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From the desk. To the bench. To the bedside.



# The HEALTH SCIENCES JOURNAL

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# Experiences of first year medical students from their teachers beyond the grave

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## Abstract

**Introduction** Dissecting cadavers to study Human Anatomy is an integral part of first year medical education. The aim of this study was to describe the experiences of the first year medical students during their first day of cadaver dissection.

**Methods** This study analyzed interviews of three first year medical students, chosen via purposive sampling, who were present during the first day of cadaver dissection in gross anatomy. Interviews were transcribed and analyzed through a Husserlian descriptive phenomenological approach.

**Results** Five common themes were identified: 1) fear of the unknown, 2) group dynamics, 3) sense of awe and amazement of the cadaver's body, 4) respect for the body, and 5) taming of death as a rite of passage to being a doctor.

**Conclusion** Of the five emergent themes, taming death as a rite of passage to being a doctor is the essence of the experiences of the first year medical students during the first day of cadaver dissection.

**Key words:** Cadaver dissection, phenomenology, anatomy

**H**uman anatomy, which deals with the study of the structures of the human body, is one of the

first and most basic subjects studied by students when they begin their medical education. Anatomy provides the very fundamental details of the human body. Anatomical dissection is a systematic exploration of preserved human cadaver by sequential division of tissue layers and liberation of certain structures by removal of regional fat and connective tissue with the aim of supporting the learning of gross anatomy by visual and tactile experience. Through dissection, students are able to visualize firsthand actual structures of the human body. Gross anatomy teaching in medical schools all over the world has been traditionally based around the use of human cadaveric specimens for complete dissection or as

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prosected specimen.<sup>1</sup> The same is true for UERMMMCI College of Medicine although this is supplemented by anatomic models and videos.

In the UERMMMCI College of Medicine, where cadaveric dissection mainly constitutes preclinical teaching of anatomy, students are exposed to cadavers in the early stages of their medical education but this exposure induces both positive and unintended negative experiences in these students. It is the first time they are viewing the body from a perspective different from a textbook.<sup>2</sup> Diagrams and plastic body parts all have a "classic" look to them in textbooks, but when a student dissects a human, the body parts show real differences among individuals. Nevertheless, viewing a human cadaver may be quite unnerving for students.

The emotional impact and the students' ability to cope have been examined in several studies. Physical (smell, nausea, conjunctival irritation) and psychological (anxiety, stress, emotional trauma, depression) effects have been identified.<sup>3</sup> The description of Helman centered on how separating the body into parts can contribute to a sense of the death of what was human, and how the dismantling of the body can play a part in the "taming of death".<sup>4</sup> Sinclair described the dissection room as a place where students have their first hands-on, practical experience as doctors and where medical students move away from the lay world and towards the medical world.<sup>5</sup>

Other studies assessed reactions of undergraduate students to dissection. Most medical students are able to adapt to dissecting rooms; but a few students were reported to have high stress after dissection for which counseling and a compulsory formal course on death and dying was desired by students.<sup>6</sup> A study found that Australian students were affected both physically and emotionally when they encountered a cadaver for the first.<sup>7</sup> Thirty percent experienced dizziness, sore eyes, nausea, and constant references to the "horrible smell." Another 30% reported having psychological effects such as post-dissection anxiety and depression. Another study found that 10% of students exhibited a stress reaction one week following their first dissection, with percentages dropping to 6.3 at one month, 3.6 at eight months, 2.1 at one year, and 0 at 2 years.<sup>8</sup>

The value of the cadaveric dissection in teaching of anatomy, more so in the student's early stages of medical education needs to be established and the

experiences of the students on the first day of cadaver dissection is important in establishing this value. The value may differ from one student to another but is also relevant to discover the differences because from these differences the faculty can help students to cope better with the experience of cadaver dissection. The students' experiences will also be used to prepare the students for clinical practice especially on issues surrounding death and dying.

The aim of this study was to describe the experiences of the first year medical students during their first day of cadaver dissection. The results of this study will serve as basis for both the faculty of the Department of Anatomy and the institution in initiating measures to ensure that the initial encounters with cadaveric dissection will be less stressful, if not truly important to medical education.

## Methods

The live experiences and perceptions of first year medical students were ascertained through a qualitative study using a Husserlian descriptive phenomenological approach.<sup>9</sup> The investigators conducted individual semi-structured in-depth interviews with the participants on what they had experienced on the first day of cadaver dissection. Data analysis was done following the method of Giorgi.<sup>9</sup> The study was approved by the Ethics Review Committee; informed consent was obtained from each of the respondents.

