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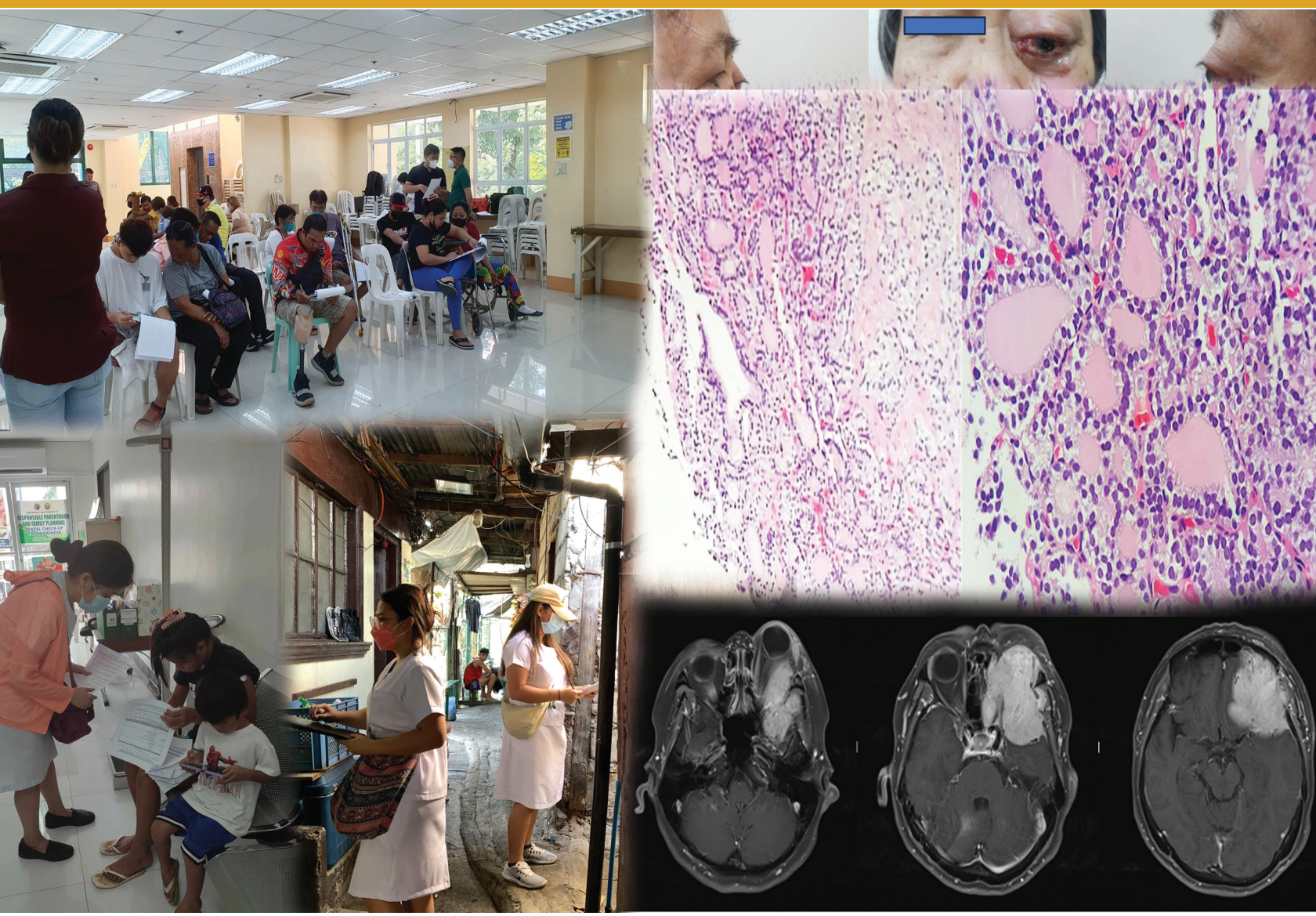

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Editorial Conflict of Interest Disclosure

(as of May 31, 2024)

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Association between prosthesis use to the physical functioning and quality of life among adult unilateral lower limb amputees: An analytical cross-sectional study*

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Abstract

Introduction A prosthesis is an artificial assistive device designed to replace a missing body part (e.g., limb), secondary to a disease, injury or congenital deformities. Prostheses are often used to restore functional capacity while improving the quality of life (QoL).

Methods An analytical cross-sectional study was conducted among adults aged 19 to 64 years who were permanent residents in Luzon who had undergone unilateral lower leg amputation. This epidemiologic study employed the Modified Barthel Index for activities of daily living (ADLs), the Frenchay Activities Index for instrumental activities of daily living (IADLs), and the WHOQOL-BREF for QoL. Descriptive and analytical statistics of the responses of the Lower Limb Amputees (LLA) were done. Prevalence odds ratio (POR) was calculated, and statistical significance was determined.

Results Among 165 LLA respondents, only 47.88% used prostheses. Unilateral LLA who exhibited greater independence in ADLs (POR=19.22), more actively performed IADLs (POR=5.51), and had good QoL (POR=3.83) were more likely to have been using prosthesis. All these findings were statistically significant.

Conclusion This study revealed a statistically significant association between prosthesis use to the physical functioning and QoL among adult unilateral LLAs. It showed that prosthetic use was likely linked with improved performance in ADLs and IADLs, and better QoL compared to those without.

Key words: prosthesis, functional capacity, quality of life

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Amputation results in the removal of a limb, which can be secondary to trauma, chronic disease, or congenital causes.[1] Due to its irreversible nature, amputation renders substantial and lifelong changes in an individual's body structure and function, affecting mobility to a great extent.[2] Restrictions in mobility mainly cause limitations in physical function, which refers to the ability to perform everyday self-care tasks (i.e., activities of daily living / ADLs), as well as daily activities involving interaction with the environment (i.e., instrumental activities of daily living / IADLs).[3]

The effect of physical function creates an adverse and immense impact physically, psychologically, socially, and environmentally – essentially affecting the overall quality of life (QoL). The World Health Organization (WHO) defines QoL as "an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns".[4] Since QoL is linked to overall well-being and satisfaction, people with amputation cope by modifying and adapting their well-established habits and motion patterns through rehabilitation or use of a prosthesis – an artificial device intended to replace a missing part of an extremity.[5]

In the Philippines, over 600,000 amputees were reported in 2018.[6] Relative to other disabling conditions, the proportion of disability due to amputations in the country was less than 1%, based on the 2016 National Disability Prevalence Survey of the Philippine Statistics Authority (PSA).[7] Despite its low prevalence, amputation is a considerable social and economic burden to society and individuals. With limb loss causing multifaceted challenges, artificial limbs intend to provide an individual with the opportunity to perform functional tasks and, in turn, improve QoL. Despite the huge demand and apparent benefits of prosthesis, there seems to be paucity of medical literature in the Philippines that dwell on physical functioning and overall QoL of prosthetic users.[8,9] Little is known to adequately establish whether the use of prostheses among those with lower limb amputation provides significant improvement in their physical function and QoL.

Therefore, the primary objective of this study was to determine association between the use of prosthesis to the physical functioning and QoL among adult unilateral lower limb amputees (LLAs). This epidemiologic investigation could establish, if indeed, prosthesis use could genuinely enhance physical function and more importantly, positively impact the overall QoL. Through this, the study might help provide insight into how LLAs viewed and valued prosthesis use for physical functioning, which could serve as a catalyst for better rehabilitation outcomes for LLAs. In addition, this could likewise potentially improve understanding of the field of rehabilitation medicine, orthotics, and prosthetics, which might potentially further the development of government or non-government services for LLAs.

Methods

This analytical cross-sectional study compared the level of physical functioning and QoL among LLAs with and without prostheses. This study underwent approval by the Ethics Review Committee of the UERMMMCI Research Institute for Health Sciences.

Respondent recruitment via purposive sampling and data collection was done from July 2023 to October 2023 through face-to-face interviews, phone calls, and online surveys throughout Luzon with the help of government units and non-government organizations. Study respondents met the inclusion criteria, set as follows: 1) Filipino; 2) 19 to 64 years old; 3) residing in Luzon; and 4) who underwent unilateral lower limb amputation. Excluded from this study were individuals who had been using prosthesis for less than six months; those with established neurologic and/or orthopedic impairments (i.e., stroke, cerebral palsy, poliomyelitis); those with insufficient cognitive skills, as well as those with previously diagnosed psychiatric disorders; and those who had congenital limb loss. Out of 197 study respondents, 32 were eventually not included in the study, due to failure of meeting all eligibility criteria or secondary to incomplete responses. Hence, only 165 consenting study respondents were included in the study.

Data were collected using a structured survey questionnaire consisting of a sociodemographic questionnaire and compiled previously validated tools, in particular: 1) the Modified Barthel Index (MBI); 2) the Frenchay Activities Index (FAI); and 3) the WHOQOL-BREF Questionnaire. Since a translated version of one questionnaire was already available, the remaining two questionnaires were translated into the vernacular and pilot tested for internal consistency (i.e., Cronbach's $\alpha = 0.936$)

The MBI, an 11-item self-care assessment test measured ADL, where a sum score of ≥ 60 indicated independence and < 60 implied dependence. Due to its superior test-retest reliability and lower random measurement error in comparison to the original Barthel Index (BI), the MBI was recommended for clinical and research purposes.[10]

The FAI, a 15-item self-care assessment test measured IADL, where a sum score of ≥ 16 was considered active and < 16 was inactive, exhibited good retest reliability when discerning group-level distinctions in research involving amputee populations.[11] Consequently, it was recommended

to ensure comparability of results across different populations and studies. Test-retest reliability of the tool among LLAs measured 0.79 with a Cronbach's α of 0.87.[11,12]

The WHOQOL-BREF was a 26-item assessment test that included each of the 24 facets in WHOQOL-100 as a one-item question with the addition of 2 items from the overall QoL and general health facet.[13] Items were rated on a 5-point scale system from 1 (i.e., not at all) to 5 (i.e., completely). A score of ≥ 80 indicated a good QoL, while < 80 was considered poor QoL. The test-retest for all domains of WHOQOL-BREF had an internal reliability measured above 0.70 and a Cronbach's α of 0.896.[14]

Both the MBI and FAI were scored as the sum of all responses in each questionnaire. The total scores determined the study respondents' capacity for ADLs and IADLs based on the cut-off scores set. For WHOQOL-BREF, responses were recorded per domain of QoL, namely the physical domain, psychological domain, social relationships domain, and environment domain. An overall QoL score, which was the total of all 26 items, was also reported and was used to classify whether an individual had good or poor QoL, based on the set cut-off score.

All of the statistical analyses were done using IBM Statistical Package for Social Sciences (SPSS) Version 29.0.1.0 (171).

Results

Of the 165 study respondents, 79 (47.88%) were included in the group with prostheses, and 86 (52.12%) were grouped under LLAs without prostheses. The age range of the study respondents was from 21 to 64 years, with the prosthesis group having a computed mean age of ~43 years old, while the group without prosthesis had an average age of ~49 years old. Table 1 shows the sociodemographic profile of the study respondents and other pertinent information on the individual and environmental factors that might have a consequent effect on the overall QoL.[15]

The demographic profile of unilateral LLAs predominantly consisted of males, accounting for approximately 69% of the study respondents across both groups. Among those with prostheses, a significant portion (51.9%) finished tertiary education, whereas only 33.7% of those without prostheses attained the same educational attainment. In terms of employment status, 46 (58.23%) of those with prostheses were currently employed or could do work, while only 23 (26.74%) of those without prostheses were gainfully employed.

The leading causes of amputation among the study respondents were due to 1) trauma or accidents, 2) complications of diabetes mellitus, and 3) others (i.e., amputation secondary to osteosarcoma, giant cell tumor, osteomyelitis, infection, etc.), comprising 42.42%, 38.79%, and 18.79%, respectively. Between the two groups, however, the predominant causes of amputation were different, with trauma or accidents leading in the group with prosthesis, while complications of diabetes mellitus were the major reason for amputation in the group without prosthesis. Below-knee amputation (BKA) comprised the majority of the responses for each group, with 62.03% with prosthesis and 53.49%, without prosthesis.

Descriptive statistics of the MBI, FAI, and WHOQOL-BREF had been summarized in Table 2, showing the mean and standard deviation of test scores. Both MBI and FAI scores were recorded as the sum of every item in each questionnaire. WHOQOL-BREF raw scores were reported as the sum of specific questions about each domain, and an overall QoL score from the sum of all domains and two general questions regarding perceived QoL. Summarized in Table 3 were the mean and standard deviation of the transformed WHOQOL-BREF scores of each domain.

Unilateral LLAs who performed ADLs with greater independence were 19.22 times more likely to have been using prostheses(p-value < 0.001) (Table 4).

Table 5 shows unilateral LLAs who were more active in performing IADLs were 5.51 times more likely to have been using prostheses, and this association was statistically significant (p-value <0.001).

Table 6 shows that unilateral LLAs with good QoL were 3.83 times more likely to have prostheses, and this association was statistically significant (p-value <0.001). These results showed the positive association between the use of prosthesis and physical function (i.e., level of independence on ADLs; level of activity in performing IADLs), as well as QoL, and all were statistically significant.

Discussion

This epidemiologic investigation determined the proportion of LLAs with prostheses who had good

Table 1. Sociodemographic profile.

	Total (N = 165)	With Prosthesis (N = 79)	Without Prosthesis (N = 86)
Sex	N (%)	N (%)	N (%)
Male	114 (69.10)	55 (69.62)	59 (68.60%)
Female	51 (30.90)	24 (30.38)	27 (31.40%)
Educational Attainment			
Did Not Finish School	10 (6.10)	7 (8.90)	3 (3.50%)
Primary Education	14 (8.50)	3 (3.80)	11 (12.80%)
Secondary Education	71 (43.00)	28 (35.40)	43 (50.00%)
Tertiary Education	70 (42.40)	41 (51.90)	29 (33.70%)
Marital Status			
Single	42 (25.45)	26 (32.91)	16 (18.60)
Married	112 (67.88)	46 (58.23)	66 (76.74)
Separated	6 (3.64)	5 (6.33)	1 (1.16)
Widowed	5 (3.03)	2 (2.53)	3 (3.49)
Occupational Status			
Employed	69 (41.82)	46 (58.23)	23 (26.74)
Non-employed	96 (58.18)	33 (41.77)	63 (73.26)
Level of Amputation			
Above the Knee (AKA)	70 (42.42)	30 (37.97)	40 (46.51)
Below the Knee (BKA)	95 (57.58)	49 (62.03)	46 (53.49)
Cause of Amputation			
Trauma / Accidents	70 (42.42)	37 (46.84)	33 (38.37)
Diabetes Complication	64 (38.79)	23 (29.11)	41 (47.67)
Others (infection, cancer)	31 (18.79)	19 (24.05)	12 (13.95)
Presence of Comorbidities			
No Comorbidities	87 (52.73)	51 (64.56)	36 (41.86)
With Comorbidities	78 (47.27)	28 (35.44)	50 (58.14)

Table 2. Descriptive statistics for MBI, FAI & WHOQOL-BREF.

	Total (N = 165)		With Prosthesis (N = 79)		Without Prosthesis (N = 86)	
	Mean	SD	Mean	SD	Mean	SD
Modified Barthel Index	83.62	18.18	91.77	10.51	76.14	20.45
Frenchay Activities Index	23.50	10.29	27.95	8.90	19.42	9.82
WHOQOL-BREF						
Physical Domain	23.35	4.96	25.65	4.11	21.23	4.75
Psychological Domain	21.10	4.12	22.57	3.77	19.76	3.98
Social Relationships Domain	10.72	2.43	11.29	2.37	10.19	2.38
Environment Domain	26.19	5.03	27.71	4.89	24.79	4.77
Overall QoL	87.47	15.73	93.86	14.44	81.59	14.59

Table 3. Transformed WHOQOL-BREF scores (0-100).

WHOQOL-BREF Transformed Scores (0-100)	With Prosthesis (N = 79)		Without Prosthesis (N = 86)	
	Mean	SD	Mean	SD
Physical Domain	66.43	14.95	50.90	16.98
Psychological Domain	68.86	15.88	57.44	16.70
Social Relationships Domain	69.24	19.68	59.88	20.41
Environment Domain	63.28	15.53	54.06	14.79

Table 4. 2x2: Prosthesis use and ability to perform ADLs.

Total (N = 165)	Independent (≥ 60)	Dependent (< 60)
With Prosthesis (N = 79)	78	1
Without Prosthesis (N = 86)	69	17

POR: 19.22; p-value < 0.001

Table 5. 2x2: Prosthesis use and ability to perform IADLs.

Total (N = 165)	Active (≥ 16)	Inactive (< 16)
With Prosthesis (N = 79)	72	7
Without Prosthesis (N = 86)	56	30

POR: 5.51; p-value < 0.001

Table 6. 2x2: Prosthesis use and perceived quality of life scores.

Total (N = 165)	Good QoL (≥ 80)	Poor QoL (< 80)
With Prosthesis (N = 79)	66	13
Without Prosthesis (N = 86)	49	37

POR: 3.83; p-value < 0.001

physical functioning and a good QoL. Furthermore, this study hypothesized that the use of prostheses would have a positive association with enhanced physical function and QoL.

The findings of this research were consistent with a previous study in Turkey, which demonstrated that individuals below 65 years old with lower limb amputations exhibited significantly improved physical balance, greater satisfaction with their prostheses, and enhanced performance in ADLs.[16] As shown by the results, unilateral LLAs who used prosthetics were more inclined to maintain independence in carrying out ADLs, in contrast to those without prosthetics. This was corroborated by a Malaysian study, which showed a significant association between the mobility aids used and the level of independence ($p < 0.001$). Specifically, individuals with prostheses exhibited greater independence in ADL compared to those using standard wheelchairs and standard walkers.[17] The research findings were also consistent with prior epidemiologic investigations where study respondents emphasized the personally significant aspects of using prosthetics. These aspects encompassed values such as a sense of purpose, enthusiasm, and the capability to perform ADLs that prosthetics facilitate. This highlighted that concerns related to prosthetic use

extended beyond their functional aspects, aligning with our study's results.[18] Hence, prostheses had been shown to improve the QoL of LLAs by providing normal body image and increasing physical capabilities.[19] Furthermore, a study also stated that the QoL and general satisfaction of people with LLA were positively correlated with the fit and socket comfort of the prosthesis.[20]

As shown in the current study, unilateral LLAs who used prostheses were more active in terms of the overall performance of IADLs in contrast to those without prostheses, with only 9% of prosthesis users reporting inactivity. These findings were consistent with a previous study where 67% of war veteran amputees had complete independence in taking their medicine, and 70% were able to perform financial activities.[15] Another study reported a high percentage of independence on telephone use, food preparation, housekeeping, laundry, and the ability to handle finances with limitations on IADLs, like shopping, and traveling.[21] While the most dependent domains of the LLAs were housekeeping, food preparation, and laundry, their results were still consistent with the current results of this cross-sectional study, as most of them were still independent of the other domains of IADL, with the highest percentage on telephone use followed by medication intake.[15] These collective findings suggest a positive relationship between the utilization of prostheses among LLAs and their overall performance in IADLs.[21]

As shown by the study results, there was a statistically significant association between the unilateral LLAs with prosthesis and a good QoL. These results were consistent with previous studies, which demonstrated that the overall QoL among LLAs with prostheses was either satisfactory or good.[9,22-25] In a systematic review of literature covering multiple QoL measures, walking with a prosthesis was considered the most notable factor positively influencing QoL amongst LLAs.[26] All four domains reflected a positive impact on QoL with the social relationships domain obtaining the highest transformed score, followed by psychological, then physical, and the environment domain getting the lowest transformed score While all the scores indicated a level of satisfaction indicative of a good overall QoL, the low ranking for the physical domain was reflective of another study where it obtained the lowest score. Their study attributed this to the restriction that amputation had imposed on the respondent's physical mobility, which was considered to be a significant factor to QoL in LLAs.[22,27] Thus, rehabilitation efforts with a focus on improving mobility were emphasized to likely enhance the overall QoL of LLAs.[27] On the other hand, the highest ranking for the social relationships domain aligned with another epidemiologic investigation, which expressed that study respondents valued social standing and relationships with family and friends more than physical ability. This emphasized that the ability to achieve social integration as part of the post-amputation rehabilitation process was deemed more desirable than physical activity or even personal psychological well-being.[28]

The World Report on Disability of the World Health Organization (WHO) highlighted the significant role of the environment in facilitating or restricting participation for people with disabilities, including LLAs. The environment domain getting the lowest transformed score could have stemmed from the observation that there was widespread evidence of environmental barriers that prevented people with disabilities and LLAs from exercising their full autonomy even if they had acquired prostheses.[29] In the National Disability Prevalence Survey of the PSA, it was reported that such barriers included limited community and citizenship participation; constrained accessibility to education or school, work, establishments, health facilities, places of leisure and worship, and transportation; and inadequate access to information and health care services.[7] These disabling barriers contributed to the disadvantages experienced by people with disabilities.

