that, the data was represented using tables and graphs. A cross-tabulation of the categorized levels of Knowledge, Awareness, Attitude, and Interest in One Health and relevant demographic characteristics was done. A Chi-square test was performed to determine any relationships/associations. $P \leq 0.05$ was considered statistically significant. Results generated from SPSS were exported to Microsoft Office Professional Word 2016 to

generate tables and GraphPad Prism version 8.3.1 to generate graphs.

Awareness, Attitude, And Interest Scoring

The Awareness, Attitude and Interest scores were based on Yes and No. All the questions in these sections were positively phrased; therefore, correct answers of Yes were awarded one (1) mark, and zero (0) marks were awarded for a No. Two questions under the Attitude section had five options each; however, only one option was deemed correct, and the other four options were wrong. Hence, the correct answers to these two questions were awarded one (1) mark and zero (0) marks for the wrong options. A total of 4 marks were attainable for Awareness and Interest, and 5 marks were attainable for Attitude. To categorize these sections, total Awareness scores were put into Lack Awareness (0), Fair Awareness (1 - 2), and Good Awareness (3-4). Attitude scores were categorized into Poor Attitude (0 - 1), Fair Attitude (2 - 3) and Good Attitude (4 - 5). Interest scores were also divided into Lack of Interest (0), Fair Interest (1 - 2), and Good Interest (3 - 4).

Knowledge Scoring

This section had 18 questions with 5-point Likert scale response options ranging from strongly agree (awarded 5 marks) to strongly disagree (awarded 1 mark) in all positive questions. Four questions were negative, and these were reverse-scored. A total score of 90 was attainable in this section. The total Knowledge scores were transformed into categorical variables, using Bloom's cut-off criteria, as Good Knowledge (scores $\geq 80\%$) and Poor Knowledge (scores below 80%)

adapted from Akande-Sholabi et al (2021). Nonparametric One-Way ANOVA was performed on the One Health Knowledge questions against the respondents' study program. Pairwise comparisons were made in situations where the distributions were significant.

RESULTS

Demographics of Respondents

There were 419 respondents. Human Medicine and Veterinary Medicine had an equal number of respondents ($n = 148$), and Environmental Science had 123 respondents. Of the total respondents, 45.3% (190) were between 18 and 20 years old, and 28.2% (118) were between 21 and 22 years old. The total number of males was 236 (56.3%), and 183 (43.7%) were females.

About 257 (61.3%) of the respondents showed interest in working in clinical practice, 100 (23.9%) wanted to work in industry, and 21 (5%) expressed interest in working in academia. Concerning pet ownership, 38.4% (161) of the respondents owned pets, and 81.1% (340) had lived with a pet at some point (Table 1).

Respondents Awareness of One Health

A total of 274 respondents, representing 65.6%, had never heard about the One Health concept, and only about one quarter (104, representing 24.8%) said they could define the concept. A small percentage (11.7%) have attended a One Health conference, lecture, seminar, or symposium before, and over three-quarters of the respondents had never heard

about One Health in any of their lectures at the university. (Table 2).

According to the individual programs of study, 82.4% of medicine, 87.8% of environmental science, and 30% of veterinary respondents have never heard about the One Health concept. While 57.4% of veterinary had heard about one health in their lectures in the university, 89.2% of medicine and 91.1% of environment respondents had not. (Table 3).

Respondents Interest in One Health

For the students' interest in the One Health concept, 344 (82.1%) will like to pursue further studies in One Health sometime in the future. Most of the students (320, representing 76.4%) wished they had taken a course on One Health as part of their studies at the university. The majority (361, representing 86.2%) recommended teaching One Health in their program of study or curriculum. Almost all (383, representing 91.4%) of the respondents were willing to attend a One Health conference, seminar, or workshop (Table 4).

According to program of study, 70.9% of medicine, 89.2% of veterinary, and 87.0% of environmental science students will like to pursue further studies in One Health in future. A similar majority across the programs; 62% of medicine, 84.5% veterinary, and 83.7% of environmental science students will like to have taken a course on one health as part of their studies. Also, 79.1% of medicine, 93.9% of veterinary and 85.4% of environmental science respondents recommended the teaching of One Health in their programs of study. (Table 5).

Respondents Attitude Towards One Health

On the aspect of respondents' attitudes concerning the One Health concept, most (97.1%) of the total respondents perceived the One Health concept to be relevant to their programs of study, and 95.5% (400) think that One Health will be relevant to their future careers or jobs.

The majority of respondents above 95.3% across all three programs of study believed that the One Health concept is relevant to their program. A similar majority (minimum of 93.9% in all three programs) indicated that the One Health concept will be relevant to their future career.