Regular first year students of UERMMMCI College of Medicine who were enrolled in Human Anatomy for the first time in SY 2015-2016 and were present during the first day of cadaver dissection were invited to participate and those who agreed to participate were asked to sign an informed consent. The participants were recruited by purposive sampling specifically to achieve a criterion sampling. Individual semi-structured in-depth interviews were conducted for 30-45 minutes in one of the rooms at the Department of Preventive and Community Medicine during the free time of the student. Interview questions were formulated based on the following: What were the experiences/perceptions of the first year medical students on the first day of anatomical dissection using cadavers? What was the impact of the first day of cadaver dissection on the student? To what extent did the cadaver dissection serve its function in understanding Human Anatomy and in

becoming a doctor? The interviews were recorded and transcribed verbatim for analysis. Field notes were made not later than the morning after each interview.

Transcribed data supplemented by field notes underwent the following steps or phases: 1) reading of the entire unit to get the sense of the whole, 2) discriminating units from participants' description of phenomenon being studied, 3) articulating the psychological insight in each of the meaning units, 4) synthesizing all of the transformed meaning units into a consistent statement regarding the participants' experiences (referred to as the structure of the experience) which was expressed on a specific or general level. Thematic analysis was conducted to determine the perceptions. The analysis moved from broad data towards discovering patterns and developing themes. Qualitative information gathered were encoded thereby developing "codes," words or phrases that served as labels for sections of data. Codes were developed to represent the identified themes.

## Results

Twelve first year medical students with a mean age of 22 years, consisting of eight females and four males were interviewed. Half of them graduated from a premed course in college (BS Biology 3, BS Psychology 3) while the rest came from other courses (economics, advertising, computer science/information technology).

The respondents' description of their experiences on the first day of cadaver dissection clustered around five main themes: 1) fear of the unknown, 2) group dynamics, 3) sense of awe and amazement of the cadaver's body, 4) respect for the body and 5) taming death as a rite of passage to being a doctor.

### *Fear of the Unknown*

A very evident theme in this analysis was the participants' experiences of fear of the unknown. Participants were all hesitant upon entering the gross anatomy laboratory especially in opening the cadaver bags of the cadavers assigned to them. A common fear was that of being haunted of the cadaver thereby deciding to initially cover the face. Because of the lack of previous experience, they were scared to make the first cut. They were scared to make mistakes and were asking themselves if this was indeed medical

school. It was difficult for them to look at an unfamiliar body compared to those seen during wakes and funerals. It was overwhelming, scary, surprising and shocking for them to be in a room with more than twenty cadavers.

"My first two weeks in anatomy was scary especially the first day of dissection. I have never even dissected a frog; so it was my first time to see a dead person aside from those that I saw during funerals plus I had to hold them. The feeling was overwhelming." (Male)

"My groupmates and I were all hugging our clipboards. We attempted poking the skin and realized that it was hard as leather. We covered the face immediately. We were scared that the cadaver will haunt us. Because of this, we didn't accomplish anything on the first day of dissection. We had no progress because we were not sure of what we were doing. The fear was that much that we had no direction. We were reading the manual and the atlas but we couldn't understand anything. It was culture shock because I have only been to two funerals my whole life and on that day I am in a room with 20-30 dead people." (Female A)

### *Group Dynamics*

Another important theme was how the experience of dissection allowed them to work and continue with process despite the initial feeling of fear. Adjustment was hard because the pace was fast unlike in college and at work. All the participants relied on their groupmates to initiate dissection especially those who had prior experience or exposure, i.e., those who had physical therapy or nursing as a premed course. Looking at cadavers as teachers allowed them to progress with their dissection. Constant reminders from friends, senior medical students and groupmates that cadaver dissection was needed to learn Human Anatomy and to pass medical school gave them the will to study and appreciate the importance of dissection. The team interaction in the anatomy laboratory proved to advance student learning ability and comfort level around the cadavers. Students perceived that their

peers assisted them in improving their education in anatomy.