The presence of poor ADL was associated with a decreased QoL, indicating poor physical health. Given the significance of respondents' functional dependence level and their capacity to perform ADL in relation to QoL, these factors were poised to exert a direct influence on overall quality of life.[30] Nonetheless, the mean scores in terms of the physical, psychological, social relationships, and environment domains among the unilateral LLAs with prostheses were generally greater than those without prostheses, highlighting the better scores in perceived QoL by those with prostheses. Other epidemiologic investigations reported the same findings, where unilateral LLAs with prostheses scored better on all four domains.[9,22] A previous study suggested that even though Thai LLAs would face various physical hindrances at the workplace, work was still perceived positively as a source of life's purpose, enhanced

self-esteem, financial security, and reduced social isolation.[9]

The investigators focused on how the utilization of prosthetics with the sociodemographic profile, ability to do ADLs and IADLs, and capacity to have QoL would impact the level of physical functioning and QoL. This focus, however, was centered around adult unilateral LLAs only. Other studies indicated that bilateral lower limb amputees had displayed an impressive ADL score exceeding 90%; or that the relationship between the combined scores for ADL and IADL, while only showing a moderate correlation, was still statistically significant.[31] In addition, other studies showed that better QoL was associated with LLAs who were amputated in their younger years, compared to those who were amputated when they were older, since it gave them time to process and adapt to their new life setup. Educational attainment also played a pivotal role in the QoL of LLAs as it provided them with a greater opportunity to be employed, leading to potential stable financial gains, a sense of purpose, and life satisfaction.[9] Although the data on employment were observed to be significantly different among the two groups, this study was not able to determine the effect of prosthesis on employability or capacity to return to work. A finding from a local study demonstrated that the length of prosthesis use was a critical factor associated with physical health QoL scores, as a longer duration of prosthesis use equated to better adjustment to the physical limitations, capabilities, and health rating.[32] The investigators were also not able to quantify the duration of prosthesis use among LLAs.

To enhance the physical functioning and QoL of adult unilateral LLAs, it is highly recommended that healthcare professionals consider prosthesis use as a potential intervention.[33] Healthcare systems should strive to make prosthetic devices more accessible, especially to those with financial limitations. The need for patient education and counseling regarding the benefits of using a prosthesis ought to be highlighted.[34] Healthcare professionals are encouraged to engage patients in detailed discussions on how prosthetics might improve QoL and capacity for everyday activities.

This epidemiologic study was limited to unilateral LLAs residing in Luzon, which curtailed generalizability to the greater number of Filipino LLAs. In addition, the survey questionnaires employed in this research might be susceptible to social desirability and recall biases. Other unmeasured factors might potentially have an impact on the outcomes. Aside from these, there was a lack of related literature, which tackled the ADL, IADL, and QoL of LLAs with and without prosthesis, highlighting the novelty of this study. The variety of tools used to gather data underscored the lack of universally accepted standards, which presented a challenge in comparing the results of this study with the others.

Conclusion

There was a statistically significant association between the use of prosthesis to physical functioning and QoL among adult unilateral LLAs. In addition, the data suggested that among adults with unilateral LLAs who were able to perform ADLs more independently and IADLs more actively, there were the prosthesis users. All of these positive associations were also statistically significant (i.e., p-value < 0.001).

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Risk of developing type 2 diabetes mellitus among college students enrolled in Quezon City: A descriptive, cross-sectional study

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Abstract

Introduction In 2021, the International Diabetes Federation, reported 536 million people with diabetes, mainly from countries with lower income.

Methods A cross-sectional descriptive study was employed using the Finnish Diabetes Risk Score (FINDRISC), a validated questionnaire which determines the risk of developing diabetes. The questionnaire was conducted online to be accomplished by students enrolled in universities located in Quezon City.

Results Among the 178 college students in Quezon City, with average age of 20 years old, 28.1% are at risk of developing T2DM. The factors contributing to the risk were: (1) Lack of physical activity of at least 30 minutes a day (51.7%); (2) lack of daily intake of vegetables and fruits or berries (52.8%); and (3) family history of DM (74.7%).

Conclusion The study found that one in every four college students in Quezon City is at risk of developing T2DM in the next ten years.

***Key words*:** Diabetes mellitus, Type 2; FINDRISC; College students

The incidence and prevalence of type 2 diabetes mellitus (T2DM) and related deaths have been steadily increasing worldwide.[1,2] In 2014, the World Health Organization (WHO), reported 422 million people with diabetes, mainly from low- and middle-income countries including the Philippines. In 2014, there were at least 3.2 million cases of T2DM in the Philippines and 5.9% of those diagnosed were adults aged 20 to 79 years. After 7 years, the International Diabetes Federation (IDF) report showed that 10.5% of the global adult population has diabetes (approximately 537 million people).[2] Previously, T2DM was considered a disease of the middle-aged and elderly however, trends showed an increased incidence in younger individuals.[1] With this trend, prevention and early detection are keys to reducing the incidence of diabetes in this population. Establishment of the number of people at risk for developing T2DM is essential in planning effective prevention and control programs.[3]

College students are transitioning from adolescence to adulthood. At this stage, they are beginning to form

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lifestyle choices including diet, physical activity influenced by their awareness of nutrition and well-being. Particularly, Asian college students have been found to have the greatest gap between perceived and actual risk of developing diabetes thus, it is in this age range that awareness of health risks and lifestyle modifications may be most beneficial to prevent diabetes. According to the International Diabetes Federation, the Finnish Diabetes Risk Score (FINDRISC) is a valid and inexpensive tool to use in resource limited settings for identifying individuals at high risk for T2DM.[4,5] Universities worldwide have conducted research using FINDRISC to determine the risk of developing T2DM among university students due to the increased prevalence of diabetes mellitus and/or obesity in their country. Findings of previous studies have concluded that influencing modifiable risk factors can significantly decrease the progression of T2DM in this population.[6,7]

Locally, there is lack of sufficient research on the determining the risk of developing T2DM among university students despite the increasing number of younger individuals being diagnosed with the condition. the objective of the study was to identify the risk of developing T2DM in university students, specifically by describing the proportion of students with and without the risk of developing T2DM.

Methods

The study was approved by the UERM Ethics Review Committee. A cross-sectional descriptive type of research design was utilized to determine the risk of college students in developing T2DM wherein the participants were categorized into those with risk and those without risk. The researchers recruited students currently enrolled in a bachelor program, from different colleges in Quezon City, who were able to understand English and who provided consent. Those who have a previous diagnosis of T2DM were excluded. Non- probability convenience sampling was employed, through online recruitment.

The sample size computation was based on a study conducted in Zamboanga, Philippines where 74.3% of the study sample was found to have slightly elevated to very high risk of developing T2DM.[8] The calculated sample size was 293.

The FINDRISC questionnaire was used in assessing the risk of the participants. It is a validated and reliable prediction tool (Cronbach's alpha of 0.84) developed to identify individuals at risk of developing T2DM. The FINDRISC questionnaire is validated for use in the Philippine setting, along with the modified FINDRISC and the simplified FINDRISC questionnaires.[9] The researchers retained the use of the FINDRISC questionnaire instead of the modified and simplified FINDRISC since the latter two omitted the physical activity and diet in the questionnaires. Literature review showed that physical activity and diet are important risk factors for T2DM in the younger population.[10] In the current study, only risk factors included were age, Basal metabolic index (BMI), waist circumference, use of blood pressure medication, physical activity, daily consumption of vegetables or fruits, history of high blood glucose and family history of diabetes.[4]

Data collection was conducted using an online questionnaire. Descriptive statistics were used to describe the demographic characteristics of the participants and present the risk of college students in developing diabetes. The participants were classified as either with risk or without risk based on the recommendations of the validity studies, in which a cut off score of 9 was found to be the most accurate and sensitive in screening Filipinos with dysglycemia when using the original FINDRISC questionnaire.[9]

Results

Of the 202 college students who answered the form online and underwent the screening process, 24 college students did not fit the inclusion criteria. Of the 178 eligible participants who completed the survey, 56 (31.5%) were males and 122 (68.5%) were females. The average age of the participants was 20 years old.

Table 1 shows the risk of developing T2DM among the participants, using the recommended cut-off value of 9 and above. More than one- fourth (28.1%) of the college students had a risk of developing T2DM.

Table 2 shows a breakdown of the components of the FINDRISC with the number of responses per

Table 1. Classification of risk of T2DM development among the participants (n = 178).

FINDRISC Classification	Total
Without risk (<9)	128 (71.9%)
With risk (≥9)	50 (28.1%)

possible option in the questionnaire. Selecting an option with a corresponding score of zero indicated the absence of risk, while selecting the other possible options indicated otherwise. Overall, there were three out of eight components wherein the zero-score options were not chosen by majority of the participants. This indicated that the majority of the college students in Quezon City have these risk factors. The components were as follows: physical activity (51.7% did not engage in physical activity at work or leisure); intake of vegetables, fruits or berries (52.8% did not eat vegetables, fruits or berries daily); and familial history of T2DM (51.1% have a grandparent, uncle, aunt or first cousin but no parent, brother, sister or child with T2DM).

After getting the FINDRISC score of each of the participants, they were separated into two categories based on the absence or presence of a risk. All participants regardless of risk were below 45 years of age.

The BMIs of the majority of the participants with risk (40%) were between 25 to 30 kg/m^2, as compared to the majority in those without risk (66.4%) and overall (55.1%) where it was less than 25 kg/m^2. The waist circumferences of the majority of the participants with risk (60%) were between 94 to 102 cm for the males and 80 to 88 cm for the females, as compared to the majority in those without risk (78.9%) and overall (64.6%) where it was below 94 cm for the males and 80 cm for the females.

Table 2. Frequency distribution of FINDRISC components among participants (overall and categories based on risk).

Age (years)				
<45 (0)		178 (100)	128 (100)	50 (100)
45-54 (2)		0	0	0
55-64 (3)		0	0	0
>64 (4)		0	0	0
BMI (kg/m^2)				
<25 (0)		98 (55.1)	85 (66.4)	13 (26)
25-30 (1)		58 (32.6)	38 (29.7)	20 (40)
>30 (3)		22 (12.4)	5 (3.9)	17 (34)
Waist Circumference (cm)				
Male	Female			
<94 (0)	<80 (0)	115 (64.6)	101 (78.9)	14 (28)
94-102 (3)	80-88 (3)	54 (30.3)	24 (18.8)	30 (60)
>102 (4)	>88 (4)	9 (5.1)	3 (2.3)	6 (12)
At least 30 minutes of physical activity daily				
Yes (0)		86 (48.3)	71 (55.5)	15 (30)
No (2)		92 (51.7)	57 (44.5)	35 (70)
Intake of vegetables, fruit or berries				
Everyday (0)		84 (47.2)	67 (52.3)	17 (34)
Not everyday (1)		94 (52.8)	61 (47.7)	33 (66)
History of high medication use blood pressure				
No (0)		164 (92.1)	122 (95.3)	42 (84)
Yes (2)		14 (7.9)	6 (4.7)	8 (16)
History of high blood glucose levels				
No (0)		166 (93.3)	127 (99.2)	39 (78)
Yes (5)		12 (6.7)	1 (0.8)	11 (22)
Family History of Diabetes Mellitus				
No (0)		45 (25.3)	42 (32.8)	3 (6)
Yes: second-degree relative, at most (3)		91 (51.1)	67 (52.3)	24 (48)
Yes: first-degree relative (5)		42 (23.6)	19 (14.8)	23 (46)

The majority in both those with risk (70%) and overall (51.7%) did not engage in at least 30 minutes of physical activity daily, as compared to the majority of those without risk (55.5%) who did. The majority in both those with risk (66%) and overall (52.8%) did not have daily vegetable, fruits or berries intake, as compared to the majority of those without risk (52.3%) who did have.

The majority did not have any history of high blood pressure medication (92.1%). Only 4.7% in those without risk and 16% in those with risk have used medications for high blood pressure. The same is true with regards to high blood glucose levels (93.3% did not have a history of being tested with high blood glucose levels). Only 0.8% in those without risk and 22% in those with risk had a history of having high blood glucose levels.

With regards to family history of diabetes mellitus (DM), the majority have relatives who were diagnosed with type 1 or type 2 DM (only 25.3% did not have relatives with DM). In the group without risk, 52.3% have second-degree relatives (but with no first-degree relatives) with DM and 14.8% have first-degree relatives with DM. In those with risk, 48% have second-degree relatives (but with no first- degree relatives) with DM and 46% have first-degree relatives with DM.

Discussions

Type 2 diabetes mellitus (T2DM) is a highly prevalent disease that is often undiagnosed until complications become apparent. Although adults and the elderly remain at a higher risk compared to young adults, evidence showed that T2DM is becoming more prevalent in young adults. It is projected to become predominant in many ethnic groups in the following years.[10,11,12] The increasing prevalence should be associated with an increasing risk of development to formulate ways to prevent acquisition of the disease. The risk of developing T2DM among college students was assessed using the FINDRISC questionnaire, which was already validated and found to be an effective tool in screening the risk for developing T2DM even in the Philippines.

In this study, the prevalence rate of the risk for developing T2DM in the next 10 years among college students in Quezon City (28.1%) was comparable to a previous study conducted in the Philippines wherein the overall prevalence of T2DM risk in the general population with mean age of 47 years old was 28.5%.[9] Obtaining a result close to the T2DM risk of the older population could imply that the present risk among college students should be of concern. In other countries, a similar study assessing the risk of developing T2DM in university students was done and results showed that prevalence of those with slightly elevated to high risk was at 33.2% indicating the same concern.[6]

The main driving force behind the increasing risk of developing T2DM in the younger population may be attributed to the increasing prevalence of sedentary lifestyles and obesity.[10] The sedentarism of college students can augment the burden of the increased risk of T2DM.[13,14] Sedentarism in this study encompassed an estimated 12 hours engaged in sedentary behaviors, as well as an increased daily sitting time and decreased physical activity during the pandemic.

The classification of the study participants as with risk or without risk using the FINDRISC questionnaire was based on the individual risk factors highly associated with T2DM. Among these risk factors considered were having a first- degree relative diagnosed with T2DM and having a history of high blood glucose during previous health examinations. In this study, only a fourth of the participants (23.6%) had a first-degree relative diagnosed with T2DM while very few (6.7%) had previously detected high blood glucose levels. Prominent risk factors found among college students were the lack of at least 30 mins of physical activity per day (51.7%), not consuming vegetables, fruits and berries daily (52.8%) and having a second-degree relative diagnosed with DM (51.1%).

Age

The mean age of the participants was 20 years old, and all were below 45 years old. The prevalence of T2DM and the risk for its acquisition remain higher in the elderly as compared to the younger population. In a 2016 study in China, it was found that adults from 55 to 74 years old were up to 7 times more likely to develop T2DM compared to when they were 20-34 years old.[15] Similarly, it was reported by the American Diabetes Association that T2DM rates remain higher in the elderly population.[16] This is attributed to the aging process itself or indirectly through age- related risk factors such as central obesity, mitochondrial dysfunction, free fatty acid and lipid metabolism disorders, inflammation,

beta-cell dysfunction, insulin resistance and metabolic syndrome.[17] Additionally, a different study on Chinese adults showed that, more than the metabolic risks, lifestyle factors, such as unhealthy sleeping patterns, played a bigger role in the development of DM in this age group.[18] In the Philippines, the mean age of diagnosing a new onset T2DM is 50 years old, which is close to the age at risk indicated in the FINDRISC questionnaire specified as 45 years old.[19] The study population consisted of individuals younger than 45 years old, suggesting no risk.

BMI and Waist Circumference

Being overweight or obese is heavily linked to T2DM by various mechanisms, two of which are insulin resistance and β-cell dysfunction.[20] Measuring the BMI of an individual and waist circumference can easily and non- invasively provide information regarding the risk of developing T2DM.

The BMI and waist circumference of the participants may be classified into different groups depending on different cut-off values, namely the Europoid-based cut-offs and the suggested cut-offs for Asia-Pacific. The FINDRISC questionnaire employed in this study uses the Europoid-based cut-offs and although Asia-Pacific cut-offs are preferred for the Filipino population, this would entail the use of a modified version of the questionnaire. The modified versions exclude the use of some risk factors, namely diet, physical activity, and even BMI. All of which are important factors to consider for the target population.[9,10] In the study, slightly more than a half (55.1%) of the participants had a BMI of less than 25 kg/m^2. This meant in turn that almost half (44.9%) of the students have a BMI of equal or more than 25 kg/m^2.

The waist circumference is a widely used measure of obesity in adults. It has been validated as a measure of overweightness and obesity in adolescents.[21] In this current study, more than half (64.6%) of the students have waist circumferences that fell within the normal expected values (below 94 cm for the males and 80 cm for the females). A greater proportion of the students had a waist circumference that indicated absence of risk. Approximately half of the participants have unfavorable anthropometric measurements. This is important since this risk factor is modifiable.

Physical Activity and Consumption of Fruit and Vegetables

Lifestyle modification through physical activity and diet has been widely recommended as part of the therapeutic regimen for patients diagnosed with diabetes mellitus. At least thirty minutes every day or 150 minutes total per week of moderate intensity exercises like brisk walking, could delay the progression of impaired glucose tolerance to overt diabetes. Physical inactivity may be associated with an increased risk of developing T2DM as noted in previous studies. In a study that stratifies participants into different degrees of risk (low, slightly elevated, moderate, and high risk), it was stated that having fewer participants with high risk may have resulted from half of their participants engaging in physical activity.[22] Similar to the results of this study, half of the participants engaging in physical activity may have played a part in a low proportion of the participants with risk.

A combination of physical activity and diet modification were said to achieve notable reduction in HbA1C levels.[23,24] Caloric restriction through dietary modification resulting in modest weight loss has been found to affect glycemic control and insulin sensitivity, especially in patients with hypertension or obesity. Studies suggest that both caloric restriction and weight loss could independently affect glycemic control, which may decrease the risk of developing T2DM.[25,26]

In addition, consumption of fruits and vegetables have protective effects against the progression of hypertension and cardiovascular diseases, which are conditions associated with developing diabetes. More than half of the total participants do not consume fruits and vegetables daily. Compared to the participants who have a good diet, those without could have a poorer outcome. Together with inactivity, these parameters could possibly contribute to the risk of developing T2DM.