Almost all the respondents (409, representing 97.6%) agreed that their program of study was vital to the overall success of the One Health approach or framework.

The majority (72.6%) answered correctly to the question about which profession One Health favours most by indicating "All professions below". That is 83.1% of medicine, 66.2% of veterinary and 67.5% of environmental science respondents believed that one health favours all professions in the study.

Most of the medicine respondents who did not choose all programs tended to indicate medicine (8.1%) as the most favoured, that of veterinary respondents tended to say veterinary (19.4%) and medicine (14.2%), while that of environmental science tended to say environmental science (21.1%).

Also, 73.0% of medicine, 62.8% of veterinary and 72.4% of environmental science

respondents believe that current one health efforts should focus on "all the one health challenges" listed. This represent (69.2%) of the total respondents in the study.

The majority of medicine respondents who did not say "all health challenges" tended to indicate food safety and food security (10.8%) and antimicrobial resistance (6.1%), that of veterinary respondents tended to say zoonoses and infectious diseases (20.3%) and antimicrobial resistance (12.2%), while that of environmental science respondents tended to say climate change (12.2%). (Table 6 and Table 7).

Respondents Knowledge About One Health

In the category of the animal health and zoonosis of the one health knowledge section, 42.5% and 45.2% of respondents, respectively, agreed and strongly agreed with all the positively phrased questions. Similarly, a majority of 53% and 32.9%, respectively, strongly disagreed and disagreed with the negatively worded One Health knowledge questions under animal health and zoonosis.

Under human health and well-being, while the majority of the respondents agreed (43.9%) and strongly agreed (25.9%) with the One Health questions, a significantly high percentage of (23.8%) answered neutrally. The question with the highest number of neutral responses, (26.7%), was whether pet ownership can improve a person's attitude.

Regarding environmental stewardship, 41.5% and 46.3% of the students agreed and strongly agreed, respectively, to the positive questions concerning One Health's knowledge towards environmental health. Again, the majority

answered strongly disagree (45.2%) and disagree (37.5%) to the negative One Health knowledge questions regarding the environment. An almost equal percentage of respondents answered neutrally to the positively phrased questions (11.0%) and the negatively phrased questions (11.1%) in this section on the environment. However, a higher proportion of respondents (2.1%) strongly agreed with the negative phrased One Health knowledge questions on environmental health than those who strongly disagreed (0.4%) with positively phrased questions in that section (Table 8).

The categorization of awareness about One Health revealed that a little above two-thirds of the respondents (61.3%) lack awareness of the One Health concept, while the remaining have either Fair Awareness or Good Awareness about One Health, 81 (19.3%). For interest, we realized that the majority of 341 (81.4%) respondents have a Good Interest in the One Health concept and its initiatives. Only 15.8% (66) had Fair Interest concerning One Health, and 2.9% (12) were not interested or Lacked Interest in the One Health concept and its initiatives. (Fig. 1).

When the attitude responses were categorised, 349 (83.3%) had a Good Attitude toward One Health, 65 (15.5%) had a Fair Attitude and only 1.0% (4) had a Poor Attitude towards One Health. For their knowledge, 67.3% (282) were observed to have Good Knowledge in general about One Health and then, 32.7% (137) to have possessed Poor Knowledge about One Health. (Fig 2).

When the level of awareness about One Health was compared among the three programs of

study, we realized that the majority of Human Medicine students 119 (80.4%), and Environmental Science students 98 (79.7%) Lack Awareness of the One Health concept. And 45.3% (67) of Veterinary Medicine students had Good Awareness, with about a quarter (41, 27%) having Fair Awareness, and the remaining quarter (40, 27%) Lack Awareness. Comparing the interest level showed that Veterinary Medicine students were more interested in One Health, followed closely by Environmental Science students. Human Medicine students were least interested in One Health because they recorded the lowest percentage score in Good Interest (67.6%) and the highest percentage in lack of interest (6.1%).

For respondents' attitudes, Human Medicine had the highest percentage of Good Attitude towards One Health compared to the two other programs, which had almost similar percentages in the Good Attitude category. Though veterinary medicine had the highest percentage of respondents with Poor Attitudes, it has almost the same percentage as human medicine and environmental science.

In comparing the level of knowledge regarding One Health, we observed that though the majority of respondents under each program had Good Knowledge, Veterinary Medicine students had the highest proportion at 84.5% (125), followed by Human Medicine students at 60.1% (89), and Environmental Science students had the least percentage at 55.3% (68). (Table 9).

The gender and future career field of respondents did not have associations with their knowledge of One Health (p-values

>0.05); however, age, the program of study, level or year of study, living with a pet, and owning a pet all had associations with their level of knowledge about One Health (p-values <0.05). (Table 10).