"During the first two weeks of first year medical school, I felt that there were a lot of things to do. I was lost initially but I had to remind myself that this is really medical school. On the first day of cadaver dissection, I initially felt that I didn't want to dissect first but when I talked with my groupmates, I was the only one who had a previous experience with dissection of the cat. My groupmates and I got along well after some short introductions. We always work together constantly reminding each other that it was something we needed to do otherwise we won't be able to identify anything." (Female B)

"With my med classmates, we can go on and on talking for like an hour about the things that we saw during cadaver dissection. It is a topic that we keep repeating every day, every gross lab, the dissection process." (Female A)

#### *Sense of Awe and Amazement About the Body of the Cadavers*

A significant theme was how the participants described the experience as awesome together with the sense of discovering something new. External and internal variations of the body were identified and found to be important in the understanding of Human Anatomy. All the participants noted the hard and leather-like human skin when preserved. The smell of the cadavers specifically the adipose tissue was repugnant, distinct and memorable. Everyone including the participants' families would notice if they came from cadaver dissection. One of the participants even realized that she had to lose weight so that her body wouldn't smell bad once preserved due to the amount of adipose tissue.

"Oh my God, why is the skin of the cadaver this hard...like leather. During the first few weeks of dissection, I was thinking of giving my body for continuing medical education; but I realized that whoever will dissect me might have a difficult time due to the amount of adipose tissue and the smell. If God was the one who made the body, He is truly intelligent. He knew where to place

each structure and the body is well thought of... every little detail matters. The body is just so amazing." (Female B)

"The first thing that I remembered when I entered the Gross Lab was the smell. The smell was distinct and too strong. When we started, we were just poking the skin which was so hard and leather-like. I started dissection because I felt that I had no choice. I can't just stand and look at the cadaver while others dissect but there were so many fascia. Compared to models, the structures are not color-coded like blue for vein and red for artery. You do need to study the relationship of structures. People would vary not just externally but also on the structures inside. I also didn't know before that the adipose tissue smells so bad. I also don't know why some of the cadavers are dark compared to the others then we realized while dissecting that our cadaver has a hematoma involving the whole back and my groupmates and I thought it's probably because of prison fight." (Female A)

#### *Respect for the Body*

Another important theme was the need to respect the body. Doing the first cut was difficult for the students because of the thought of the body having a soul and a previous life. Proper cadaver care was realized by the participants since they were utilizing the cadaver as a learning tool that will enable them to study anatomy. One of the participants would even ask permission while dissecting.

"We covered the face of the cadaver immediately because when I saw the face what I was thinking was that this person had a life before. What did he do?... I have a classmate who can spend the whole day 8 AM - 5 PM during free lab. He spent that whole day removing all the fascia, spraying formalin and taking care of the cadaver. Compared to all the other cadavers, their cadaver is soft, clean and smells good." (Female A)

"According to my groupmates, I should just think that the cadaver had to make a sacrifice for me to learn everything about his body. I felt relieved of my fear and not so guilty after that.

There would be times that I talk to our cadaver asking him to clearly show us the muscles and other structures that we need to identify." (Male)

#### *Taming of Death as a Rite of Passage to Being a Doctor*

Making death less powerful and controlling how they thought of the dead human bodies in the gross anatomy laboratory, to go on with the dissection process because of the need to identify structures in studying gross anatomy which is essentially taming of death as a rite to passage to being a doctor was the final theme. The students described dissection as an initiation to medical school and a requisite to achieving their dream of becoming a doctor. The participants appeared to make a link between the diversity seen in cadaveric structures and how they initially carried out the dissection process with the type of patients they will encounter in the clinics. They appreciated the variation in the orientation of certain structures during the dissection in contrast to ideal orientation in models and atlases. For many, it was the first glimpse of the structures that they will work with in their professional career. The variation simulated the variety in real life. Dissection was seen by participants as a training ground for treating patients because mistakes in cutting the structures can still be committed unlike on actual patients. Most of them considered the actual visualization of structures being studied very important in managing patients in the future.

"The first day of dissection felt like an initiation to medical school.....from what I have experienced, not all cadavers are the same. One side of our cadaver lacks a nerve or an artery which according to the teacher was not abnormal... only a variant. So that is what I realized that not all people are the same like actual patients. When I study the cadavers, it seems like you can pinpoint where the structures are and where they are connected not like in our notes it gets rumbled in my mind. Using the cadaver, there is visualization." (Female A)

"During dissection, at a point it is okay to commit mistakes now like not cutting the sartorius muscle on the belly which you can't do on actual patients because by then you have to

be very careful in cutting through structures." (Female B)