Intake of Medications for High Blood Pressure

Individuals with poorly controlled blood pressure have a greater risk of developing diabetes. High blood pressure induces microvascular dysfunction, which may contribute to the pathophysiology of diabetes development.[27] Endothelial dysfunction is

related to insulin resistance, and hypertension since this constitutes a common ground for cardiovascular disease and T2DM.[28]

The findings in the study regarding antihypertensive medications as a risk factor for diabetes shows that the majority (92.1%) of the college students have not taken any high blood pressure medications. Only a few (7.9%) respondents also reported history of medication intake for high blood pressure. A study conducted on university students in Jordan demonstrates that majority (95.12%) of respondents did not take any medications for high blood pressure, while less than two percent of the total respondents had a history of taking medications in the past.[6] A noteworthy number of respondents have not taken any medication possibly due to the absence of increased blood pressure at the time of the study proper and lack of disease awareness.

In the Philippines, only 27% of hypertensive patients were aware of their hypertensive status. Asymptomatic subjects in lower social classes have undiagnosed hypertension. Policies and intervention trials that try to identify and modify risk factors are considered time-consuming for developing countries hampered by financial constraints. Hypertension among young people in Asian countries was said to be due to the interaction of environment, nutritional inadequacies, and genetics. Prevention efforts are burdened in developing Asian countries by the presence of other diseases and low community awareness of the dangers of cardiovascular diseases. The transition of developing Asian countries towards becoming an industrial market paves the way for consumers that impatiently seek affluent and indulgent lifestyles that affect their health.[29]

High Blood Glucose Levels

The increasing prevalence of diabetes in low to middle income countries puts a burden on both the healthcare system and individuals. The results of the study showed that majority of respondents (93.3%) had no high blood glucose at any instance in the past. However, 6.7% answered that they have had high blood glucose pointing to evidence that a high blood glucose level can also be seen in the younger age groups. These results showed that majority of respondents did not have any history of increased blood glucose, potentially due to absence of any risks, lack of awareness and resources. These problems exist due to some gaps in the implementation of detection and treatment programs for diabetes.[30] A more pressing concern is the high cost of laboratory testing for comprehensive evaluation of diabetes, which is three to four times than the average daily earnings of a working Filipino. These out-of-pocket expenses make it hard for individuals to prioritize screening and diagnosis of comorbid conditions such as diabetes.[3]

Family History of Diabetes

This study found that majority of respondents reported that they had at least one first or second degree relative diagnosed with diabetes. A considerable number of respondents (23.6%) reported having first-degree relatives (parent, sibling, or child) with a diagnosis of T2DM. More than half of the respondents (51.1%) had a grandparent, uncle, aunt, or first cousin with diabetes. Almost the same number of study participants (25.3%) who said that they had first degree relatives with T2DM reported that they did not have a first or second-degree relatives with T2DM. The results of the study were comparable to a study conducted in Jordan wherein half of the total respondents (49.9%) mentioned having second degree relatives diagnosed with T2DM. There were fewer respondents (24.8%) who reported having first degree relatives diagnosed with T2DM.[6] Another study among young adult students in Nepal, showed that there were more respondents (38.5%) with second-degree relatives having T2DM, than respondents (21.8%) who have first-degree relatives diagnosed with T2DM.[31] Difference between studies may be attributed to the diverse interactions of environment, genes, and nutritional inadequacies in each country.[25] The relevance of family history in assessing the risk of developing diabetes is well established among various studies, however, there is no single explanation on the mechanism as to how positive family history of diabetes translates to an increased risk of developing diabetes.

The limitations in this study included not being able to achieve the desired sample size and having a sampling bias towards participants who have access to the internet and social media. Both of which reduced the internal validity of the results of the study. Additionally, the data collection was conducted during the COVID-19 pandemic but the study did not factor in

the effects of the pandemic to each of the risk factors of the participants, the FINDRISC score, and how it would impact the categorization of the individual into the groups of whether they were considered to have risk or not. The choice of the questionnaire also affected the interpretation of the results to a certain extent. The original FINDRISC questionnaire is validated for use for the Filipino population but it may not yet be considered the best data collection tool as it does not utilize the recommended cut- offs for the Filipino population specifically for the BMI and waist circumference parameters. Moreover, the questionnaire did not take into account other possible risk factors such as education and mental health conditions, which may also be contributory to the risk of developing T2DM.[32]

Conclusion

In a study involving 178 participants, it was found that one in every four (28.1%) college students in Quezon City was at risk of developing T2DM in the next 10 years. This is comparable to the prevalence rate of the risk for developing the condition in the general population which is at 28.5%; raising concerns since the student population mean age was 20 years old yet the risk is almost the same as that of the general population.

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Association of knowledge and use of contraception to unplanned pregnancies of Filipino females aged 19-45 in an analytical cross-sectional study

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Abstract

Introduction Studies had shown that many women of childbearing age did not have sufficient knowledge of contraceptive methods and use; more so, there was paucity of epidemiological data that assessed reproductive health issues in the Philippine setting.

Methods This cross-sectional study determined the relationship of the level of knowledge and use of contraceptives of sexually active Filipino females aged 19 to 45 years with unplanned pregnancy. The prevalence odds ratio (POR) quantified the association between the level of knowledge and use of contraceptives with unplanned pregnancy, while the Fisher's exact test determined the p-value and the 95% confidence interval of the POR.

Results Among the respondents, the prevalence of unplanned pregnancies was 5.7%. The CKA established that only 37.8% of the total respondents had adequate knowledge, and in the past 12 months, only 28.57% used contraceptives. Among those with unintentional pregnancies, there was a negative association between those with an adequate level of knowledge (POR = 0.22; 95% CI: 0.0048-1.8) and surprisingly, the odds that they used contraceptives were three times higher (POR = 2.67; 95% CI: 0.47-15.0). In this study, both relationships were not statistically significant (p = 0.259 and p = 0.225, respectively).

Conclusion In line with previous epidemiologic studies, women with unintended pregnancies had inadequate level of knowledge of contraceptive use, which might consequently lead to improper use of natural and artificial means of contraception. In addition, women who had unplanned pregnancies had higher odds of using one or several means of contraception, but it could be assumed that there might have been inconsistent condom use or poor compliance with oral contraceptive pills.

Key words: contraceptive use, unplanned pregnancy, reproductive health

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Unplanned pregnancy is one of the issues that the Philippines has been facing for a long time. According to the United Nations Population Fund (UNFPA), the Philippines ranks 56th among 150 countries for the number of unintended pregnancies at 71 per 1,000 women annually.[1] Given the prevalence of unintentional pregnancy in this country, there are different problems that plague both the mothers and their children. According to the World Health

Organization (WHO), unplanned pregnancies may lead to a wide range of health risks for the mother and child, such as malnutrition, non-communicable disease, infections, abuse, neglect, and even death. Furthermore, it can also lead to cycles of high fertility, as well as lower educational and employment potential and worsening poverty which are challenges that can span through generations.[2] Unintended pregnancy can also contribute to an increased risk of maternal depression and parenting stress.[3] One of the ways to address unplanned pregnancy, from a public health perspective, would be through contraceptive use and proper family planning services.[4] Despite this, studies show that the knowledge of women of reproductive age on contraceptive methods remains inadequate, while the utilization of available reproductive health services continues to be problematic.

In several cross-sectional surveys done abroad of the reproductive contraceptive pills it was concluded that their knowledge regarding oral contraceptive pills (OCP) methods was insufficient.[5,6,7]

However, there is paucity of local research investigations that assess these reproductive health concerns in the Philippines setting. Thus, this study determined the association between the level of knowledge and use of the different methods of contraception with unplanned pregnancies of sexually active Filipino females aged 19-45 years old living in an urban barangay.

Methods

An analytical cross-sectional study was done that determined the relationship between (1) level of knowledge and (2) use of the different methods of contraception, and unplanned pregnancy. This study was duly approved by the Ethics Research Committee of the UERMMMCI Research Institute for Health Sciences.

Female study subjects were recruited via purposive sampling, and inclusion criteria were as follows: (1) aged 19-45 years; (2) resident of the barangay for at least one year; and (3) sexually active --- i.e., previously active or currently engaging in sexual activities with (a) male partner/s. Excluded were women with primary amenorrhea, with history of gynecologic malignancy, had undergone hysterectomy, who identify as lesbian / transgender, and with established psychiatric / neurocognitive condition that might prevent them from answering the self-administered questionnaires which were written in Filipino. The calculated minimum sample size was 126.

A self-administered questionnaire, the Contraceptive Knowledge Assessment (CKA), gauged the knowledge of the study participants regarding reproductive health and contraception, using an 11-item multiple choice questionnaire (MCQ)[8]. The CKA consisted of a myriad of topics in contraception, such as reproductive physiology, common misconceptions about contraception, and the proper usage and placement of different methods of contraception. This was then translated to Filipino by the *Komisyon ng Wikang Filipino* (KWF) and modified to fit the local setting; thus, the question regarding the vaginal ring (NuvaRing) and morning-after pills were deleted, since were generally not readily available in the Philippines.

The reproductive health questionnaire, a self-made dichotomous questionnaire with 14 items was used to collect information on use of any method of contraception within the past twelve (12) months, and whether or not they were natural or artificial methods. The reproductive health questionnaire was reviewed by a gynecologist / reproductive health and fertility expert for its theoretical content and face validity.

The natural methods of contraception included the calendar method, body temperature method, withdrawal method, cervical mucus test, and breastfeeding after giving birth. On the other hand, artificial methods of contraception included the use of condoms (by the male partner), intake of oral contraceptive pills, having an intrauterine device (IUD), undergoing bilateral tubal ligation, using the Yuzpe method, administering an injectable contraceptive, having a hormonal subdermal implant, and having a partner who underwent vasectomy.[9]

Pilot testing of the questionnaires was conducted on ten (10) volunteers. Cronbach alpha of the questionnaire to test for its internal consistency was computed to be 0.85, suggesting good reliability of the questionnaire. All statistical tests were performed in R version 4.2.1, under a 5% level of significance.

Results

A total of 140 female volunteers participated in the study, with a mean age of 32.8 years (SD = 7.2), were married or with a partner (n = 92; 65.7%). In addition, majority had at least high school education. Only 15 (10.7%) respondents had been pregnant already, and 8 (5.7%) of them were unplanned pregnancies, but the majority (89.3%) had never been gravid all their lives (Table 1).

Table 1. Descriptive statistics on the sociodemographic background of the study participants (n = 140).

Demographics	n (%)
Age:	
40 to 45 years	34 (24.3)
33 to 39 years	36 (25.7)
26 to 32 years	44 (31.4)
19 to 25 years	26 (18.6)
Civil Status:	
Separated / Annulled	3 (2.1)
Married	45 (32.1)
With Male Live-in Partner	47 (33.6)
Single	45 (32.1)
Educational Attainment:	
Post-Graduate Level	1 (0.7)
College Graduate / Level	55 (39.3)
High School Graduate / Level	64 (45.7)
Elementary Graduate / Level	8 (5.7)
Vocational Course	12 (8.6)
Pregnancy Status:	
Had planned pregnancy/ies	7 (5.0)
Had unplanned pregnancy/ies	8 (5.7)
Never pregnant	125 (89.3)

Only 53 (37.8%) respondents had knowledge adequacy, while 87 (62.2%) respondents had knowledge inadequacy (Table 2).

The item that most respondents were familiar with was the proper placement of birth control subdermal implants (i.e., Implanon), followed by intrauterine device (IUD) as the best birth control that could be reversed, if one wanted to become pregnant. Moreover, the majority of the respondents were also familiar with oral contraceptive pills (OCPs) being a type of hormonal birth control that was available in the Philippines, and that two pills can be taken at once when intake of the birth control pill was inadvertently forgotten and was consequently remembered only the following day (Table 3).

Table 2. Proportion of respondents on their level of knowledge on contraceptives.

Level of Knowledge	n	%
Adequate (i.e., CKA score > 6)	53	37.8
Inadequate (i.e., CKA score < 5)	87	62.2

Table 3. Results on contraceptive knowledge assessment (CKA).

	Correct Answers n (%)	Incorrect Answers n (%)
1. woman's fertile period	43 (30.7)	97 (69.3)
2. sperm's lifespan inside woman's body	43 (30.7)	97 (69.3)
3. withdrawal or the "pull-out" method	46 (32.9)	94 (67.1)
4. forms of hormonal birth control available in the Philippines	72 (51.4)	68 (48.6)
5. benefits of hormonal birth control	38 (27.1)	102 (72.9)
6. primary effect of birth control	62 (44.3)	78 (55.7)
7. ingredients of birth control pills	58 (41.4)	82 (58.6)
8. best action if a birth control pill is forgotten and remembered the next day	71 (50.7)	69 (49.3)
9. best birth control methods that may be reversed if pregnant is wanted	79 (56.4)	61 (43.6)
10. proper placement of intrauterine device (IUD)	28 (20.0)	112 (80.0)
11. proper placement of birth control subdermal implant (i.e., Implanon)	108 (77.1)	32 (22.9)
Total Score (Mean ± SD)	4.60 ± 2.57	

The respondents were least familiar with the uterus as the proper placement of the intrauterine device (IUD), with only 20.0% correct responses. This was followed by the benefits of birth control (e.g., fewer pimples, lowers risk of heavy menstrual bleeding, iron deficiency, ovarian and uterine cancer) with only 27.1% respondents who answered correctly. Other items that the minority answered correctly included woman's fertile period, sperm's lifespan inside the woman's body, knowledge regarding withdrawal or the "pull-out" method, primary effect of birth control, and the ingredients of birth control pills. Overall, the respondents obtained a mean score of 4.60 (SD = 2.57), which meant that most respondents had inadequate knowledge of the different methods of contraception.

Table 4 shows that out of 140 respondents, 40 (28.57%) reported that they were using contraception in the past 12 months. It also showed that from 40 respondents who alleged that they were practicing contraception, 24 (60%) of them were advocating for natural methods, and 35 (87.5%) were employing artificial methods. A total of 19 (47.5%) respondents were using both (i.e., natural and artificial contraceptives), while 5 (12.5%) of them were engaging in natural methods only, and 16 (40%) of them utilized artificial methods only.

Among those with unplanned pregnancies, there was a negative association between those with adequate level of knowledge (POR = 0.22; 95% CI: 0.0048-1.8), but surprisingly a positive relationship with actual contraceptive use. The odds that they used contraceptives were three times higher (POR = 2.67; 95% CI: 0.47-15.0) in women with no intention of being impregnated. However, both relationships were not statistically significant (p = 0.259 and p = 0.225, respectively) (Table 5)

Table 4. Use of contraceptive methods results.

	Yes n (%)	No n (%)
From 140 respondents, those that used any method of contraception in the past 12 months	40 (28.57)	100 (71.43)
From 40 contraception users, use of natural methods	Yes n (%)	No n (%)
1. calendar method	7 (17.5)	33 (82.5)
2. body temperature methods	1 (2.5)	39 (97.5)
3. withdrawal method	17 (42.5)	23 (57.5)
4. cervical mucus test	4 (10.0)	36 (90.0)
5. breastfeeding / lactation amenorrhea	12 (32.5)	28 (67.5)
Total Natural Methods Users	24 (60)	
From 40 contraception users, use of artificial methods	Yes n (%)	No n (%)
1. male condom	12 (30.0)	28 (70)
2. oral contraceptive pills	21 (52.5)	19 (47.5)
3. intrauterine device (IUD)	4 (10.0)	36 (90.0)
4. bilateral tubal ligation (BTL)	0 (0)	40 (100)
5. Yuzpe method	1 (2.5)	39 (97.5)
6. injectable	7 (17.5)	33 (82.5)
7. hormonal subdermal implant	3 (7.5)	37 (92.5)
8. vasectomy	1 (2.5)	39 (97.5)
Total Artificial Methods Users	35 (87.5)	

Table 5. Prevalence odds ratio for level of knowledge and actual contraceptive use versus unplanned pregnancies.

	With Unplanned Pregnancy	Without Unplanned Pregnancy	Total	POR (95% CI)	p-value
Knowledge on Contraception					
• adequate	1	52	53		
• inadequate	7	80	87	0.22 (0.0048-1.8)	0.259
	8	132	140		
Actual Use or Practice of Contraceptive Methods					
• used contraception	4	36	40		
• did not use contraception	4	96	100	2.67 (0.47-15.0)	0.225
	8	132	140		

Discussion

Proportion of Unplanned Pregnancy

The percentage of unplanned pregnancy in this current study was lower than that found in another study conducted in Gambia (West Africa).[10] The higher rates of unplanned pregnancy (25.3%) in that study, however, could be attributed to a bigger sample size, with a wider age range of females included in the study (i.e., 19 to 45 years). A similar epidemiologic investigation in Ethiopia likewise found a higher rate of unintentional pregnancy at 36.5%.[11] In these epidemiologic investigations, the observed rates were due to two reasons: (1) the respondents were unaware that they were fertile or (2) their contraceptive methods did not work. Though the latter study still had a bigger sample size, the findings were consistent with the results that inadequate knowledge of contraceptive methods contributed to higher rates of unplanned pregnancies.

Knowledge of Contraceptive Use

The CKA included questions on general knowledge of reproductive physiology, contraceptive methods, their benefits, effects, proper usage and placement. Majority of the respondents were familiar with the proper placement of birth control subdermal implants, IUD as a type of reversible contraception, pills as a type of hormonal birth control, and the best action to take after failing to take one birth control pill.

On the other hand, majority of the respondents were not familiar with the uterus as the proper placement for IUDs, a woman's fertile period, sperm's lifespan inside woman's body, knowledge regarding withdrawal or the "pull-out" method, benefits of birth control (e.g., fewer pimples, lower risk of heavy menstrual bleeding, iron deficiency, ovarian or uterine cancer), primary effect of birth control, and the ingredients of birth control pills.

The majority of the respondents had poor knowledge regarding contraceptive methods, which was consistent with previous literature documenting poor understanding of contraception among women of reproductive age in Gambia, Ethiopia, Vietnam, and the Kingdom of Saudi Arabia.[10-13]

Public health experts consider knowledge about contraceptive methods, as well as access to them, as a basic requirement for effective contraceptive use. Knowledge, on its own, may not be sufficient to ensure consistent use of contraception; it is a necessary component but it may not always be enough to prevent unintended pregnancy. On a different light, it will be irrational to expect cautious use of contraceptives without the basic knowledge and access to these, but this also does not assure that adequate level knowledge will translate to good contraceptive use.[14] Based on a local study, Filipino women have a positive attitude toward hormonal contraceptives, both for gynecologic and contraceptive purposes even with their limited knowledge.[15]

Association of Knowledge on Contraceptive Use and Unplanned Pregnancy

There was a negative association between adequate level of knowledge and unplanned pregnancy; nonetheless, it was not statistically significant ($p = 0.259$). This was in line with previous studies wherein inadequate knowledge of contraceptives was a significant factor for unplanned pregnancies.[11,16-17] Previous studies also explained that women with less knowledge regarding modern contraceptives were less likely to know about the available and accessible contraceptive methods thus they had lower chances of utilizing the different contraceptive methods correctly and consistently and it could also lead to method discontinuation which could increase the chances of unintended pregnancy.[11,18-19] Additionally, it was documented in a local study conducted that better knowledge of contraceptives was associated with increased usage of long-acting reversible contraceptives (LARCs), such as IUDs and implants, and had extremely low failure rates which could prevent unplanned pregnancy.[20]

Use of Contraceptive Methods

Only less than a third of the participants claimed using contraception in the previous twelve (12) months. There are more respondents (87.5%) who employed artificial methods, particularly regular intake of OCPs (52.5%) than users of natural techniques (60%). Comparable findings from a local study showed that OCPs and natural methods (e.g., withdrawal and the calendar / rhythm approach were also the two most popular means of contraception.[20] According to the 2020 Annual Report of the Responsible Parenthood and Reproductive Health Act, at least

8.1 million Filipinos had used some form of modern family planning method, which was an increase of 6% or 460,000 users from the 7.64 million reported in 2019.[21] A recent study among young Filipinos aged 15–24 years, there were few current users of contraceptive methods.[22] This low contraceptive use among young Filipinos could potentially increase the risk of unintended pregnancies, unsafe abortions, and maternal deaths. Hence, it is imperative to raise awareness of the benefits of utilizing contraception and to provide access to affordable and reliable methods.