Veterinary students obtained higher mean scores in the majority of the One Health knowledge questions on animal health and zoonosis, human health and well-being, and environmental health and stewardship sections than medical and environmental students. The nonparametric Krushal Wallis test showed that most question items' mean distribution within the three programs was statistically significant.

Only four statements under the environmental stewardship section were not significant (Climate change can have direct and indirect effects on human and animal health; failure to protect the environment will have disastrous consequences for human and animal health; deforestation is a significant issue that can affect human and animal health; and neglecting the health of the environment does not have animal and human health repercussions, p values = 0.144, 0.466, 0.786, and 0.060, respectively). (Table 11).

DISCUSSION

The respondents demonstrated a lack of awareness (61.3%) about the One Health concept, and their level of awareness significantly varied across the program of study. This contrasts with the 75% familiarity with One Health reported among similar student respondents in a Caribbean university by Roopnarine et al[5]

Most students (73.3%) have never heard about One Health in any of their lectures at the university. It emphasizes the view that conscious effort is not being made in the delivery of academic knowledge to introduce the concept to students at the university.

When compared, 80.4% of medicine, 79.7% of environmental science, and 27% of veterinary students lack awareness. The proportion of medical students who lack awareness is much higher than the 40.2% reported in Turkey among medical interns (Akpina & Dumas, 2022).

Most students were very interested in the One Health concept; thus, 81.4% had Good Interest. Human Medicine students were least likely to be interested in One Health. Veterinary students had the highest interest in One Health (90.5%), followed by Environmental Science (87.0%) and Human Medicine (67.6%). Similar results were found in Nigeria, where most veterinary students were eager to learn more about One Health than medical students (Terrigbade & Babalobi, 2020).

The majority of students had Good Attitudes towards the One Health concept. When compared, 86.5% of human medicine students had Good Attitudes which is similar to the findings of Akpinar and Durmaz (2022), where 85.4% of medical interns declared a positive attitude toward the One Health concept.

It, however, contrasts the findings of Terrigbade and Babalobi (2020) , where veterinary students had an excellent attitude towards the One Health Concept compared to medical students.

A high proportion of students (23.8%) were answering neutrally to the statements under human health and well-being centred around the human-animal bond. It contrasts with the One Health understanding of the psychological and physical benefits pets provide to their owners (McConnel et al., 2011). This also suggests a unilateral perception of animals, skewed towards the concept of the animal being detrimental to health, rather than being able to provide health benefits [9].

Most students (67.3%) had Good Knowledge about One Health. Veterinary students were most likely to have Good Knowledge about One Health, p values = 0.001 and this finding is similar to what was observed in Nigeria among veterinary and medical students (Terrigbade & Babalobi, 2020). This observation was expected since the KNUST School of Veterinary Medicine applies the principles of “The One World, One Health Concept” to train their students (Folitse et al., 2014).

Senior-level students across all the programs had more knowledge about One Health than junior-level students, with a p -value of 0.006. Respondents who had lived with pets before and those who owned pets were more likely to have Good Knowledge of One Health than those who did not. These associations were statistically significant, with p -values of 0.007 and 0.002, respectively.

CONCLUSION

It can be concluded from the study that the majority of students lacked awareness of the One Health concept. However, their knowledge, attitude, and interest in One Health were generally good. The knowledge, interest, and

awareness levels of veterinary students about One Health were mainly higher than those of Environmental Science and Human Medicine students. These associations were all statistically significant.

Human Medicine students in this study had a higher level of attitude towards the One Health concept than Environmental Science and Veterinary Medicine students. The association was, however, not statistically significant. The majority of students recommended the teaching of One Health in their programs of study. Among the programs, veterinary medicine students were most likely to recommend the study of One Health, followed by Environmental Science, and then Human Medicine.

One Health awareness creation should be enhanced in the university, and this can be done through One Health conferences, seminars, and workshops. Student One Health clubs can also be established. The study advocates for the inclusion of One Health into the curriculum of Human Medicine, Veterinary Medicine, and Environment Science programs at the university and for the development of One Health postgraduate programs.

More empirical evidence on the role of pets in human health and well-being should be provided to students to help them appreciate this aspect. The negative implications of encroachment on wildlife should be emphasized in the delivery of academic knowledge to students at the university.

Veterinary and Environmental Science educators should address the attitude of their students by making them understand that One

Health does not favour them over others and also their flawed perception that One Health efforts should prioritize some health challenges over others.

The main limitation of the study has to do with the uneven program durations (the Environmental Science program at the university is four years, while the Human Medicine and Veterinary Medicine programs are both six years) and the proportional representation of respondents for the different programs. Also, the inherent limitation of self-reporting is another limitation of this study.

Conflicts Of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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