"If I am not going to dissect, I will not become a doctor to treat patients and serve the country. I should not be scared of the cadavers, the blood, the blades and the injections. Whatever happens, we have to experience anatomy and dissection, we have to do it because if we don't we can't treat patients properly and we can't be called doctors. The dissection process teaches you that not all muscles are the same.... not all conditions of the patients are like the book and are the same. It is still easier now that as a student we are dissecting cadavers.. dead body; but in the future this is a training ground where we will be sharpened and honed to be the finest doctors." (Male)

#### **Discussion**

During their first day of cadaver dissection, students primarily felt fear as a result of apprehension about what they were about to do, which was essentially to cut into the flesh of a dead human body. As they proceeded to the tasks for the day, reminders from professors and group mates that cadaver dissection was needed to learn Human Anatomy and to pass medical school gave them the will to continue with the dissection process and progress. They became habituated to the cadaver's presence and eventually became more capable of feelings such as a sense of awe and amazement about the process of dissecting a human being as well as the external and internal variation of the human body. They were also increasingly curious about the unique structure of the body and how the cadaver's body reflects but varies from the atlases and models as well as when compared with other cadavers. Recognizing that the cadaver had a previous life and a soul, the students realized the need to respect the body which meant taking care of the cadavers to even asking permission during the dissection process. By covering the cadavers' face, talking with them while dissecting to ask permission, reminding on the objectives, importance and benefits of the dissection process and taking care of the cadavers as a sign of respect during the first day of cadaver dissection was essentially taming death as a rite of passage to being a doctor.

The findings of this analysis validate prior researches on the experiences of the students during cadaveric dissection. Of the five emergent themes, taming death as a rite of passage to being a doctor is the essence of the experiences of the first year medical students during the first day of cadaver dissection. In making death less powerful and the thoughts on dissecting dead people more controllable, the students had to overcome their fear of cutting thru a dead human body through group dynamics and respect for the body guided by their sense of awe and appreciation of the external and internal variations in terms of structures. The findings are similar to those of Robbins wherein the students gained awareness of the uniqueness of each body through the surprising discovery of the irregularities in the bodies of the cadaver; but more importantly the students underwent an emotional experience that demanded from them a confrontation with death and mortality by which they were challenged to mature into young medical professionals.<sup>10</sup> Undergraduate students found dissection as a tool that helps them better understand Anatomy and provides to visualize different organs of the human body and their relationship.<sup>11</sup>

The emotional issues during cadaveric dissection should be addressed. Proper conditioning of students prior to entering the dissection hall may be beneficial, in addition to enforcement of this practice under guidance from teachers.<sup>12</sup>

This qualitative study was conducted in only one medical school with only a small sample which allowed the researchers to focus on detailed descriptions and their meanings. Therefore, the findings may not be generalizable but remain valuable as they generate important educational issues. The results are revealing because instead of the dissection process being a stressful and tedious process as described in most researches, the study showed an appreciation of the experience not just in relation to the study of Human Anatomy but more importantly to the entire medical curriculum.

This study highlighted the importance of dissection using cadavers in the study of Human Anatomy as well as other relevant and positive learning opportunities to enhance the psychomotor skills and attitudes of future doctors. This study showed that students learn much more than a simple

understanding of the intricacies of the human body. They did not only learn Human Anatomy; but they also learned the need for empathy, care, and respect.

Based on the findings of the study, students have to be prepared mentally and emotionally before the commencement of cadaveric dissection considering that graduates of non-premed courses are being accepted in medical school. Teachers of the course must take this into consideration for a productive and stress-free anatomy learning through dissection.

Of the five emergent themes, taming death as a rite of passage to being a doctor is the essence of the experiences of the first year medical students during the first day of cadaver dissection.

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# A cross-sectional study on the biopsychosocial factors influencing quality of life and adherence to treatment of people living with HIV (PLHIV) in the National Capital Region

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## Abstract

**Introduction** This study investigated the association of selected biopsychosocial factors (i.e., CD4 cell count, self-stigma, and social stigma) with the quality of life and adherence to treatment of people living with HIV in the National Capital Region.

**Methods** A cross-sectional study design was conducted to document the health status and behavior of respondents affiliated with a clinic in Quezon City. Participants answered an online questionnaire containing the Berger HIV Stigma Scale, WHO-QOL for HIV, and HIV Treatment Adherence Self-Efficacy Scale. Bivariate analyses and prevalence risk ratios were used to determine the association of selected biopsychosocial factors with quality of life and adherence to treatment.