Modern reproductive health services and resources (i.e., especially OCPs) are the most often used type of contraception because they are perceived to be more dependable, convenient, and have a lower failure rate than traditional (artificial) methods. Furthermore, modern contraception methods provide people more control over their reproductive health and allow heterosexual couples to plan their families around their preferences and needs.[23]

Association Between Use of Contraceptive Methods and Unplanned Pregnancy

Among the contraceptive users, only 10% had unplanned pregnancy. Although the use of contraceptives could theoretically prevent unintended pregnancies, the results of this study could be explained by the improper use of the different contraceptive methods, such as wrong or inconsistent condom use or poor compliance with OCPs.[23,24] Some epidemiologic investigations showed that reasons for inconsistent condom use included unavailability of condoms, dislike of condoms, the perception that it reduced sexual pleasure, and the perception that the risk for sexually transmitted diseases was low.[25-26] Furthermore, women relied on traditional or less effective contraceptive methods than modern or more effective contraceptives due to fears of modern contraceptive side effects.[26]

Conclusion

The prevalence of unplanned pregnancies in this study was found to be low (5.7%) in the last twelve (12) months. Only 37.8% showed adequate knowledge of contraceptive methods, and only 28.57% actually used contraceptives, whether natural or artificial. Additionally, this study also revealed that among women with unplanned pregnancies, there was a negative association between those with adequate level of knowledge (POR = 0.22; 95% CI: 0.0048-1.8) and the odds that they used contraceptives were three times higher (POR = 2.67; 95% CI: 0.47-15.0). However, both relationships were not statistically significant in this study.

Limitations and Recommendations

This study did not evaluate the proper usage of the different contraceptive methods of the target population. Future studies can assess whether their accessible population will practice the proper usage of the different contraceptives and even try to correlate it with their knowledge of contraceptives.

The study did not compare the effectiveness between artificial and natural contraceptive methods in preventing unplanned pregnancies. Subsequent research initiatives may be directed towards investigating this aspect, aiming to ascertain and contrast the efficacy of artificial and natural contraceptive approaches in mitigating the occurrence of unintended pregnancies. Such endeavors will contribute significantly to understanding the relative effectiveness and implications of employing different contraceptive modalities in averting unplanned pregnancies among the studied population.

Moreover, the study's reliance on self-reported data could have introduced recall bias, as participants might not have accurately remember details regarding their contraception usage or pregnancy history. The questionnaires could still be refined by simplifying medical jargon.

Our recommendation was to increase the contraceptive knowledge and use among women of reproductive age, especially those who are at risk of unplanned pregnancies, by providing them with accurate and comprehensive information about the benefits, risks, and effectiveness of different contraceptive methods, both natural and artificial techniques by implementation of health education initiatives, such as community-based fora, seminars, peer-led learning, or counseling services, facilitated by healthcare experts. It is strongly recommended that local authorities, healthcare facilities, and non-governmental organizations collaborate to enhance community access to a broader range of reproductive health services and resources.

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Cutaneous adverse effects of COVID- 19 vaccines: A cross-sectional study among AstraZeneca and Sinovac vaccine recipients at UERMMMCI*

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Abstract

Introduction COVID-19 has emerged as a global problem with vaccines being established as one of the best tools in its control. Of particular interest in dermatology are risks and manifestations of cutaneous reactions from such countermeasures, with strides made in documenting and associating skin reactions with vaccines against COVID-19. This study aimed to determine the incidence of cutaneous adverse reactions in recipients of recombinant ChAdOx1-S and inactivated SARS-COV-2 vaccines among healthcare personnel and employees of UERMMMCI.

Methods A cross-sectional study was done were respondents, chosen through randomized stratified cluster sampling, were given a questionnaire to elicit cutaneous adverse effects associated with COVID-19 vaccines.

Results There were198 respondents, of which 29.3% were male and 70.7% were female, with a mean age of 26.07 years. Of these respondents, 72 (36.36%) received recombinant ChAdOx1-S and 126 (63.64%) received inactivated SARS-COV-2 vaccine. For the first dose, cutaneous reactions developed in 6 (8.33%) recipients of recombinant ChAdOx1-S, and 2 (1.59%) recipients of inactivated SARS-COV-2. For the second dose, no reactions followed vaccination with recombinant ChAdOx1-S while 4 (3.17%) reactions developed after inactivated SARS-COV-2 vaccination. Lesions were mostly confined to the injection site presenting with erythema for both vaccine types. One urticarial, widespread reaction was associated with a second dose of inactivated SARS-COV-2 vaccine.

Conclusions Adverse reactions to COVID-19 vaccinations have been documented which may be attributed to respective excipients rather than vaccine antigens. Due to the rare occurrence of severe anaphylactic reactions, vaccine use is recommended as they confer protection even to those with prior infections. Documented reactions in this study were observed to be mild and self- limiting similar to larger studies.

Key words: vaccine, drug reaction, COVID-19, pandemic

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The coronavirus disease 2019 (COVID-19) with the causative agent of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has emerged as a global problem. The impact of the aforementioned disease was significant enough for the World Health Organization (WHO) to declare it as a global pandemic

as of March 11, 2020.[1] Upon acquiring the infection, cases may drastically range from asymptomatic presentations to those that become critically ill with severe respiratory distress, lung infection, and even death. As such, protective behaviors become key to improving the circumstances.[2] The use of vaccines has been established as one of the best tools in public health in infectious disease cases where no absolutely effective treatments have been found. The same rings especially true in cases of global pandemics.[1]

Of particular interest in the field of dermatology are the risk and manifestation of cutaneous reactions from such countermeasures. Strides have been made in documenting and associating certain skin reactions with vaccines against Covid-19 infections. Specifically, the mRNA-1273 vaccine against SARS-CoV-2 being developed by Moderna has been observed to cause both immediate (84.2%) and delayed (0.8%) cutaneous reactions in a study of 30,402 participants.[3] A case series from phase III efficacy trials has also shown that the extent of these manifestations can range from localized erythema and swelling, termed as "Covid arm", to larger and more generalized erythrodermic and urticarial reactions after being administered with the same vaccine.[4] Specifically, as well, no studies have yet been done on cutaneous reactions to the abovementioned vaccine brands Sinovac, Moderna, and AstraZeneca.

In particular interest to dermatologists is the onset of cutaneous manifestations of these reactogenic occurrences. Presently, there is a lack of studies exploring the various dermatologic sequelae in patients receiving these vaccines in the Philippine setting. Results of this study can help promote better understanding on how to better manage the expectations for both those administering and receiving this crucial vaccine during this time of a pandemic. Hence, this study aimed to determine the incidence and prevalence of cutaneous adverse reactions in recipients of AstraZeneca and Sinovac vaccines among healthcare personnel and employees of UERMMMCI.

Methods

Study design and subject selection

This cross- sectional study determined the prevalence of cutaneous manifestations in recipients of AstraZeneca and Sinovac vaccination among healthcare workers and employees in the UERM community. The research protocol was approved by the UERMMMCI Ethics Review Committee.

A minimum of 192 patients were needed to determine the proportion patients who had adverse cutaneous reactions to COVID-19 vaccines, based on the assumption that 52% of all who receive COVID vaccinations present with adverse cutaneous reactions, as per the study of McMahon et al. (2021).[5] This was computed with a precision of + 0.10 and at 5% alpha level of significance.

Descriptive statistics were used to summarize the general and clinical characteristics of the study participants. Missing data were neither replaced nor estimated. STATA 15.0 was used for data analysis.

Results

A total of 206 respondents agreed to participate in this study. Eight (8) of them have received a different brand of COVID-19 vaccine and were excluded from this study. Of the remaining 198 participants, majority were aged between 20-29 years old (93.9%). Mean age was 26 years. There were 56 (28.2%) males, and 142 (71.7%) females. Seventy (35.4%) of the respondents received the AstraZeneca brand while 128 (64.6%) received the Sinovac brand of vaccination for both 1st and 2nd doses of vaccination (Table 1). Brands were not mixed as per protocol for consequent doses. Out of 198 respondents, the first dose of vaccination yielded a total of 8 cutaneous reactions.

Table 1. Demographic data of respondents.

	n	Frequency (%)
Age (in years)		
20-29	186	93.9%
30-39	11	5.6%
40-49	1	0.5%
Sex		
Male	56	28.2%
Female	142	71.7%
Brand of Vaccine Received		
AstraZeneca	70	35.4%
Sinovac	128	64.6%

From this total, 6 (75%) were documented with AstraZeneca while 2 (25%) were seen with Sinovac. Comparing recipients with non-reactions, 6 (8.57%) and 2 (1.56%) were noted to develop cutaneous manifestations with AstraZeneca and Sinovac, respectively. For the first dose (Table 2), reactions were characterized according to extent, size, onset, and time of resolution. All reactions were seen to be localized to the injection site at this time with variation in size of 1-2 cm (50%) and >5cm (50%). Onset of symptoms to all was seen within 2-24 hours of vaccine administration while resolution ranged from less than 24 hours (25%), 2-24 hours (50%), and within 1 week (25%).

Table 2. Cutaneous manifestations after first COVID-19 vaccination..

	Astra Zeneca (n=6)	Sinovac (n=2)
Type of cutaneous reaction		
Localized to site of injection	6 (75%)	2 (25%)
Size		
1-2 cm	4 (50%)	2 (25%)
>5cm	2 (25%)	0
Onset		
Within 2-24 hours	6 (75%)	2 (25%)
Resolution		
<24 hours	2 (25%)	0
2-24 hours	2 (25%)	2 (25%)
Within 1 week	2 (25%)	0

The cutaneous manifestations were also characterized by a range of accompanying symptoms including redness, warmth, swelling, tenderness, and itching which were not mutually exclusive amongst each other. Prolonged redness after vaccine administration was noted to be the most common associated finding. No constitutional symptoms were recorded during the first dose of vaccination (Table 3).

The second dose of vaccination yielded a total of only 4 cutaneous reactions and were only seen with the Sinovac brand. Comparing recipients with non-reactions, 4 (3.16%) were noted to develop cutaneous manifestations with the aforementioned brand. For the second dose, reactions were characterized with the same parameters. Reactions were noted to mostly be

Table 3. Associated symptoms after first COVID-19 vaccination.

	Astra Zeneca (n=6)	Sinovac (n=2)
Type of associated symptoms		
Redness	6	1
Warmth	4	0
Swelling	4	0
Tenderness	4	0
Itchiness	0	2

localized to injection site (75%), however, one (25%) patient experienced urticarial lesions extending to distant sites of the body. Onset of symptoms were mostly seen within 2-24 hours (75%) of vaccine administration with the exception of the urticarial eruption occurring within 14- 30 days (25%) of vaccination. Resolution ranged from 2-24 hours (75%) and within 1 week (25%) since symptom onset (Table 4).

Table 4 Cutaneous manifestations after second COVID-19 vaccination.

	Astra Zeneca (n=0)	Sinovac (n=4)
Type of cutaneous reaction		
Localized to site of injection	0	3 (75%)
Urticarial	0	1 (25%)
Size		
1-2 cm	0	4 (100%)
Onset 0		
Within 2-24 hours	0	3 (75%)
	Astra Zeneca (n=0)	Sinovac (n=4)
Within 14-30 days	0	1 (25%)
Resolution		
2-24 hours	0	3 (75%)
Within 1 week	0	1 (25%)

The accompanying symptoms for the second dose was limited to redness, warmth, and itching only which were still not mutually exclusive among each other. Prolonged redness and itchiness were equally the most common associated finding. No constitutional symptoms were recorded during the second dose of vaccination (Table 5).

Table 5. Associated symptoms after seconds COVID-19 vaccination.

	Astra Zeneca (n=0)	Sinovac (n=4)
Type of associated symptoms		
Redness		4
Warmth		2
Itchiness		4

Over the course of 2 doses, a total of 140 injections for AstraZeneca and 256 for Sinovac were given. Cumulatively, administration of consequent doses for both brands of COVID-19 vaccines were tallied showing a recorded frequency of cutaneous manifestations of 4.29% for AstraZeneca and 2.34% for Sinovac (Table 6).

Table 6. Cumulative incidence for both doses of COVID-19 vaccination.

	Astra Zeneca (n=140)	Sinovac (n=256)
Presence of cutaneous reaction		
With cutaneous reaction	6 (4.29%)	6 (2.34%)
Without cutaneous reaction	134 (95.71%)	250 (97.66%)

Discussion

The study aimed to determine the prevalence of cutaneous manifestations in recipients of AstraZeneca and Sinovac vaccination among healthcare workers and employees in a tertiary hospital with ready access to the abovementioned vaccines. As of May 2021, more than 1.5 billion vaccine doses have been administered worldwide and especially in the background of an ongoing epidemic, any information that could be gleaned to better understand the safety profile of these drugs are of utmost importance.[6]

Nine out of the 12 (75%) of the study participants with cutaneous manifestations were females. From this data, 4 were recipients of AstraZeneca and 5 were recipients of Sinovac vaccines. This demographic was comparable with a study by McMahon et.al with 414 unique patients with cutaneous reactions showing 90% of them were also females.[5] In the same study, 63% of patients with cutaneous adverse effects developed their symptoms after the second dose. This was followed by the first dose and both doses in terms of frequency of eruption. Interestingly, the participants of this current study showed a split result in terms of the brand of vaccine. AstraZeneca showed a higher percentage (8.57%, n=70) of cutaneous adverse effects among recipients during the first dose while Sinovac exhibited the same observation (3.16%, n=128) during the second dose. An additional finding showed that 2 participants experienced cutaneous adverse effects during both doses of Sinovac.

The cutaneous manifestations post-COVID-19 vaccination have been noted to mostly be self-limiting and transient with the appearance of non-specific rashes such as macules, papules, and urticarial lesions. However, as seen in another study, these reactions could sometimes lead to more extensive diseases such as functional angiopathies and auto-immune mediated reactions, and reactivation of viral infections.[6] Other examples include pityriasis rosea-like rash[7], herpes zoster[8], and Stevens-Johnson syndrome.[9] The findings of this current study seemed to appear in line with these larger studies showing majority of symptomatic participants experienced nonspecific and self-limiting skin problems. The most extensive of them only included one episode of generalized urticarial rash without progression of more severe signs and symptoms. Constitutional symptoms such as fever, malaise, nausea, and difficulty of breathing were all absent in all participants, regardless of the appearance of cutaneous manifestations.

As per the findings of this study, most cutaneous vaccine reactions were noted to be immediate in onset. Type 1 or immunoglobulin E-mediated allergic reactions are not often caused by viral particles constituting these vaccines. Instead, they may be the due to the excipients added to these drugs that may have inadvertently caused these hypersensitivity reactions. Examples would include polysorbate 80 found in AstraZeneca and aluminum adjuvants found in Sinovac which are ideally inert but have been suspected to cause allergic reactions to their recipients.[10]

Lastly, in balancing the need for the protection conferred by these vaccines against the potential risk of cutaneous adverse effects, the current recommendation would still be to receive administration even if with prior mild to moderate reactions.[11] Correlating with the findings of the study, the observed frequency of developing evanescent symptoms for both AstraZeneca

(4.29%) and 2.34% for Sinovac (2.34%) were quite low enough to support this stance, especially during a pandemic.

Conclusion

Adverse reactions to COVID-19 vaccinations have been documented which may be attributed to respective excipients rather than vaccine antigens due to their onset and resolution. Documented reactions in this study were observed to be mild and self-limiting similar to larger studies. Due to the rare occurrence of severe reactions, vaccine use is recommended as they confer protection even to those with prior infections or with previous mild to moderate adverse effects upon vaccine administration particularly for healthcare workers in the setting of a pandemic.

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Association between knowledge and actual practices of family member caregivers of low-income families on the prevention and control of soil-transmitted helminthiasis in an urban barangay: An analytical cross-sectional study

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Abstract

Introduction Soil-transmitted helminthiasis (STH) remains to be highly prevalent in the Philippines, despite the implementation of school-based bi-annual mass drug administration and other preventive measures under the Garantisadong Pambata Program by the Department of Health (DOH).

Methods This analytical cross-sectional study determined the association between the level of knowledge and the actual practices of family care givers in the prevention of STH among school-age children belonging to low-income families in an urban barangay.

Results Among 193 respondents, 97.93% had good level of knowledge of STH prevention and control, 83.42% had good hand hygiene practices, but only 39.90% adhered to the recommended bi-annual anti-helminthic prophylaxis for their school-aged children. A positive association was noted between level of knowledge and actual hand hygiene practices, but this was not statistically significant (i.e., prevalence odds ratio = 5.3, p = 0.129). Among those who did not comply with the bi-annual anti-helminthic administration, there was a prevalence odds ratio (POR) of 0.66 that the family care giver was knowledgeable on STH prevention and control, and this negative association was not statistically significant (i.e., p = 0.529).

Conclusion: Level of knowledge on STH prevention was positively associated with hand hygiene practices but was negatively associated with compliance with the bi-annual deworming prophylaxis. But these associations were not statistically significant.

Key words: soil-transmitted helminthiasis, hand hygiene, deworming prophylaxis

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Soil-transmitted helminth (STH) infections, commonly caused by Ascaris lumbricoides, Trichuris trichiuria, Necator americanus, and Anyclostoma duodenale, are part of the neglected tropical diseases (NTD) and are among the most common global communicable diseases that adversely plague low-income areas and the most deprived communities.[1] Infections caused by STH continue to have a major impact on the nutritional status, physical, and cognitive development of preschool-age toddlers,

school-age children[2], and women of childbearing age.[3,4]

School-age children experience the heaviest burden of disease due to their increased nutritional needs for development, and their lack of awareness of STH prevention and control. As the most vulnerable group, they function as the most important carriers and sources of transmission of STH infections.[5] Coupled with the endemicity of STH, the prevalence of STH infections is seen as of national concern.[6] Currently, the national government has initiatives to address the problem for STH infections, namely the Garantisadong Pambata Program (A.O. 36, s2010) and the Integrated Helminth Control Program by the Department of Health (DOH), including the implementation of the school-based bi-annual mass drug administration (MDA). However, despite the decade-long implementation of the programs, sub-optimal MDA coverage, limitations in water, sanitation, and hygiene (WASH), and public health education projects continue to make these public health endeavors more challenging to implement.[7,8,2]

Given the current dilemma presented by STH infections and the setbacks experienced by the government program made to address the issue, this study determined the association between the level of knowledge of family member caregivers on STH prevention and control, and the actual practice of hand hygiene and administration of anti-helminthic agents to school-age children under the *Garantisadong Pambata* Program of the DOH inan urban Barangay using an analytical cross-sectional study. This epidemiologic investigation could potentially aid in the alleviation of the STH burden in the Philippines by recognizing the relevant factors contributing to the gap in the knowledge and practice for STH prevention and control.

Methods

Study Design

Using an analytical cross-sectional study, the associations between the level of knowledge of family primary caregivers and the actual practice of STH prevention and control were assessed. The actual practice of prevention and control included hand hygiene and administration of anti-helminthic agents to school-age children. The study was approved by the Ethics Review Committee of the UERMMMCI Research Institute for Health Sciences. The researchers collected information from family member caregivers of low-income families with school-aged children in an urban barangay.