**Results** One hundred respondents were analyzed, of which 42% had CD4 cell counts < 350 cells/mm<sup>3</sup>, 43% had high self-stigma and 36% had high social stigma while 11% had poor QOL and 7% had poor ATT. There was no significant association of CD4 cell count, self-stigma and social stigma with quality of life and with adherence to treatment.

**Conclusion** A weak association was noted between poor QOL and low CD4 cell counts and among those who felt higher social stigma, but the relationships were not significant. The association between poor ATT and the selected biopsychosocial factors was not significant.

**Key words:** CD4 cell count, self-stigma, social stigma, quality of life, adherence to treatment

**I**n March 2016, the Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome

(HIV/AIDS) and the Anti-Retroviral Therapy (ART) Registry of the Philippines (HARP) reported 736 new HIV antibody seropositive individuals, which was 10% higher compared to the 667 antibody seropositive individuals in 2015. From January 1984 to March 2016, there have been 32,647 HIV antibody seropositive cases reported to HARP. Majority (43%) of these were recorded in the National Capital Region (NCR), with 14,102 cases being documented. The number of people newly diagnosed with HIV per day has drastically increased from one new case per day in 2008 to 29 new cases per day in 2016.<sup>1</sup>

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According to the World Health Organization (WHO), the Philippines continues to have one of the fastest growing HIV epidemics in the world, even though it was still considered to be of low prevalence. This alarming increase in the number of HIV cases has been attributed to several factors, such as having the lowest documented rates of condom use in Asia, increasing casual sexual activity, returning overseas Filipino workers from high-prevalence settings, widespread misconceptions about HIV/AIDS, and high needle sharing rates among injecting drug users.<sup>2</sup> Furthermore, different biopsychosocial factors had also been important considerations in the growing HIV epidemic. For instance, people living with HIV (PLHIV) experienced physical derailments and malfunctions brought about by the disease, had heavy emotional burdens, and feared isolation.<sup>3</sup> Since studies exploring the association of various biopsychosocial factors to the quality of life (QOL) and adherence to treatment (ATT) of PLHIV in the Philippines had been generally lacking, there was interest in identifying biopsychosocial factors that might possibly influence QOL and ATT. Any new information on determinants of HIV/AIDS might be valuable for health awareness advocacy campaigns, as well in improving current health programs for the prevention and control of this communicable disease.

This study determined the association of selected biopsychosocial factors - CD4 cell count, perceived self-stigma, and social stigma - to the QOL and ATT of people living with HIV in NCR.

## Methods

A cross-sectional study was conducted among people living with HIV (PLHIV) from a clinic in Quezon City using an online questionnaire which generated the respondents' biopsychosocial characteristics, measured stigma, quality of life and adherence to treatment. Three independent variables were analyzed, specifically CD4 level as the main biological factor, perceived self-stigma as the primary psychological factor, and social stigma as the sole social factor. In addition, the main dependent variables were QOL and ATT. The study was approved by the UERMMMCI Research Institute for Health Sciences Ethics Review Committee.

Those recruited were adult PLHIV currently on anti-retroviral therapy (ART) with recent CD4 level

determination and who were willing to answer an online questionnaire in Filipino. Excluded were those who exhibited neuropsychiatric clinical manifestations (e.g., schizophrenia, psychosis, etc.), those who were AIDS converted, and did not know how to use the internet/computer. A sample size of 100 respondents was computed using the formula for proportion of a single population, and were recruited via non-probability sampling (e.g., snowball method) from Klinika Bernardo, a social hygiene clinic and HIV treatment hub in Quezon City.

The online questionnaire had three parts, the first of which documented the demographics and biopsychosocial characteristics of the study subjects. The second part, which contained inquiries generated from the Berger HIV Stigma Scale, measured both self-stigma and social stigma.<sup>4</sup> It consisted of 24 items that measured self-stigma, including its two aspects personalized and negative self-stigma, and 16 items that measured social stigma, including its two aspects disclosure concerns and public attitudes. It was answered using a 4-point Likert scale (1 - strongly disagree, 2 - disagree, 3 - agree, 4 - strongly agree). Scores of 61 to 96 were considered as high self-stigma and 24 to 60, as low self-stigma. Scores of 41 to 64 were considered as high external stigma and 16 to 40, as low external stigma.