Over 267 million preschool-age toddlers and over 568 million school-age children were documented to live in areas where STH infections had been transmitted intensively.[9] School-age children have been recognized as the most vulnerable group and the most susceptible to being infected by STH nationwide, especially in areas where sanitation is poor and enhanced by poor hygiene practices, the participants were gathered from a target population in an urban barangay, composed of family member caregivers to school-age children of 6 to 12 years old. In this study, family member caregivers were defined as the individuals who were responsible for primarily taking care of the school-age child in the household. Hence, data collection, through purposive sampling, was done from July 2023 to September 2023.

Inclusion criteria for the selection of the target population covered family member caregivers of school-age children (i.e., 6 to 12 years old) who resided in an urban barangay with a household monthly income that belonged to the low-income category of PhP 10,957.00 to PhP 21,194.00.[10] Excluded from the study were the transient residents, family member caregivers who could not or did not stay with the school-age child at home, participants who showed questionable and unstable mental status, family member caregivers who refused vaccinations or other prophylactic measures and medications for their children, and family member caregivers whose children exhibited hypersensitivity reactions towards anti-helminthic agents.

The researchers developed a new data collection tool in Filipino (Tagalog), based on two previous similar studies.[11,12] The content of the said questionnaire was reviewed by experts in the fields of Medical Parasitology, Tropical Medicine, as well as Preventive, Family and Community Medicine who did preliminary face validity of the said data collection tool. In addition, the investigators performed a series of pilot-testing of the new tool, one month prior to the actual data collection. After achieving an internal consistency (i.e., Cronbach's alpha) of at least 0.80 on all the variables used in the questionnaire, the researchers proceeded with the actual data collection.

The knowledge and practices of family member caregivers towards STH were studied using a structured questionnaire containing thirty-five (35) questions categorized into four (4) headings. The number of questions per heading was as follows: four (4) questions under *Demographic Profile*; eleven (11) questions under *Knowledge on Prevention and Control of Soil-Transmitted Helminthiasis*; fifteen (15) questions under *Practices on Prevention and Control of Soil-Transmitted Helminthiasis: Hand Hygiene*; one (1) question under *Practices on Prevention and Control of Soil-Transmitted Helminthiasis: Deworming*, and four (4) questions on *Other Practices on the Prevention and Control of Soil-Transmitted Helminthiasis*.

The researchers selected respondents using purposive sampling through a house-to-house circumnavigation of the *barangay* with the assistance of the volunteer *barangay* health workers.

The target population was 184 respondents, but the principal investigators were able to gather a total of 223 responses. The questionnaires were examined based on the completeness and reliability of data, and after careful screening, only 193 responses were accepted for encoding.

Demographic information, knowledge, and practices results were the subjects of the descriptive analyses. The knowledge score was defined as the percentage of correct responses. Scores ≥ 80% were considered "good," while scores below 80% were considered "poor."[13]

Practices for hand hygiene were measured using an ordinal scale in Filipino which were designated with a score of 1, 2, 3, and 4, respectively. The percentages of the scores per respondent were determined. "Good hand hygiene practice" was defined to be those who scored above the median value (96%) while "poor hand hygiene practice" was those who scored below.[12]

Adherence to the administration of anti-helminthic agents was assessed by determining the number of times the school-age child underwent anti-helminthic administration in the past year. Responses were classified as "good compliance" if their child was able to adhere to the recommended bi-annual administration, while responses stating that their child was administered only once or not at all were classified as "poor compliance."[12]

For statistical analysis, the IBM Statistical Package for Social Sciences (SPSS) Statistics version 29.0.1.0 (171) software was utilized. Pearson chi-square test was applied to determine the one-tailed p-value between the variables (p-value < 0.05). The prevalence odds ratio (POR) was used for the factors influencing knowledge and practices.

Results

Demographics

A total of 193 participants participated in the study and their socio-demographic profile had been summarized in Table 1. The majority of surveyed participants (35.80%) were between the ages of 31 and 40 years old. It also showed a significant gender imbalance, with 87% of study participants being female and 13% being male.

Table 1. Characteristics of study participants (N=193).

Characteristics	Frequency	Percentage (%)
Age (years)		
21-30	44	22.80
31-40	69	35.80
41-50	39	20.20
51-60	28	14.50
61 pataas	13	6.70
Sex		
Female	168	87.00
Male	25	13.00
Educational Attainment		
No Formal Education	2	1.00
Elementary Level / Graduate	20	10.40
Secondary Level / Graduate	76	39.40
Vocational Course	16	8.30
Tertiary Level / Graduate	46	23.80
Graduate School	26	13.50
Incomplete Education	7	3.60
Civil Status		
Single*	90	46.60
Married	85	44.00
Separated / Annulled	9	4.70
Widowed	9	4.70

*with or without a live-in partner

Assessment of Knowledge on the Prevention and Control of Soil-Transmitted Helminthiasis

A total of 189 (97.93%) study participants garnered a score ≥80%, whereas only four (2.07%) study participants scored <80%, with the lowest score of 59.09%.

Assessment of Actual Practices of Hand Hygiene

It was identified that 161 (83.42%) of the study participants alleged "good hand hygiene practices," while 32 (16.58%) of the study participants reported "poor hand hygiene practices."

Frequency of Anti-Helminthic Administration

A total of 77 (39.90%) completed the two-dose anti-helminthic prophylaxis, while 89 (46.10%) study participants answered that their school-age children received a single dose of the anti-helminthic prophylaxis. Lastly, 27 (14.00%) reported that their school-age child had not received any anti-helminthic prophylaxis. Only 77 (39.90%) were classified as having "good compliance", while 116 (60.10%) were designated as having "poor compliance".

Association Between Knowledge and Practices

The association between knowledge and hand hygiene practices, as determined by the prevalence odds ratio (POR) of 5.3 (p = 0.129), suggested a positive association but was not statistically significant (Table 2). On the other hand, the association between knowledge and anti-helminthic administration (i.e., POR = 0.66, p = 0.529) revealed a negative association that was also not statistically significant (Table 3).

Discussion

In the Philippines, STH is one of the NTDs of public health concern. Various government programs have been established to combat the spread of the infection, such as the DOH's Garantisadong Pambata Program which has STH prevention as one of its agenda.[15] As children are dependent on their caretakers to provide assistance and guidance regarding their health, it is imperative that these family-member caregivers have adequate knowledge of common diseases, such as STH, and practices on how to prevent them. This comprehensive program covered integration of essential services that encompassed health, nutrition, and environmental sanitation with particular emphasis on the provision of micronutrient supplementation, such as vitamin A and iron for young children.[14,15] Under the program, health centers would continuously provide health care services for children daily and promote health behaviors that could be practiced at home, in school, in daycare centers, and in other settings where children are.[16] The strategy implemented by DOH in controlling STH infections in the Philippines included the implementation of a school-based bi-annual mass drug administration (MDA) with Albendazole or Mebendazole.[4] This program would be conducted mostly in public

Table 2: Association between level of knowledge and hand hygiene practices using POR.

	Good Hand Hygiene Practice	Poor Hand Hygiene Practice	POR, p value
Good Level of Knowledge	159	30	5.3 (p-value=0.129)
Poor Level of Knowledge	2	2	

Table 3. Association between level of knowledge and compliance to anti-helminthic administration using POR.

	Good Compliance	Poor Compliance	POR, p value
Good Level of Knowledge	75	114	0.66 (p-value=0.529)
Poor Level of Knowledge	2	2	

schools led by teachers under the supervision of healthcare workers. The DOH collaborated with the Department of Education (DepEd) to help target the most vulnerable group (i.e., school-age children) in the most cost-effective way. The program was based on the principle of preventive chemotherapy (PC) that focused on the integrated use of broad-spectrum drugs.[5] Aside from the implementation of MDA, the water, sanitation, and hygiene (WASH) program was also being taught in schools.[7] Between handwashing and deworming, the latter remained to be the better determinant for STH prevention and control as it was both a preventive and treatment measure beneficial to the most vulnerable group.[6,7]

Demographics

The study participants belonged to low-income families. STH infections were observed to be highly endemic among low-income communities due to limited access to safe potable water supply, inadequate sanitary facilities, and lack of knowledge on desired health behaviors.[7]

In this study, most of the family member caregivers who participated showed an educational attainment of secondary education (39.4%). In another epidemiologic investigation conducted in the Philippines, a lower level of educational attainment was found to be among the risk factors for human helminthiasis infections, specifically more likely among individuals with an elementary, high school, or vocational degree.[17]

Since some of the strategies implemented by the DOH in controlling STH infections in school-age children in the Philippines involved school-based bi-annual MDA and WASH program, the demographic characteristics of primary caregivers in our chosen community had little effect on the administration of STH control procedures on school-age children.

Assessment of Knowledge

This epidemiologic investigation revealed that the majority of the study participants (97.93%), demonstrated a good understanding of the subject, and effectively applied their knowledge on the questionnaire. These results were aligned with a prior study held in Guimaras, Philippines where the parents and teachers demonstrated adequate knowledge about STH control (93.7% and 98.7% respectively).[8] However, in comparison to a study in Ibadan, Southwestern Nigeria, 66.8% of the respondents have inadequate knowledge about prevention of STH transmission.[18] It was highlighted in that study that education campaigns should address misconceptions to decrease barriers to treatment and improve adherence to public health recommendations of MDA.[19]

Assessment of Hand Hygiene Practices

Proper hand hygiene practices have always been advocated to prevent the occurrence and transmission of several known diseases. In a study conducted in the district of Cumilla in Bangladesh, a significant portion of children failed to exhibit good practices against STH e.g., children not washing their hands with soap after defecation (64.8%), drinking from a deep tube well-water (91.1%), and not washing fruits before eating (43.7%).[20]

The previous study mentioned contrasts with the current study where it showed that the majority of the study participants (83.42%) adhered to good hand hygiene practices for the prevention of STH. Nonetheless, further intervention is necessary to improve the practices of respondents who exhibited poor hand hygiene. DOH implemented the expanded *Garantisadong Pambata* Program and incorporated WASH to improve hand hygiene to reduce STH burden in vulnerable groups. This followed the directive of the WHO in that achieving STH control was influenced by practices in water, sanitation, and hygiene (WASH).[2]

Administration of Anti-Helminthics

On the administration of anti-helminthics, the Garantisadong Pambata Program of the DOH requires that school-age children undergo deworming twice a year.[14] However, the results of the study showed that only 39.9% of the study participants complied with the bi-annual administration of anti-helminthics which showed poor compliance with the guidelines released in the *Garantisadong Pambata* Program of DOH.

In comparison to the national percentage of compliance to deworming, as of 2019, only 60% and 59% of preschool-age toddlers and school-age children, respectively, had undergone full deworming

compliance. The present study's finding was still much lower than the national average, which was also much lower than the 80% required coverage by WHO.[2] However, it was also possible that the multiple controversies surrounding the use of anti-helminthics over the years and the COVID-19 pandemic might have played a role in the decreased compliance for deworming. As of 2020, the deworming strategy was moved from school-based administration to house-to-house visits for the deworming of children aged up to 18 years old due to the COVID-19 restrictions posed by DOH.[2]

Association of Knowledge and Hand Hygiene Practices

A study conducted in Bangladesh discovered that 81.5% held misconceptions about helminthiasis. The majority of the respondents were unaware of how STH could be transmitted via contaminated soil and unhygienic practices; as a result, their children were not participating in hygienic practices.[20] These findings would run contrary to this present investigation's findings, wherein a positive association between the level of knowledge on STH and hand hygiene practices, was seen such that study participants who practice proper hand hygiene were the ones who had higher level of knowledge. However, the association between the two variables was statistically insignificant.

Association of Knowledge and Anti-Helminthic Administration

In a Nigerian study, results showed that poor specific knowledge of the risks and burden of the infection resulted in poor coverage of periodic deworming for STH infections in preschool-age. There was a difference in the accurate knowledge of deworming frequency between mothers who periodically dewormed their pre-school-age children and those who did not (i.e., adjusted OR = 0.41, 95% CI: 0.18–0.90, p = 0.026).[19] The results of the Nigerian study varied with the findings of this current epidemiologic investigation (i.e., POR = 0.67, p = 0.529), such that even though the family caregivers had a high level of knowledge regarding STH prevention, there was still poor compliance on anti-helminthic administration. Poor compliance was shown to be associated with several predictors. One study concluded that it was not only ignorance that contributed to poor compliance, but also the lack of concern about parasitic infection among the primary caregivers and their untoward effects on children's health.[20]

In adherence to the latest program encompassing children aged up to 14 years old, the barangay health center had not yet devised a method for procuring data on whether children beyond the age range of 0-59 months would have access to healthcare services. The center was still adopting health practices pertinent to STH prevention. The findings indicated a need to enhance the involvement of the *barangay* and families in curbing STH infection, which could entail conducting needs for administering anti-helminthic treatment. This would serve as an educational tool not only for *barangay* health workers and residents, but also for individuals who were accountable for their families' well-being.

The current statistics of the chosen community for STH prevalence and prevention (i.e., bi-annual administration of anti-helminthics) had yet to be completed at the time of the study. Furthermore, the shift of strategy of MDA to house-to-house visits led to the lack of epidemiological information of schools on the subject matter.

The lack of statistical significance of the associations between variables led to the inability to generalize the results to other communities in the Philippines. One factor would include socioeconomic status which could affect the level of knowledge and practice of each community. In the National Capital Region (Metro Manila) in which the study was conducted, the socio-economic status was different, as compared to other cities outside of it in which there were less employment opportunities.[21] This difference might lead to diverse results in terms of knowledge and practice.

Conclusion

Based on the results, a high level of knowledge of family care-givers on STH prevention and control was positively associated with good hand hygiene among children, but negatively associated with administration of bi-annual anti-helminthic prophylaxis. However, neither associations were statistically significant.

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Assessing the impact of cognitive competencies on the success in physician licensure examination: a case-control study*

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Abstract

Introduction In the realm of education and professional licensure, the assessment of individuals' competencies is pivotal in determining eligibility for entry into various fields of practice. Medical school assessments encompass cognitive and non-cognitive measures. The Philippines' Physician Licensure Examination (PLE) relies solely on cognitive assessment. This study explored the predictive power of cognitive assessment in the passing the Physician Licensure Examinations.

Methods A case-control study design was done. Cognitive examination grade was defined as the average cumulative grade of written examinations in specific subjects, while the dependent variable was PLE scores.

Results The study revealed a positive association between failing written examinations and failing the Physician Licensure Examination. In all subjects, there is an observed association, but only Pharmacology reached statistical significance (OR: 2.30 CI:1.01,5.24). For the remaining subjects, although there is an association, it did not reach statistical significance (Biochemistry OR:1.42, CI: 0.43, 4.72; Medicine 3 OR:1.56, CI: 0.81, 3.0; Surgery 3 OR:1.28 CI: 0.63, 2.58). There was no association seen between failing the written examination and failing the PLE in Obstetrics (OR:0.98 CI: 0.47, 2.03). Furthermore, there was a weak positive correlation (0.18-0.31) between written examination grades and corresponding board exam subject grades for all subjects, highlighting the importance of cognitive assessments in predicting success. The research also found a statistically significant difference in PLE grades between those who failed the written examinations and those who passed.

Conclusion These findings emphasized the crucial role of cognitive assessments in predicting success in the PLE and its associated board subjects. The study underscored the need for medical institutions to focus on strengthening cognitive competencies and to align the content and rigor of written examinations with the PLE. Addressing these issues would better prepare students for the licensure examination and enhance the quality of healthcare professionals entering the workforce. The results may contribute to the ongoing discussion on the effectiveness of assessment methods in medical education and licensure examinations.

Key words: Cognitive assessment, physician licensure examination, correlation, association, case-control

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In the realm of education and professional licensure, the assessment of individuals' competencies is pivotal in determining eligibility for entry into various fields of practice. National licensure examinations, which serve as gatekeepers to professions ranging from medicine and law to teaching and engineering, are designed to evaluate a candidate's readiness

and competence. The successful prediction of an individual's performance on these examinations is of immense importance, not only to the candidates themselves but also to the institutions responsible for conducting the assessments and the professions they serve.[1,2,3]

Medical school assessments can be classified into cognitive and non-cognitive measures. Cognitive measures include Grade Point Average (GPA), Medical College Admission Test (MCAT) scores, and other traditional academic indicators of knowledge and intellectual abilities. Non-cognitive measures, on the other hand, focus on attributes such as communication skills, problem-solving abilities, professionalism, and interpersonal skills.[4] The relationship between these assessment types and success on national licensure examinations has been examined. Research has indicated that both cognitive and non-cognitive assessments are important predictors of success on national licensure examinations in medical school.[5,6,7,8]

The PLE in the Philippines, however, is solely based on cognitive assessment as in other parts of the world (US, UK and Australia).[9,10,11] The academic competence of medical students, however, is assessed based on both cognitive and non-cognitive assessments.[12] With the addition of the non-cognitive domain, the cognitive adequacy of the students may be overestimated leading to their passing of the academic curriculum but, subsequently, failing the board examination. This study aimed to investigate whether cognitive assessment, represented by written examination grades, could predict success in the PLE. This emphasized the need for the medical school to fortify the cognitive preparations of the students and take full responsibility for assessing the non-cognitive domain of education.

Methods

After receiving approval from the UERMMMC Ethics Review Committee, a case-control study design was done to explore the relationship between cognitive assessment and success in the PLE. Cognitive examination grade was defined as the average cumulative grade of written examinations in specific subjects. The dependent variable was the scores in selected PLE subjects, while the independent variable was the cumulative grade in written examinations during the academic years. Data from students who took the PLE from March 2021 to October 2022 were collected, including their long examination grades. Cases were identified as those who passed the PLE and controls were those who failed the physician licensure examination.

Using convenience sampling, the authors identified 75 students who failed and 75 students who passed the PLE from March 2021 to October 2022. The minimum required sample size is 77 based on the computation of sample size for a correlational study with a 0.05 type 1 error rate and 0.80 type 2 error rate and a correlation of 0.3150 based on a preliminary study conducted to determine sample size.[13] The data on the academic grades were obtained from the different departments. The names of the students were given to the chair and the average grades for the written examinations were asked.

Odds ratio with 95% confidence interval was determined for the following: association of failing the written examinations with passing the PLE; association of failing the written examinations with failing the corresponding board exam subjects. The chi-square test or Fisher exact test was used as appropriate to determine statistical significance. A p-value of <0.05 was deemed statistically significant. Pearson's correlation was used to determine the magnitude of the correlation between the written examination grades and the corresponding grades in the board exam subjects. Independent T-test was used to determine statistically significant difference in the PLE scores of those who passed versus those who failed the written examinations.

Results

The study identified a statistically significant positive correlation between failing written examinations and failing the PLE. While an association was observed across all subjects, only Pharmacology demonstrated statistical significance (OR: 2.30, 95% CI: 1.01-5.24). For other subjects, although an association was noted, it did not reach statistical significance (Biochemistry OR: 1.42, 95% CI: 0.43-4.72; Medicine OR: 1.56, 95% CI: 0.81-3.0; Surgery OR: 1.28, 95% CI: 0.63-2.58). No association was found between failing the written examination and failing the games in Obstetrics (OR: 0.98, 95% CI: 0.47-2.03) (Table 1).

In Table 2, there is a statistically significant positive association between those who failed the written examination and those who failed the corresponding board subjects for Biochemistry (OR 5.5 ,CI: 1.10, Pharmacology OR: 2.44 CI: 1.07,5.54 and OB OR: 2.58, CI: 1.22, 5.47)); . For the remaining

Table 1. Association of written exams to failing PLE.