The third part was patterned after the validated WHO-QOL for HIV and the HIV Treatment Adherence Self-Efficacy Scale (HIV-ASES).<sup>5,6</sup> The QOL part consisted of 31 items that measured the six domains (physical health, psychological, level of independence, social relationships, environment and spirituality), answered using a 5-point Likert scale (1 - very dissatisfied, 5 - very satisfied). Scores of 13-20 were interpreted as good QOL and 4 to 12, as poor QOL. The HIV-ASES consisted of 12 items rated through a 10-point Likert scale. Scores of 67 to 120 were considered as having good ATT and 12 to 66, as having poor ATT. The Filipino version of the questionnaire was reviewed by a language professional. Pilot testing of the questionnaire was done, in cooperation with PLHIV from the non-government organization, Pinoy Plus Association, Inc. in Manila.<sup>7</sup>

After finalization of the main data collection tool, the questionnaire was uploaded on Online Forms by Google. All study subjects who met the inclusion criteria were asked to sign the informed consent form, before answering the online self-administered

questionnaire. All study subjects accessed the online questionnaire within the Klinika Bernardo facility, using a single computer. Each respondent took about 30 minutes to complete the online questionnaire.

Data gathered were encoded digitally and tabulated using the Statistical Package for the Social Sciences (SPSS Version 24). Frequency distribution, percentages, and means were used to present descriptive statistics, such as age and sex. Furthermore, Chi-square test, Fisher's exact test, and prevalence risk ratio were used to analyze the association between variables.

## Results

A total of 106 respondents agreed to participate in the study. However, six were excluded since two of them had already converted to AIDS, while the remaining four did not know their current CD4 cell count. Thus, only 100 respondents were included in the study and analyzed. Majority (97%) of respondents were genotypic males, reflecting the vulnerable population for HIV in the Philippines, specifically the men who have sex with men (MSM). The age range was 15-50 years (31.2 years  $\pm$  6.66 years), but majority of the study subjects (57%) were aged 26-35 years. Most of the subjects were single (94%) and high school graduates (77%).

Important to note was almost all subjects (97%) had affiliation with HIV/AIDS support groups, such as Partnership for Prescription Assistance, The Project Red Ribbon, AIDS Society of the Philippines, White Dove Community Care Inc., Pinoy Plus Association

Inc., HIV/AIDS Support House Inc. (HASH), and Take the Test. In addition, 99% of the respondents were diagnosed to have HIV within the last five years, while only 1% was diagnosed to have HIV more than five years ago. The mean CD4 cell count was 448.8 cells/mm<sup>3</sup> (SD=222.76); majority (87%) of the study subjects remained asymptomatic and with good functional capacity, with most (81%) being aware of how they acquired the HIV infection.

Forty-two percent of respondents had CD4 cell counts < 350 cells/mm<sup>3</sup>, 43% had high self-stigma and 36% had high social stigma while 11% had poor QOL and 7% had poor ATT as seen in Table 1. There was no significant association of CD4 cell count, self-stigma and social stigma with quality of life and with adherence to treatment (Table 1).

## Discussion

### CD4 cell count as a biological factor

Monitoring the disease status of PLHIV through immunological markers, such as CD4 cell count, has been a cornerstone for managing patients prior to and during ART. CD4 cell count has been used as a guide for assessing risk for opportunistic illnesses, for determining the timing of ART initiation, and for evaluating possible treatment failure.<sup>8</sup> Moreover, CD4 cell count has been strongly associated with HIV progression to AIDS-related illnesses or deaths. However, rapid progression to AIDS could be prevented through ART, coupled with early

**Table 1.** Bivariate analysis of selected biopsychosocial factors and QOL and ATT among PLHIV.

	Quality of Life		p-value*	Adherence to Treatment		p-value*
	Poor	Good		Poor	Good	
Biological factor: CD4 cell count						
• < 350 cells/mm <sup>3</sup>	5	37	1.15 (0.38-3.52)	1	41	0.23 (0.03-1.84)
• $\geq$ 350 cells/mm <sup>3</sup>	6	52		6	52	
Psychological factor: Self-stigma						
• High Level	4	39	0.76 (0.24-2.42)	1	42	0.33 (0.04-2.86)
• Low Level	7	50		4	53	0.39
Social factor: Social stigma						
• High Level	5	31	1.48 (0.49-4.52)	1	35	0.44 (0.05-3.83)
• Low Level	6	58		4	60	0.65

\* Fisher exact test

diagnosis; thus, in the advent of better and faster diagnosis with prompt initiation of effective medications, PLHIV would now have a longer life expectancy.<sup>9</sup>

However, previous researches found inconsistent association between CD4 cell count and QOL. One study showed that patients with higher CD4 cell counts had better QOL, while patients with lower CD4 cell counts had poorer QOL. PLHIV with higher CD4 cell counts usually had better nutrition, higher educational attainment, higher socioeconomic status, better employment opportunities, and an effective health care support system; thus, their QOL was deemed better, as compared to PLHIV with low CD4 cell count.<sup>10</sup> However, another study found the relationship between CD4 cell count and QOL not to be statistically significant, and female PLHIV were documented to have poorer QOL compared to male PLHIV.<sup>9</sup>

Bivariate analysis of this study also found weak association between low CD4 cell count and poor QOL, but this relationship was not statistically significant (PRR=1.15, 95% CI 0.38, 3.52). Important to note was that majority of subjects, regardless of CD4 cell count, still reported good QOL. This observation could be explained possibly by the self-report of majority of the subjects (87%) of having no subjective complaints and good functional capacity. Since there were no significant limitations in the ability of the subjects to perform their regular activities of daily living, regardless of their current levels of CD4 cells, good QOL was still the common perception. This finding suggested that CD4 cell count was not a significant determinant for poor QOL, and the drop of CD4 cells below 350 cells/mm<sup>3</sup> did not automatically translate to apparent perception of poor QOL.

QOL could be viewed as a subjective construct and thus, several factors aside from immunological markers could consequently influence it.<sup>10</sup> Some factors believed to affect QOL would be age, socioeconomic status, behavioral characteristics, psychiatric conditions to include depressive and anxiety symptoms, annual income, socialities and relationships, and educational attainment.<sup>9,11</sup> Another possible determinant of QOL was gender. Given that majority of the subjects were males and only three were females, this unequal distribution in terms of gender could also be a potential source of interference in the data gathered.

ART had been the mainstay of management of HIV/AIDS, especially in reducing overall mortality. Readily available antiviral agents had been recommended to achieve life-long viral suppression, though cure and complete restoration of health had never been the main objective of ART.<sup>12</sup> Consequently, good compliance to ART had been previously linked to good QOL, together with lower HIV viral load, absence of debilitating symptoms, greater CD4 cell count, and higher levels of hemoglobin.<sup>13</sup> Thus, looking into compliance to ART could also be an important parameter to consider in the holistic management of PLHIV.

Patients with high CD4 cell counts ( $\geq 660$  cells/mm<sup>3</sup>) demonstrated suboptimal ATT, as compared to PLHIV with intermediate (450-660 cells/mm<sup>3</sup>) and low ( $\leq 450$  cells/mm<sup>3</sup>) CD4 cell counts.<sup>14</sup> Such an observation could be reflected in this study since low CD4 cells counts and poor ATT had a PRR of 0.23 (95% CI 0.03, 1.84). However, this finding was not consistent with other investigations, which concluded that PLHIV with CD4 cell counts of 200-400 cells/mm<sup>3</sup> exhibited the most favorable ATT.<sup>15</sup>

Findings of this study revealed that PLHIV generally exhibited good ATT, regardless of their CD4 cell counts, an observation consistent with other previous investigations.<sup>13,14</sup> Reasons for such inconsistencies in the behavior of PLHIV when it comes to ATT could still be explored. A high level of CD4 cell count could reflect positive response to ART, which consequently might result in either good ATT or poor ATT.

### **Self-stigma as a psychological factor**

The growing epidemic and pathogenicity of HIV/AIDS had become a major public health concern not only in the Philippines, but also from the global perspective. The impact of the condition on the patient resulted in the need for a holistic type of management that addressed the emotional and psychological issues of fear, ignorance, denial, anger with PLHIV. Perceived self-stigma, therefore, was conceptualized because of internalization of guilt, blame, hopelessness, shame, and fear for discrimination among PLHIV.<sup>16</sup>

Many investigators have studied potential barriers to achieving good QOL and having good ATT among PLHIV.<sup>17-20</sup> In sub-Saharan Africa, PLHIV compromised health-related QOL due to effects of

clinical depression and negative self-esteem brought about by self-stigma. The depression had been further aggravated by anxiety symptoms and feelings of alienation among PLHIV. Thus, some experts concluded that there was an urgent and apparent need to confront self-stigma, as this might undermine ATT in HIV/AIDS prevention and treatment.<sup>20</sup>