	Failed PLE	Passed PLE	OR (95% CI)	p value
Biochemistry			1.42	0.56
Failed Written Exam	27	19	0.43 to 4.72	
Passed Written Exam	7	7		
Total	34	26		
Pharmacology				
Failed Written Exam	40	32	2.31	0.04
Passed Written Exam	13	24	1.02 to 5.24	
Total	53	55		
Medicine Year 3				
Failed Written Exam	39	30	1.56	0.18
Passed Written Exam	35	42	0.81 to 3.00	
Total	74	72		
Surgery Year 3				
Failed Written Exam	29	26	1.28	0.49
Passed Written Exam	34	39	0.63 to 2.58	
Total	63	65		
Obstetrics Year 2				
Failed Written Exam	20	20	0.98	0.96
Passed Written Exam	53	52	0.47 to 2.03	
	73	72		

Table 2. Association of failing written exam to failing corresponding board exam subjects.

	Failed corresponding board subjects	Passed corresponding board subjects	OR (95% CI)	p value
Biochemistry				0.03
Failed	22	24	5.50	
Passed	2	12	(1.10 to 27.37)	
Pharmacology				0.03
Failed	41	31	2.44	
Passed	13	24	(1.07 to 5.54)	
Medicine				
Failed	33	36	1.70	0.12
Passed	27	50	(0.87 to 3.30)	
Surgery				0.05
Failed	29	26	2.02	
Passed	27	49	(0.99 to 4.10)	
Obstetrics				0.01
Failed	21	18	2.58	
Passed	33	73	(1.22 to 5.47)	

subjects, although there is an association, it did not reach statistical significance (Medicine 3 OR: 1.70, CI:0.87, 3.30 and Surgery 3 OR: 2.02, CI: 0.99, 4.11)

There is a statistically significant weak positive correlation between the written examination grades and the corresponding board exam subject grades for all subjects (Table 3).

There is a statistically significant difference in the PLE grades of those who failed the written examinations versus those who passed the written examinations. The mean difference ranges from 2.5 to as high as 6 points. On the average, those who failed their written examinations also failed their PLE and those who passed their written examinations also passed their PLE (Table 4).

In Table 5, the optimal cut off scores to ensure passing the PLE were: a general weighted average of 2.96, an NMAT score of 87 and a passing grade for each subject. To ensure passing the specific subjects, the optimal cut off score was at least 75 (Table 6).

Table 3. Correlation of written grade per subject to corresponding board exam subjects results.

Subject	Pearson's r	95% CI	p value
Biochemistry Year 1	0.3150	0.07 to 0.52	0.01
Pharmacology Year 2	0.3025	0.12 to 0.46	0.001
Medicine Year 3	0.2627	0.10 to 0.40	0.001
Surgery Year 3	0.2155	0.04 to 0.37	0.01
Obstetrics Year 3	0.1863	0.02 to 0.33	0.02

Table 4. Comparison of the mean score in the corresponding subjects in the Board exams of those who failed and passed their subjects.

	PLE grade of those who failed the written exams	PLE grade of those who passed the written Exams	Difference	p value
Biochemistry Year 1	72.15 ± 8.44	78.21 ± 5.686	6.06 ± 2.41	0.01
Pharmacology Year 2	71.15 ± 7.88	75.68 ± 6.66	4.52 ± 1.51	0.003
Medicine Year 3	71.97 ± 7.63	74.51 ± 5.64	2.54 ± 1.10	0.02
Surgery Year 3	71.44 ± 7.83	74.43 ± 6.14	2.99 ± 1.22	0.01
Obstetrics Year 3	72.30 ± 7.26	75.41 ± 5.14	3.110 ± 1.08	0.004
Overall	71.73 ± 7.78	75.10 ± 5.76	3.370 ± 0.56	<0.0001

Table 5. ROC curve analysis of optimal cut off for passing board exams.

Subject	Optimal cut off score	Sensitivity	Specificity
GWA (medicine)	2.96	0.96 (0.89 to 0.99)	0.19 (0.10 to 0.29)
NMAT	87.00	0.51 (0.39 to 0.62)	0.73 (0.61 to 0.83)
Biochemistry	75.64	0.38 (0.20 to 0.59)	0.76 (0.59 to 0.89)
Pharmacology	75.16	0.625 (0.48 to 0.75)	0.60 (0.46 to 0.73)
Medicine	75.71	0.56 (0.43 to 0.67	0.64 (0.51 to 0.74
Surgery	75.53	0.71 (0.58 to 0.81)	0.43 (0.30 to 0.56)
Obstetrics	75.68	0.25 (0.16 to 0.37)	0.82 (0.71to 0.90)

Table 6. ROC Curve analysis of optimal cut off for passing corresponding board exam subjects.

Subject	Optimal cut off score	Sensitivity	Specificity
Biochemistry	75.06	0.75 (0.58 to 0.88)	0.58 (0.37 to 0.78)
Pharmacology	75.55	0.73 (0.39 to 0.86)	0.72 (0.58 to 0.83)
Medicine	75.7	0.76 (0.45 to 0.86)	0.67 (0.53 to 0.78)
Surgery	75.04	0.65 (0.53 to 0.76)	0.57 (0.43to 0.70)
Obstetrics	75.29	0.75 (0.64 to 0.83)	0.46 (0.32to 0.60)

Discussion

The results of this study provided valuable insights into the relationship between cognitive assessments, specifically written examination grades, and success in the PLE as well as its impact on corresponding board exam subjects. These findings may have significant implications for medical education and the predictive power of cognitive assessments.

The grading system of the medical school consisted of cognitive assessment composed mainly of written examinations and non-cognitive assessments composed of grades on clinical preceptor sessions, peer evaluations, manual submissions and others.[14] There were some students who did not pass any single written examination but were able to pass the subjects because of the non-cognitive assessments. This research determined if the students who passed the subjects because of the non-cognitive assessments despite failing the written examination would pass the PLE.

Association Between Failing Written Examinations and PLE Success

The research identified a statistically significant positive association between those who failed the written examination, and those who subsequently failed the PLE. This finding underscores the importance of cognitive assessments in predicting PLE outcomes and the need for a strong foundation in these subjects. Moreover, there was a significant positive moderate relationship between academic performance and licensure performance. Similar studies showed that students who have good academic grades passed and attained a higher rating in the PLE.[15,16]

Association of Failing Written Examinations with Corresponding Board Subjects

The study also revealed a significant positive association between failing the written examination and failing the corresponding board exam subjects like Biochemistry, Pharmacology, Surgery, and Obstetrics. For instance, graduates who failed the Biochemistry exam in the PLE were 5.5 times as likely to have failed the written examin Biochemistry during their medical course. These results highlighted the strong predictive power of cognitive assessments in determining performance in both written exams and board subjects.[16]

Correlation Between Written Examination Grades and Board Examination Subject Grades

The data showed a statistically significant weak positive correlation between written examination grades and the corresponding board examination subject grades for all subjects studied. The higher the examination grades, the higher the corresponding board examination subject grades. This correlation suggests that students who perform well in written examinations tend to excel in the corresponding board subjects, emphasizing the role of cognitive assessments as a predictor of success. A similar study for nursing students showed that all six subjects in the board examination were significantly correlated with academic performance in the individual subjects. The Academic Performance significantly predicted the Licensure Performance. This direct relationship implied that when academic performance was high, board rating also was high.[17,18]

Difference in PLE Grades

The research uncovered a statistically significant difference in PLE grades between those who failed the written examinations and those who passed. The mean differences ranged from 2.5 to as high as 6 points. Moreover, students who failed their written examinations also failed their PLE, while those who passed their written examinations also passed their PLE. This finding reinforces the strong link between performance in written assessments and overall success in the PLE.

These findings have important implications for medical education and assessment practices. It highlights the necessity of focusing on cognitive competencies, and the need for early intervention and targeted support for students who struggle in these areas. These results should prompt medical educators to consider assessing whether students who failed the written examination should be permitted to pass the subjects based on their non-cognitive assessments, which may have elevated their overall grades. Additionally, these results emphasize the importance of aligning the content and rigor of written examinations with the content of the PLE, thereby ensuring that students are adequately prepared for the licensure examination.

Conclusion

In conclusion, the study's results underscored the pivotal role of cognitive assessments in predicting success in the PLE and its associated board subjects. By recognizing the significance of cognitive competencies in medical education and licensure, educational institutions can develop strategies to enhance student performance and, ultimately, the quality of healthcare professionals entering the workforce. These findings may contribute to the ongoing discussion on the effectiveness of assessment methods in medical education and licensure examinations. They may also guide medical schools in enhancing their cognitive preparations for students and in comprehensively assessing non-cognitive domains to better prepare future medical professionals. The weighting of non-cognitive assessments in the overall grade should be carefully considered. While they provide valuable information, they should not overshadow the importance of cognitive assessments which play a significant role in passing the licensure examination as shown in this study.

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Student performance in year 1 undergraduate medical education during traditional, emergency online, online and HyFlex teaching strategy: a single center study*

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Abstract

Background The global pandemic caused by COVID-19, the subsequent improvement in health situation caused by anti- COVID-19 vaccination and the developments in digital technology prompted changes in undergraduate medical education as to content delivery and assessment. This study determined the difference in the performance of first year medical students in traditional face-to face, online and Hyflex teaching strategy.

Methods A non-concurrent cohort study was done to determine the performance of students in three annual subjects in Year 1 undergraduate medical education for school years 2018 to 2023. One-way ANOVA at p=0.001 determined significance of differences of variables.

Results There was no difference in the profile of students as to their sex, pre-medicine course and scores in the National Medical Admission Test (NMAT). The performance in the written examinations in Anatomy and Physiology showed significant difference (p=0.001) when the conduct of examinations was shifted online on an emergency basis. There was no difference (p=0.001) in performance in the laboratory conference sessions in Physiology, as compared to the focused group discussion sessions in Biochemistry and practical examinations in Anatomy.

Conclusion Significant difference in the performance of first year medical students was observed only during the emergency shift to online examinations, otherwise the performance was similar in traditional face-to face, online and Hyflex teaching strategy.

Key words: student performance, assessment, Year 1 undergraduate medical education, traditional face-to-face teaching, online teaching, Hyflex teaching

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The global pandemic caused by COVID-19 last 2020 forced educators to re-think their teaching-learning activities to ensure continuity of formal learning in educational institutions. Delivering content and performing student assessment online provided a viable alternative to ensure the health and safety of teachers and students alike according to study done on medical students.[1] While technology supported the rapid adaptation of educational institutions to shift to online methods of teaching and assessment, new challenges arose in undergraduate

medical institutions in the US and Spain.[2,3] These include issues on integrity of online examinations even with visual proctoring according to a study on medical students.[4]

The improved health situation brought by population wide anti-COVID19 vaccinations and developments in technology as applied to teaching-learning activities encouraged medical educators to forge onwards with a hybrid flexible (HyFlex) teaching strategy. A HyFlex teaching model refers to an instructional approach that combines face-to-face instruction with online synchronous or asynchronous content delivery, thus providing multiple ways to deliver content and interact with students.[5,6,7] There have been studies on the effectiveness of various strategies of teaching namely, traditional face to face, online, and HyFlex among medical students.[7,8] Differences of opinions, however, were found among studies regarding student performance in assessment though there are studies which saw no significant difference between face to face and online teaching in undergraduate medical courses like Anatomy and Physiology among medical students in studies done abroad.[3,9,10]

To date, there is paucity of local studies exploring the difference on student performance with traditional face to face, online and HyFlex teaching and their respective assessments. Hence, this study was conducted to determine the differences of first year students' performance in a medical school in the National Capital Region with regard to face to face, online and HyFlex or blended teaching and assessment. It was hypothesized that the performance of 1st year medical students was comparable whether the teaching strategy is traditional face-to- face, online and HyFlex. The aim of this study was to determine the difference in the performance of first year medical students in traditional face-to face, online and Hyflex or blended teaching strategy, with the following specific objectives:

1. to determine the profile of first year medical students in an academic medical institution in the NCR for the School Years 2018-19, 2019-20, 2020-21, 2021-22 and 2022-23, as to:
   A. gender distribution
   B. undergraduate/ pre -medicine course
   C. scores in the National Medical Admission Test (NMAT)
2. to compare the scores (Mean, standard deviation) in the long examinations in the annual subjects (Anatomy, Biochemistry, Physiology) and other assessment methods unique to the subject/ course in the second semester of Year 1 in the College of Medicine of the aforementioned school years.

Methods

A non-concurrent cohort study was done. This study was approved by the ethics committees of the academic medical center. The demographic profile of students was obtained as to gender, undergraduate course (health vs non health science), and scores in the National Medical Admission Test (NMAT).

The performance of first year medical students in the different assessment methods (written examinations) in the three annual subjects namely Anatomy, Physiology and Biochemistry, practical examinations in Anatomy, laboratory conference sessions in Physiology and focused group discussion sessions in Biochemistry were compared during the same period (2nd semester) when traditional on campus teaching methods were utilized pre-pandemic, during the shift to online teaching, and utilizing HyFlex teaching methods (Table 1).

Results

Table 2 shows the profile of the students enrolled to the College of Medicine program. Through the school years included in this study, the National Medical Admission Test (NMAT) mean scores which ranged from 82-89th percentile did not differ significantly between males and females. Females (average=66%) numbered more than the males consistently.

Table 3 shows that majority (92%) of students enrolled to the College of Medicine Program were students with science pre-medicine programs.

Table 4 shows the performance of students in the long examinations in the three annual subjects for the school years 2018-2022. It shows a significant difference in the mean scores for the school year 2019-2020 when the examinations were shifted on emergency remote examination platforms instead of face-to-face conduct of exams. The scores were significantly higher compared to the other school years. The subsequent school years 2020 and 2021 were still conducted online but had visual proctoring by Zoom which ia a video conferencing platform that allows users to conduct virtual meetings, webinars, and online events.

Table 1. Teaching and assessment methods, 2nd semester, school years (SY) 2018 – 2022.

School Year	Teaching Methods	Assessment Methods
2018-2019	Face to face, on campus	Face to face, on campus
2019- 2020	Face to face, on campus (1st half of semester) then shifted to online (2nd half of semester)	Face-to face, on campus Online, no visual proctoring
2020-2021	Online (synchronous and asynchronous)	Online, with visual proctoring
2021- 2022	Online (synchronous and asynchronous)	Online, with visual proctoring
2022- 2023	Online (synchronous and asynchronous) and face-to- face	Online, with visual proctoring and face- to- face

Table 2. Demographic profile of year 1 medical students, school years (SY) 2018- 2022.

School Year	Male Number (%)	Female Number (%)	NMAT Mean± sd Male	NMAT Mean± sd Male	p value
2018-2019	174 (35)	326 (65)	88.39 ± 6.98	87.85 ± 7.08	0.888
2019-2020	151 (32)	317 (68)	89.59 ± 7.77	88.72 ± 6.81	0.022
2020-2021	145 (35)	270 (65)	84.84 ± 12.19	84.83 ± 10.85	0.311
2021-2022	88 (33)	175 (67)	85.74 ± 9.07	82.03 ± 10.74	0.843
2022-2023	155 (35)	291 (65)	82.1 ± 8.20	80.71 ± 8.09	0.68

Table 3. Demographic profile of Year 1 medical students according to pre-medicine courses categorized as science and non-science courses for school years (SY) 2018- 2022.

School Year	Pre-Med Course	
	Science Number of students (%)	Non-Science Number of students (%)
2018-2019	470 (92)	40 (8)
2019-2020	433 (93)	35 (7)
2020-2021	376 (91)	39 (9)
2021-2022	240 (91)	23 (9)
2022-2023	410 (92)	36 (8)

Table 4. Student performance in the long examinations, 2nd semester, school years (SY) 2018 – 2022.

School Year	Anatomy (Mean+sd	Biochemistry (Mean ±sd)	Physiology (Mean ±sd)
2018-2019	76.43 ± 8.00	77.76 ± 9.28	78.25 ± 9.81
2019-2020	85.55 ± 8.56	78.01 ± 4.66	86.55 ± 5.00
2020-2021	77.8 ± 9.38	74.18 ± 5.77	80.76 ± 6.95
2021-2022	74.72 ± 8.77	74.08 ± 4.92	79.83 ± 6.22
2022-2023	76.11 ± 8.67	76.61 ± 5.60	77.62 ± 6.42

One- way ANOVA P value <.001

Table 5 shows the performance of students in the final examinations in the three annual subjects for the school years 2018-2022. Similar to table 4, it shows a significant difference in the mean scores for the school year 2019 when the examinations were shifted to emergency remote examination platforms instead of face-to-face conduct of examinations. The students obtained higher scores them in the other school years. The subsequent school years 2020 and 2021 were still conducted online but had visual proctoring by Zoom.

Table 6 shows the performance of students in the practical examinations in Anatomy for the school years 2018-2022. It shows a significant difference in the mean scores for the school year 2020-2021 when these examinations were conducted online with visual proctoring by Zoom. The scores were higher compared to the other school years.

Table 7 shows the performance of students in the focused group discussion sessions in Biochemistry for the school years 2018-2022. It shows a significant difference in the mean scores for the school years 2019 and 2020 and 2022 when the learning activity was conducted online. Interestingly, in school year 2021, the mean scores remained significantly different from the other school years (2019, 2020, and 2022) even if the venue remained online.

Table 8 shows the performance of students in the Laboratory Conference sessions in Physiology for the school years 2018-2022. It shows a significant difference in the mean of scores for the school year 2019 when the sessions were shifted to an emergency online venue. The students got higher grades compared to the other school years. The subsequent school years 2020 and 2021 were still conducted online using discussion board of the learning management system of the university (Canvas) or via Zoom.

Table 5. Student performance in final examinations, 2nd semester, school years (SY) 2018 – 2022.

School Year	Anatomy (Mean+sd	Biochemistry (Mean ±sd)	Physiology (Mean ±sd)
2018-2019	77.31 ± 6.19	74.03 ± 5.41	78.25 ± 9.81
2019-2020	82.37 ± 5.61	80.49 ± 5.63	86.55 ± 5.00
2020-2021	75.54 ± 8.22	74.52 ± 5.02	80.76 ± 6.95
2021-2022	75.42 ± 7.27	76.29 ± 5.20 7	9.83 ± 6.22
2022-2023	76.15 ± 7.00	76.53 ± 5.07	81.07 ± 6.42

One- way ANOVA p value <.001

Table 6. Student performance in anatomy practical examinations, 2nd semester, school years (SY) 2018 – 2022.

School Year	Number	Mean ± sd
2018-2019	490	78.37 ± 8.18
2019-2020	446	76.46 ± 9.66
2020-2021	376	88.25 ± 6.33
2021-2022	235	79.67 ± 11.94
2022-2023	382	78.34 ± 8.70
Total	1929	80.01 ± 9.80

One way anova p value <.001

Table 7. Student performance in biochemistry focused group discussions (FGD), 2nd semester, school years (SY) 2018 – 2022.

School Year	Number	Mean ± SD
2018-2019	448	76.29 ± 12.34
2019-2020	446	97.73 ± 2.63
2020-2021	371	96.73 ± 3.27
2021-2022	188	86.29 ± 6.17
2022-2023	379	96.54 ± 1.54
Total	1832	90.86 ± 11.16

One way anova p value <.001

Table 8. Student performance in physiology laboratory conference, 2nd semester, school years (SY) 2018 – 2022.

Physiology, Lab conference, 2nd Semester, SY 2018-22		
School Year	Number	Mean ± sd
2018-2019	320	71.81 ± 3.86
2019-2020	442	82.39 ± 6.50
2020-2021	395	76.79 ± 9.78
2021-2022	199	70.12 ± 11.71
2022-2023	435	74.03 ± 12.47
Total	1791	75.87 ± 10.25

One way anova p value <.001

Discussion

To manage the far-reaching restrictions on social and professional life brought upon us by the COVID-19 pandemic that affected societies globally, medical schools had to restructure their curriculum by switching to online learning.[1] Online learning meant that content delivery, student interaction and assessment have changed, therefore, the recognition that not only content but student engagement and supportive environment for both students and teachers are essential requirements in the context of an online undergraduate medicine teaching program as seen in previous studies.[5,7] While the challenges were multifaceted and have been identified, they have to be addressed appropriately. In a study among college students in Northern India, there were six major factors identified, namely, instructors, institution, students, infrastructure, content factors, and motivational factors.[11] Only the performance of students was discussed in the current study. Relevant issues beyond the scope of this paper were challenges related to students such as readiness, technical skills to learn online, network and speed issues, identity, interaction, and participation.[11] Concerns on student performance may be connected to student engagement during online classes. A study involving college

students observed that higher educational institutions' (HEI) support and faculty support significantly affected university students' academic and social concerns. Furthermore, resource availability was found to affect the academic concerns of students but not their social concerns. Further, these were the recommended strategies for HEIs and faculty to promote faculty-student interaction using both synchronous and asynchronous modes to reduce student concerns and to motivate them to engage in online classes.[12]

Regarding the teachers' skills needed for online classes, a study done on the faculty of the College of Medicine in Karachi, Pakistan, the teachers' digital competencies and technology use in teaching and learning in the time of the COVID-19 were reviewed since these skills would play a significant role in the integration of technology in the post-pandemic time in higher education.[6]

The issue of assessment in online classes needed to be addressed as well. Assessment in medical education is considered most essential as assessment would usually give the evidence that learning was carried out and the learning objectives were achieved.[4] The assessment program is a measurement tool which evaluates the progress in knowledge, skills, behaviors, and the attitude of students. It determines the extent of instruction and intended learning outcomes achieved by students; thus it is considered an integral part of the instruction process.[6] One study specified that electronic exams were conducted remotely and remained a primary mode of assessment for students' academic progress during the pandemic.[13] Examination related factors such as efforts/time needed for preparation were found to be significantly associated with student's electronic exam dishonesty according to a study done on medical students in Jordan.[14] According to a study on medical students in the US, the integrity of assessment was a vital and challenging issue, especially as testing becomes more commonly distant from the usual classroom setting.[2] Data from medical students in Spain suggested that students were searching for information about ways to cheat in examinations, including how to create cheat sheets. Most strikingly, the results showed a significant increase in searches for information on cheating on online exams during the COVID-19 timeframe and the Spanish lockdown period. Thus, their recommendation was that academic institutions should be wary about the opportunities that the students may have to commit exam fraud.[3]

In this current study, the scores of students in the written examinations in all three subjects were significantly higher during the emergency shift to online learning when there was no remote visual proctoring compared to the scores obtained pre-pandemic, when there was remote visual proctoring during online examinations and when HyFlex teaching methods were utilized as face to face examinations conducted on campus were resumed. Despite reporting serious concerns about their overall experience with e-proctoring tools (e.g., privacy, environmental, and psychological concerns), the majority of students scored above average on their online examinations. Academic integrity also seemed to matter to students.[2] The issue of academic integrity was the major concern why remote visual proctoring utilizing Zoom was done for school years 2020-2021 and 2021-2022. A US study on medical students stated that there were three critical facts about the e-proctoring tool raised. First, e-proctoring could not fully replace the traditional, in-person proctoring experience. As such, these online systems can be used as a supplementary, short-term option for schools during sudden, critical situations. The second issue raised was that the COVID-19 pandemic forced universities to modify their assessments and communication tools to counter the crisis.[2] When health restrictions were eased for school year 2022-2023, the written examinations were once more conducted utilizing the traditional, face to face proctoring using paper and pen method. The third issue was that universities should exploit the capabilities gained during this technological transition to transform to new skylines of learning and education.[2] Advances in technology to support teaching and learning activities to include assessment utilizing web-based applications for examinations with face to face proctoring on campus was done. Indeed, online examinations can be proctored in different ways including in-person testing by requiring students to be physically present at a testing session, which could be at the institution or administered by an approved proctor situated remotely from the institution, or by utilizing online real-time proctor services.[2]

Another challenge presented by online classes was the unaddressed gap in psychomotor skills of students in online classes.[4] Among the annual subjects included in this study, Anatomy would be the subject

most affected by this gap. There were a couple of studies which looked into assessment in Anatomy class. Among undergraduate medical students, the results indicated that online assessment of theoretical and practical anatomical knowledge was comparable to that of face-to-face assessment. But proper planning and preparedness were mandatory to achieve the desired outcomes.[7,8] In this current study, although students scored higher on practical examinations conducted purely online, the skills acquired through face-to-face dissection and assessment were invaluable. Similarly, in a study conducted in Greece involving medical and dental students, traditional anatomy teaching was found to be the most preferred and effective teaching modality. Students ranked online anatomy lectures and pre-recorded anatomy lectures second in terms of effectiveness and preference. While the development of remote learning methods has increased students' active participation in anatomy lessons, it has significantly negatively affected their performance in examinations. Although remote learning cannot replace traditional anatomy teaching method, online lectures could be incorporated into anatomy curricula as an additional tool.[14] On the other hand, content-heavy subjects like Physiology and Biochemistry presented with different concerns. A study conducted in Beijing on medical students concluded that there was no evidence that offline learning was more effective. Compared to offline learning, online learning has advantages in enhancing undergraduates' knowledge and skills, and could therefore, be considered a potential method for teaching undergraduate medical students.[15] Another study done in Beijing on medical students expressed that synchronous distance education was not significantly different from traditional education in effectiveness and had even higher satisfaction ratings. Their findings seemed to provide indications for the adoption of online remote education in health science education centers.[16] In a study done among medical students in the US, it was observed that changes made to the pre-clerkship Physiology curriculum during the COVID-19 pandemic were met with overall satisfaction from the students and resulted to an increase in the National Board of Medical Examiners (NBME) subject examination scores. Another study proposed that more attention to student connectedness be improved so that remote learning can be best optimized into future curricula development.[17] Similarly, among college teachers in the UK, student satisfaction of their online courses and their summative exam scores were compared to previous academic years. The overall satisfaction with the courses was similar to previous academic years; however, student performance in the summative examination of the first virtually delivered cohort was lower than the previous year's cohorts. The difference in year 1 and year 2 medical students' perceptions of virtual and blended instruction highlighted the importance of face-to-face learning during the first year.[18]

Regarding student performance in the focused group discussion sessions in Biochemistry, significant differences in scores across the school years indicated that the activity was a less reliable source of means of assessment regardless of the mode of teaching and conduct of the assessment. Admittedly, this assessment was fraught with issues. In a study done in Sweden involving college teachers, it was observed that unreliability in grading students was well-documented. However, studies investigating teachers' detailed use of assessment criteria are lacking.[19] A similar study done in UK involving college teachers stated that in assessing students, it revealed several sources of inconsistency, such as teachers' own constructs, their interpretations and expectations about students' ability to manage academic work.[20] Limitations aside, there remains a need for student assessment. In UK, college teachers have pointed that assessment was fundamental to student learning and achievement. However, while research consistently emphasizes the role of assessment in supporting student development, the reality of assessment processes and practices in higher education often falls short.[21] Moreover, to minimize grade variability, a study done in a college in China involving its faculty stated that tacit criteria and the different sources that form the tacit criteria needed to be identified, perceived, and communicated to the faculty to reduce grade variability and achieve a shared understanding of grading.[22] The use of a rubric agreed upon by the faculty as to its content and utilization did not guarantee the reliability of the learning activity as a means to assess students' performance. A revisit of the whole activity focusing on the use of rubrics is warranted to emphasize the good practices as categorized into: 1) standardization of evaluation method, 2) objectiveness of evaluation, 3) guidelines for students' work, and 4) transparency of evaluation and the bad practices in the use of rubrics: 5) vague

descriptions in marking rubrics, and 6) failure to provide the ranges of marks for each grade.[23] Utilizing rubrics for assessment may be challenging but is widely believed to be a source of authentic assessment. In Australia, a study concluded that although there have been multiple definitions and operationalizations of authentic assessment, contemporary methods or approaches often emphasize replicating or imitating real-world job-related tasks. This suggests a focus on practical, hands-on activities that closely resemble what the students will encounter in actual work environments. The aim is to prepare these students by providing realistic, applicable experiences rather than purely theoretical or abstract learning. Authenticity cannot be completely unmoored from the reality of workplaces, the demands of the discipline, and the overall intended learning outcomes, however, a restricted view of how these aspects are represented in assessment can limit the sector's ability to prepare graduates who can engage with and shape the changing world.[24] To summarize and emphasize the prime importance of reliable assessment, a study done in Australia stated that summative assessment is often considered a motivator that drives students' learning. Higher education has a responsibility in promoting lifelong learning and assessment plays an important role in supporting students' capability to make evaluative judgements about their work and that of others.[25]

Moving forward, recognizing the advantages and limitations of both online and in-person or face to face modes of teaching, a study done in Hong Kong declared that with the gradual containment of the pandemic, there is no need for school lockdown. As a result, the teaching format has changed to HyFlex mode integrating both face-to-face and online modes.[26] Even as the pros and cons have been considered, the shift to online education has significantly impacted medical students in Egypt. Medical students reported various limitations and challenges of online medical education, which must be addressed considering the potential benefits of online platforms over traditional face to face learning.[27] A study done among medical students in Saudi Arabia described the improved HyFlex course that utilized live online courses and on-demand courses where on-demand video was uploaded via the online conference system, such as Zoom or Webex, and during class schedule students only asked questions and the teacher quickly responded to these questions.[28] In a study done in Australia involving college students stated that online learning, should be allowed in combination with conventional learning (Hyflex) but students should be prepared for it.[29] A study done in Ohio, US stated that students liked face-to-face learning because it enabled them to acquire motor skills and develop interpersonal relations.[30] Another study done in the US concluded that modified HyFlex instructional model had no negative impact on student performance in the class, both in overall learning and on individual grades. Furthermore, students greatly enjoyed the educational choices and overwhelmingly reported that the incorporation of technology increased their participation in class and comprehension of course content.[31] Since a HyFlex teaching mode allowed teaching-learning activities to be conducted either face-to-face or online, providing multiple methods to deliver content and interact with students, this teaching mode would ensure minimal disruption of learning due to concerns on health and safety and societal concerns as well.[32,33,34,35] A study done in the US reported that while online teaching could not replace traditional teaching, there was no preference for one type of modality over the other. Therefore, a multi-modal learning approach combining online with face-to-face educational modalities for medical students could be efficient and successful.[36]

Conclusion and Recommendation

There was significant difference in student performance in the written examinations in the three annual subjects in Year 1 of the College of Medicine program during the emergency shift to online examinations when there was no visual proctoring, otherwise, student performance remained similar all through the school years included in this study spanning different modes of teaching and conduct of examinations from traditional face to face, online and HyFlex mode of teaching. Likewise, there was no difference in student performance in laboratory conference sessions of Physiology across the different modes of teaching.

It is recommended that online examinations (through web-based applications or through the center's learning management system) with face to face proctoring be utilized in written examinations.

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A rare case of anterior skull base metastasis secondary to follicular thyroid carcinoma: a systematic review and illustrative case

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Abstract

Introduction Skull base metastasis from follicular thyroid carcinoma (FTC) is uncommon, with an incidence of 2.5%. Presented here is a case of a 63-year-old female presenting with a 2-year history of progressive left eye proptosis, with a previous history of thyroid surgery for non-toxic goiter. Imaging findings were uncharacteristic of any common skull base tumor. Biopsy revealed follicular thyroid carcinoma. The authors used this case as basis and performed an analysis on available literature for FTC skull base metastasis to help guide management of future cases.

Methods Using PRISMA guidelines, a systematic search across PubMed, Google Scholar, and Cochrane Library using MeSH keywords "Skull base," "Metastasis," and "Follicular Thyroid Carcinoma," identified 18 records. After screening, 15 articles assessed for eligibility, with 8 studies meeting inclusion criteria for qualitative analysis.

Results Studies showcased a consistent age range (43 to 69 years) among patients diagnosed with FTC. Presentation varied depending on tumor location, with symptoms such as dysphagia, proptosis, epistaxis, facial dysesthesia, and visual impairment. Tumor size ranged from 3cm x 3cm x 2cm to 6.8cm x 3.9cm x 5.3cm, influencing management strategies ranging from simple biopsy to sub-temporal complete excision. Adjuvant therapies included combinations of intensity-modulated radiation therapy (IMRT) with immunotherapy, multiple courses of I-131 therapy, oral radioiodine ablation, and radiotherapy, with outcomes showing improvement in most cases. Follow-up duration varied from 12 to 60 months.

Conclusion FTC skull base metastasis remains to be an uncommon entity in neurosurgery. Its rarity creates a lack of established guidelines and treatment algorithms. A high index of suspicion as well as good history and physical examination skills are necessary to achieve an adequate diagnosis. Multi-disciplinary teams form the cornerstone of a patient-tailored approach to its management.

Key words: skull base tumor, follicular thyroid cancer, metastasis, proptosis

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Skull base metastases are rare and occur in about 4% from malignancies of breast, lungs, and prostate.[1,2] In a study of 473 cases of thyroid carcinoma, it was discovered that a mere 2.5% of these individuals exhibited metastasis to skull base, which is typically uncommon, relative to the tumor's slow growth.[3] However, this type of carcinoma still

carries a mortality rate ranging from 20% to 40%, mainly due to challenges in controlling it locally and the occurrence of distant metastasis. Tumor cells are pustulated to metastasize to the skull base via hematogenous dissemination from the primary tumor, similar to dural or calvarial metastasis.[1,4] However, some authors advocate perineural spread from the head and neck region to the skull base.[4]

Clinically, these tumors present most commonly with craniopathies and localized pain.[1,2,5,6] Skull base metastasis syndromes are classified based on their presentation and location of involvement (Table 1) and are largely based on location and their proximity to critical structures in the brain specifically cranial nerves, which mark their predominant neurologic finding.[6]

Prognosis of skull base metastasis largely relies on the nature and extent of dissemination of the primary tumor, site of metastasis, and accessibility to surgery.[1,4] This is congruent to what is currently known about metastatic disease in general. Skull base metastasis is usually a late complication of cancer; once seen, it usually portends late-stage disease.[4] In most cases, death is usually due to the progression of systemic disease.[1]

This paper aimed to review available literature and reports of cases of FTC metastasis to the skull base as to their identification, epidemiology, treatment, and follow-up to aid clinicians in the management of future cases.

The Case

Present here is a case of 63-year-old female who was referred for progressive painless proptosis of left eye (Figure 1), which was associated with generalized headache of 2 years duration. There was no history of focal deficit, decreasing sensorium, cognitive or behavioral changes, or seizure. Cranial MRI with gadolinium contrast (Figure 2) revealed a homogenous, avidly enhancing left spheno-orbital tumor measuring around 5.3cm x 5.2cm x 6.3cm with marked proptosis of the left globe and partial encasement of the left optic nerve. She was diagnosed with a meningioma and referred to the institution for neurosurgical consult. Her past medical history

Table 1. Greenberg et al.'s classification of skull base metastasis syndromes.

Site	Symptoms	Signs
Orbit (7%)	Supraorbital headache Diplopia	Proptosis Ophthalmoplegia ± Facial numbness (V1) ± Decreased vision ± Periorbital swelling
Parasellar (16%)	Frontal headache Diplopia	Ophthalmoplegia Facial numbness (V1) Periorbital swelling
Gasserian ganglion (35%)	Facial numbness Parasthesias Atypical facial pain	Facial numbness (V2, V3) Abducens palsy (anterior ridge) Facial palsy (posterior ridge)
Jugular Foramen (21%)	Occipital pain Hoarseness Dysphagia	Cranial palsies IX, X, XI
Occipital Condyle (21%)	Occipital pain Dysarthria	Cranial nerve XII palsy

revealed a previous history of thyroid surgery for a non-toxic multi-nodular goiter; however, no official histopathologic report was presented by the patient. On physical examination, gross tumor was visible and palpable over the left fronto-temporal area, the rest of the physical examination was unremarkable. Her neurologic examination revealed a patient with alert intact mental status examination, with no light perception on the left eye, no appreciable motor function on the left eye and marked lagophthalmos. The patient displayed no other sensorimotor deficit. A repeat cranial CT scan with contrast (Figure 3) was taken, showing increase in tumor dimensions, as well as lysis of the surrounding bony structures, including the sphenoid wing, temporal bone, orbital roof and floor, as well as the ethmoids medially.

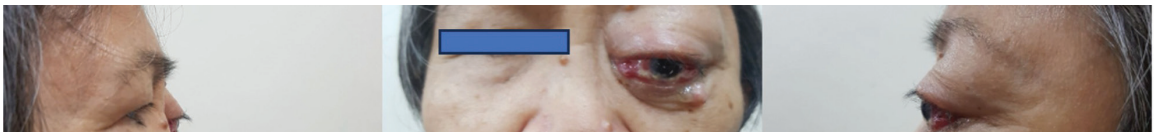

Figure 1. Gross photo of patient with marked proptosis of left eye.

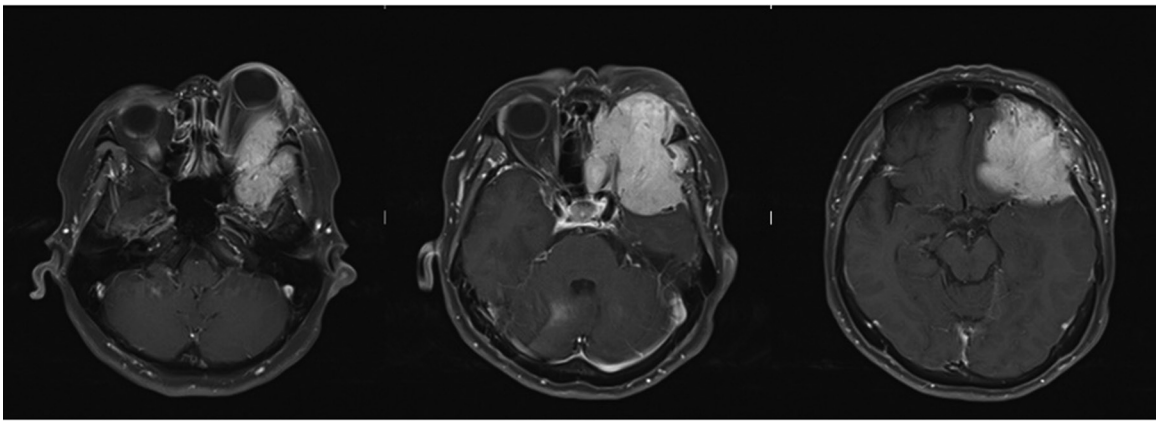

Figure 2. Cranial MRI with Contrast showing the left spheno-orbital tumor.

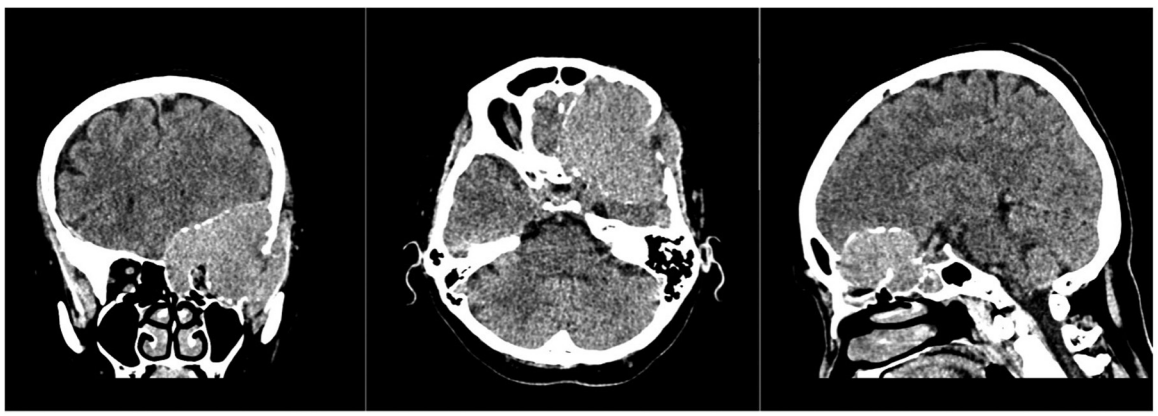

Figure 3. Lytic bony erosions seen in the cranial CT scan.

Given the marked progression of tumor size in a span of a few weeks, a malignant, aggressive tumor was suspected as opposed to the initial impression of a meningioma based on the MRI. Systemic metastatic work-up was done revealing unremarkable findings. She was then scheduled for core needle biopsy of the fronto-temporal tumor under local anesthesia. Microscopic specimen showed cuboidal cells in follicular arrangement invading surrounding soft tissues and eroded eosinophilic bone fragments with osteoclast-like giant cells, with hyperchromatic and round nuclei, which eventually turned out to be a Metastatic Follicular Thyroid Carcinoma (Figure 4). As of this writing, the patient is undergoing completion of metastatic work-up, as well as chemo- and radiotherapy to address the metastatic tumor.

Methods

After obtaining consent from the patient and securing a certificate of exemption from the Ethics Review Committee, the authors reported a case of a 63-year-old female who presented with proptosis and headache, diagnosed for left anterior skull base metastasis secondary to follicular thyroid carcinoma and did a systematic review which adhered to the guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2015 (PRISMA). MeSH keywords "Skull base", "Metastasis", "Follicular Thyroid Carcinoma" were used for the systematic search across multiple databases: PubMed, Google Scholar and Cochrane Library.

The following inclusion criteria were used: (1) Case of skull base metastasis secondary to follicular thyroid carcinoma, (2) Case Reports, Case Series and Cohort Studies. Metastasis from other histopathology, editorial and non-English articles were excluded. Data collected included demographics, pathological characteristics, surgical approaches and clinical outcomes and follow-up.

A total of 18 records were identified through a database search. Of these, 17 were screened and 16 were retrieved thereafter, but only 15 articles were assessed for eligibility. Seven articles were excluded because they did not meet the inclusion criteria. Eight studies were included in the final qualitative analysis.

Results

Demographics

All the studies included were case reports and case series with the mean age of patients ranging from 43 to 69 years, showing a minimal variability in age distribution (Table 2). These studies focused on patients diagnosed with follicular thyroid carcinoma. Surgical interventions for the primary malignancy varied among the studies, including total thyroidectomy, subtotal thyroidectomy, and in some cases, no surgical intervention was mentioned. This indicates a range in the extent of surgical management used for follicular thyroid carcinoma patients with metastasis.

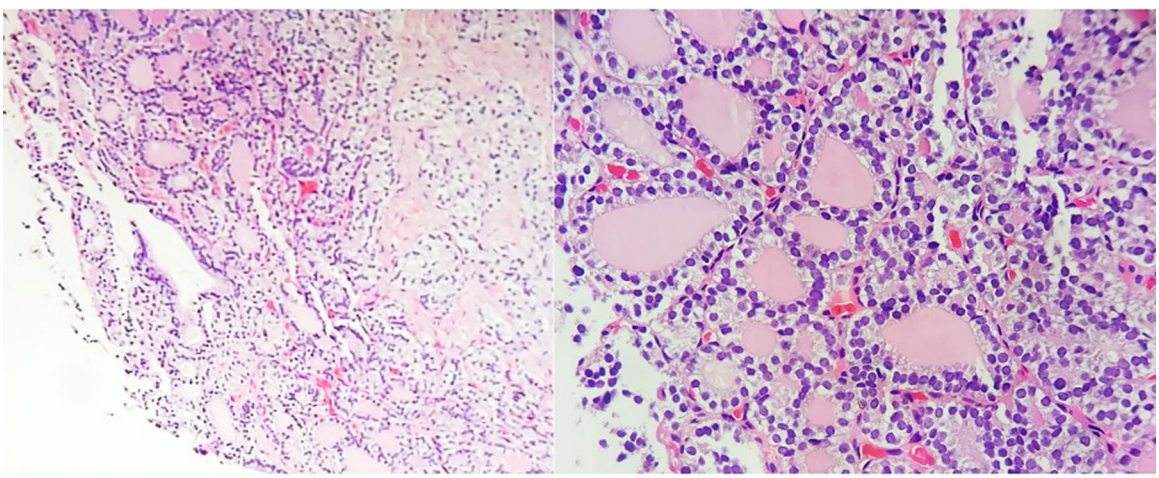

Figure 4. Microscopic findings showing follicular arrangement.

Metastasis Location and Presentation

Presentation of the metastases across the studies were dependent on the tumor's location. These included dysphagia, dysphonia and weak shoulder shrug associated with metastasis to the right jugular foramen, proptosis secondary to clivus and orbital extension, epistaxis and diplopia associated with sphenoid and clival extension, facial dysesthesia from the infratemporal and cavernous sinus involvement and visual impairment and galactorrhea from sellar metastasis (Table 3).

Tumor Size and Surgical Management

Dimensions of reported tumor sizes differed among the studies, ranging from approximately 3cm x 3cm x 2cm as the smallest to 6.8cm x 3.9cm x 5.3cm as the largest. Various approaches were employed in treating tumors of varying sizes and

Table 2. Demographics and tumor characteristics.

Author/ Year	Study	Population	Mean Age	Primary Malignancy	Surgical Intervention for Primary Malignancy	Location of metastasis	Clinical Presentation
Yang 2022	Case Report	1	57	Follicular Thyroid Carcinoma	Total thyroidectomy	Right jugular foramen	Dysphagia, hoarseness of voice and weak shoulder shrug
Altinay 2015	Case Report	1	69	Follicular Thyroid Carcinoma	Thyroidectomy	Skullbase (Clivus, sella, cavernous sinus, orbital)	Proptosis
Shen 2015	Case Series	3	64	Follicular Thyroid Carcinoma	Total Thyroidectomy	Right intraorbital, parietooccipital, occippital	Right frontal, parietal and occipital mass
Bhandary 2011	Case Report	1	59	Follicular Thyroid Carcinoma	None	Skullbase (Clivus, sella, sphenoid sinus)	Epistaxis and Diplopia
Matsuno 2010	Case Report	2	64.5	Follicular Thyroid Carcinoma	Thyroidectomy	Skullbase (Infratemporal fossa, cavernous sinus)	Facial dysesthesia
Coca Pelaz 2009	Case Report	1	61	Follicular Thyroid Carcinoma	Subtotal thyroidectomy	Left infratemporal fossa	Left hemifacial pain and facial dysesthesias
Yilmazlar 2004	Case Report	1	43	Follicular Thyroid Carcinoma	Subtotal thyroidectomy	Sella turcica	Visual impairment and galactorrhea
Rosahl 2000	Case Report	1	50	Follicular Thyroid Carcinoma	Subtotal thyroidectomy	Left middle cranial fossa (Clivus, dorsum sella)	Dysphagia and dysphonia

Table 3. Management and outcomes.

Author/Year	Location of metastasis	Diagnosis of Metastasis	Tumor size	Surgical intervention Metastasis	Adjuvant therapy	Outcomes	Follow-up
Yang 2022	Right jugular foramen	Cranial MRI	Not specified	Cortical mastoidectomy	IMRT + Immunotherapy (Lenvatinib + Pembrolizumab)	Not specified	No data
Altinay 2015	Skullbase (Clivus, sella, cavernous sinus, orbital)	PET/CT	6.8 x 3.9 x 5.3 cm	Punch biopsy	I-131 therapy	Improved	No data
Shen 2015	Right intraorbital, parietooccipital, occippital	Cranial CT/MRI	2.8 -6.0 x 3.4 - 8.0cm	Craniotomy, resection of tumor, cranioplasty	I-131 therapy	1 -mortality	22-30 months
Bhandary 2011	Skullbase (Clivus, sella, sphenoid sinus)	Cranial MRI	Not specified	None	Oral radioiodine ablation	Improved	No data
Matsuno 2010	Skullbase (Infratemporal fossa, cavernous sinus)	Cranial CT/MRI	Not specified	Subtotal resection	Radiotherapy (30 Gy)	Improved	No data
Coca Pelaz 2009	Left infratemporal fossa	Cranial MRI	5 x 4 x 3.5 cm	Subtemporal preauricular approach, excision of tumor, split temporalis muscle flap	Radioiodine + TSH Suppressive therapy	Improved	19 months
Yilmazlar 2004	Sella turcica	Cranial MRI	4 x 2.5 x 3.5 cm	Transsphenoidal decompression	I-131 therapy	Improved	60 months
Rosahl 2000	Left middle cranial fossa (Clivus, dorsum sella)	Cranial CT/MRI	3 x 3 x 2 cm	Suboccipital craniotomy, excision of tumor	I-131 therapy	Improved	12 months

locations, illustrating the intricate nature of treatment strategies in such instances. These approaches ranged from minimal intervention, like punch biopsy, to more extensive procedures such as sub-temporal excision with muscular flap reconstruction (Table 3).

Adjuvant and Outcomes

Adjuvant therapies included combination of approaches such as IMRT coupled with immunotherapy using Lenvatinib and Pembrolizumab, multiple courses of I-131 therapy, oral radioiodine ablation, radiotherapy with a dose of 30 Gy, and treatment involving radioiodine alongside Thyroid Stimulating Hormone (TSH) suppressive therapy. Outcomes across studies were not specified, with most of the cases reporting improvement but one case indicated mortality. Follow-up ranged from 12 months to as long as 60 months, indicating a variable range in the duration of monitoring for outcomes (Table 3).

Discussion

Although thyroid carcinoma has the potential to spread to the bones of the head and neck area, such as the skull, maxilla, and mandible; even rarer, is its spread to the skull base.[7] Papillary thyroid carcinomas (PTC) are typically more prevalent than follicular carcinomas (FTC).[8] Yet FTCs have a higher tendency to spread through hematogenously, particularly to the lungs and bones.[3,8] Majority of individuals experiencing skull base metastasis from FTC had primary thyroid lesions that were asymptomatic and only identified through extensive investigation of metastasis, tissue biopsy of the metastatic site, or both.[9] In a case series, the cohort revealed 6 of 12 patients who underwent previous thyroid surgeries for goiter, only 1 of these 6 was diagnosed with thyroid carcinoma.[2] Skull base FTC metastasis is an uncommon occurrence and may be the initial clinical presentation of FTC with silent primary tumors.[2,3,9] In one study, they found that the mean duration between initial presentation and skull base metastasis was 4 years.[2]

Many reported cases highlight the frequent misidentification of the initial skull base tumor as a chordoma or chondrosarcoma.[2,10] The presence of a significant soft tissue mass typically affects the skull base skeleton and exhibits bony destruction on imaging, along with local extension into surrounding soft tissue, all resembling characteristics observed in chordomas and chondrosarcomas.[2,11,12] The possibility of skull base metastasis from FTC must be considered in patients presenting with cranial nerve dysfunction and on radiography shows a highly lytic tumor.[2] The challenges in diagnosis prompted the creation and utilization of valuable immunocytologic markers tailored for differentiated thyroid tumors. Among these markers are Thyroid transcription factor-1 (TTF-1), the mesothelioma antibody (HBME-1), and galectin-3, all of which play crucial roles in aiding the diagnosis and classification of thyroid lesions.[13] These markers are, however, costly, and are not easily accessible to lower income countries.

Management of FTC skull base metastases was also largely individualized, with no single guideline to recommend a specific treatment plan. For primary thyroid carcinoma, the treatment algorithm suggests total thyroidectomy, with post-operative Iodine 131 therapy.[2,3,12] Iodine 131 (131I) has been known to accumulate well in the follicular elements of thyroid tissue, hence, cementing its efficacy for thyroid metastasis.[14] For the skull base tumor, varying degrees of resection, from simple debulking to maximal safe resection can be performed. Some authors, however, suggested that debulking may be dangerous in most cases at risk of severe bleeding due to its proximity/involvement of vital structures, including large arteries and cranial nerves.[2,12] Hence, internal irradiation with 131I has been suggested as another option, coupled with chronic suppression of TSH secretion through thyroid hormone supplementation.[3]

Limitation of the present study arose from the reliance on case reports as the primary data source. With only case reports available, they lacked the breadth and depth of data needed for robust analysis and generalization such that the case reports/series included lacked the power and treatment standardization necessary to accurately determine the impact of skull base metastasis from differentiated thyroid carcinoma on patient outcomes. Although typically, distant metastasis indicates a poor prognosis, suggesting that survival rates may decrease due to widespread systemic disease.

Conclusion

Due to the rarity of these lesions, an adequate description of the natural history of FTC skull base metastases has yet to be solidified to allow early identification of these malignancies. A thorough

history and physical examination, coupled with a high index of suspicion is necessary to avoid misdiagnosis and unnecessary steps in management. A multidisciplinary team is required, which includes a neurosurgeon, orbit specialists, maxillofacial surgeons, medical oncologists, rad-oncologists, and even palliative care specialists. There is currently no established consensus regarding the diagnosis, work-up, management, and prognosis for such cases of tumors, as such, management is still largely tailored to each patient and relies heavily on systemic factors including the control of primary tumor and the extent of its spread.

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Instructions to Authors

Aim and Scope

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Ethics Approval

Studies involving humans, including chart reviews and case reports/series, should have undergone review by the UERMMMCI Research Institute for Health Sciences Ethics Review Committee. The approval (or exemption) should be submitted together with the manuscript.

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Manuscripts that have passed the initial review by the editors will be sent for peer review. The Journal practices a double-blind review process. Manuscripts requiring major revisions will be sent back to the authors.

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All contributions should be written in English. Papers should be written to be intelligible to the professional reader who is not a specialist in the field. The editor and his staff reserve the right to modify manuscripts to eliminate ambiguity and repetitions, and to improve communication between author and reader. If extensive alterations are required, the manuscripts will be returned to the author for revision. Therefore, to minimize delay in publication, manuscripts should be submitted in accordance with the instructions detailed herein. The author may refer to the Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals 2020 available at www.icmje.org for additional guidance. The editor will not be held responsible for views expressed in this journal.

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A copy of the manuscript, including tables and figures, should be submitted in Microsoft Word format to the editor at **research@uerm.edu.ph**. The manuscript should be typed in a single column, double-spaced all throughout, using Times New Roman or Arial 12. All pages, starting from the title page should have page numbers on the lower right-hand corner. Tables, figures and illustrations should be in separate sheets (**not embedded in the text**). This should be accompanied by a cover letter containing the following: 1) corresponding author with complete contact details; 2) signed declaration by all authors of their involvement and willingness to take public responsibility for the paper's contents; 3) ethics approval when applicable; 4) declaration that the paper has not been published and is not under consideration for publication in another journal; 5) declaration of support/funding when applicable; and 6) declaration of conflict of interest. To facilitate revision of the manuscript, the editor requires submission of a printed copy aside from the electronic version.

All pages of the typed manuscript should be numbered, including those containing declarations, acknowledgments, and

references. The manuscript should be arranged as follows: 1) title and list of authors, 2) corresponding author with contact details, 3) abstract, 4) key words, 5) introduction, 6) methods, 7) results, 8) discussion, 9) acknowledgments, 10) support/funding, 11) conflict of interest declaration, 12) references, tables and figures. **Tables and figures and their legends should be submitted as a separate Word file. Photographs should be submitted as a separate jpeg file.**

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The title should be as concise and informative as possible and should contain all key words to facilitate indexing and information retrieval. This should be followed by the list of authors' names to be written as follows: first name, middle initial, family name and academic degrees. The sequence of names should be agreed upon by the authors. The department or institution of each of the authors should also be provided. Only those qualified based on the *Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals 2020* should be listed as authors. The contact details (affiliation, address, email address, contact number) of the corresponding author should be provided. The corresponding author should be a regular faculty/staff of the Medical Center.

Abstract

This should be a concise structured summary consisting of the Introduction, Methods, Results and Conclusion. It should be no more than 200 words and include the purpose, basic procedures, main findings, and principal conclusions of the investigation. New and important information should be emphasized.

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Two to six key words or phrases, preferably Medical Subject Headings (MeSH) terms, should be provided. This will assist in cross-indexing the article. The authors may refer to MeSH on Demand at https://meshb.nlm.nih.gov for possible MeSH terms.

Introduction

This should contain a summary of the rationale and objectives of the study and provide an outline of pertinent background material. It should not contain either results or conclusions.

Methods

This should adequately describe the study design, population, selection process, randomization, blinding, study procedures, data collected, and statistical methods used in data analysis.

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This should be presented in logical sequence in the text, tables, and figures, avoiding repetitive presentation of the same data. Measurements should be in International System (SI) units. This section should not include material appropriately belonging to the discussion. Results must be statistically analyzed when appropriate.

Discussion

Data mentioned in the results should be explained in relation to any hypothesis advanced in the introduction. This may also include an evaluation of the methodology and the relationship of new information to previously gathered data. Conclusions should be incorporated in the final paragraph and should be commensurate with and completely supported by data gathered in the study.

Acknowledgments

Only persons who have made genuine contributions and who endorse the data and conclusions should be acknowledged. Authors are responsible for obtaining written permission to utilize any copyrighted text and/or illustrations.

References

It is preferred that references and intext citations be in the National Library of Medicine (Vancouver) format, however, authors may choose to use the American Psychological Association (Harvard) format. The format selected by the authors should be used consistently throughout the manuscript.

References in the NLM/Vancouver style cited in the text shall be written as Arabic numerals in superscript at the end of the sentence in the order in which they appear in the text. Use the format in the *Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals* (updated 2020) which is available at www.icmje.org. Titles of journals should be abbreviated in the reference list according to the style used in Index Medicus. Electronic references should include the date that the material was accessed. Unpublished observations and personal communications may not be used as references. Examples of the correct manner of listing references in the NLM/Vancouver format are illustrated below:

Standard journal article
(List all authors when six or less; when seven or more, list only the first three then add "et al".)

Francis D, Hadler SC, Thompson S, et al. The prevention of hepatitis B with vaccine: Report of the Centers for Disease Control multi-center efficacy trial among homosexual men. Ann Intern Med 1982; 97: 362-6.

Krugman S, Overby LR, Mushahwar IK, et al. Viral hepatitis type B: studies on the natural history and prevention reexamined. N Engl J Med 1979; 300: 101-6.

Nyland LJ, Grimmer KA. Is undergraduate physiotherapy study a risk factor for low back pain? A prevalence study of LBP in physiotherapy students. Retrieved from: http://www.Biomed-central.com/1471-2474/4/22. 2003. [Accessed August 27, 2011].

Rankin J, Tennant PW, Stothard KJ, et al. Maternal body mass index and congenital anomaly risk: A cohort study. Int J Obes 2010; 34(9): 1371-80. Available from: http://ncbi.nlm.nih.gov/pubmed/20368710. [Accessed August 27, 2011].

Books and other monographs

Personal authors

Adams RD, Victor M. Principles of Neurology. New York: McGraw-Hill; 1981.

Chapter in a book

Corbett S. Systemic Response to Injury and Metabolic Support. In: Brunicardi FC (editor). Schwartz's Principles of Surgery. 10th ed. New York: McGraw-Hill; 2015: 13-50.

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These should be submitted as a **separate Word or Excel file (NOT AN IMAGE FILE)**, numbered with Arabic numerals and accompanied by a title and an explanatory caption at the top. Each table must be referred to in the text and an indication of the preferred position in the text should be given. Other explanatory materials should be placed in footnotes below the tables. All non-standard abbreviations should be explained in the footnotes. Vertical and horizontal rules between entries should be omitted. Each figure (graphs, charts, etc.) should be identified clearly and numbered in Arabic numerals and accompanied by a title and an explanatory caption at the bottom.

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