This study revealed that perceived high self-stigma was not associated with poor QOL (PRR=0.76, 95% CI 0.24, 2.42), as well as with poor ATT (PRR=0.33, 95% CI 0.04, 2.86). The lack of association could be explained by the difference in how each PLHIV viewed self-stigma. For instance, HIV-related stigma could manifest differently and in varying degrees among PLHIV.<sup>21</sup> A meta-analysis of 4,104 PLHIV demonstrated a negative correlation between self-stigma and disclosure of HIV status to others.<sup>22</sup> Past experiences of rejection due to one's HIV status, as well as subjective beliefs regarding how negatively PLHIV were regarded by others, had significantly impacted on the desire of PLHIV to disclose their HIV status to others.<sup>23</sup> Thus, some PLHIV could have endured difficulties in sustaining regular social interaction and relationships with peers, which eventually could result in poor QOL.<sup>17</sup>

Interesting to note also was that majority of the subjects had low perceived self-stigma level. This positive outlook of the subjects could be observed, and a possible explanation behind this was the presence of effective support groups, in the form of special HIV/AIDS non-government organizations, among the respondent PLHIV. Negative experiences brought about by being HIV positive could contribute to the perceived self-stigma. However, over time, better acceptance of one's HIV status had been attained perhaps through regular counseling sessions among support group members. In addition, educational attainment could be reflective of how PLHIV understood their medical condition, thereby enabling them to be empowered to seek a more active role in holistically managing their HIV status.

Perceived self-stigma has been documented to vary across different social environments.<sup>24</sup> For some, self-stigma might be perceived as a mere phase or an obstacle that the respondent had to successfully deal with and eventually transcend. Social settings could also play a role in the development of self-stigma, as a more supportive social setting could prevent the negative emotions commonly associated with having HIV. In contrast, some studies also suggested the

influence of family members, specifically spouse and biological children, could be negative at times, especially when they become the source of pressure and psychosocial stressor. This undue stress from family members could subsequently yield poor self stigma.<sup>24,25</sup> This, however, did not appear evident among the subjects since majority of them were single males.

Despite the lack of association, self-stigma might still have a strong implication for PLHIV in terms of treatment, care, and support. HIV-related self-stigma could potentially compromise QOL of PLHIV, reduce their willingness to disclose their status to significant others, and affect their access to healthcare and compliance to ART.<sup>21</sup>

### **Social stigma as a social factor**

Social stigma, an interpersonal experience of stigma, referred to discriminatory behaviors directed towards people with stigmatized conditions, specifically towards PLHIV.<sup>21</sup> HIV-related stigma could potentially impact the health and well-being of PLHIV negatively, with deleterious effects on their care, treatment, and quality of life.<sup>25</sup>

The QOL of PLHIV could be affected not only by one's general health, but by psychological well-being and social status. The psychosocial aspect of QOL had been increasingly important for PLHIV, as the QOL had been shown to deteriorate relative to the progression and chronicity of HIV infection.<sup>26</sup> This decline could be triggered not only by disease stage and physical condition, but could also be precipitated by social stigma among other factors.

This study determined that PLHIV with high degree of social stigma had weak association with poor QOL, but this relationship was not statistically significant (PRR=1.48, 95% CI 0.49, 4.52). This finding implied that PLHIV had good QOL, regardless of the level of social stigma experienced.

Apparently, the level of social stigma that the respondent PLHIV received did not necessarily affect their QOL. Such an observation could be explained by the fact that majority of the study participants had CD4 cell counts  $\geq 350$  cells/mm<sup>3</sup> (58%) and were asymptomatic (87%), enabling these PLHIV to continue to have a good QOL. This observation is consistent with findings of other studies which

found that PLHIV who exhibited clinical symptoms had poorer QOL, compared to asymptomatic patients.<sup>27</sup> Moreover, as CD4 cell count improved, PLHIV manifested better health outcomes, became clinically stable, and subsequently felt good QOL.<sup>28</sup> Similarly, having effective social support group could be appreciated in this particular setting, wherein 97% of subjects were affiliated with one or more HIV/AIDS organizations in the Philippines. Since the development of stigma involved social interactions, it followed that social support could affect HIV-related stigma.<sup>29</sup> A supportive environment that accepted a person with HIV infection and provided positive experiences could help build a person's self-esteem and self-efficacy, while reducing psychological distress, including potential depression. Moreover, health and wellness, relationships and recreation, and faith-based aspirations were just some of the coping strategies the respondents could have possibly developed in dealing with stigma and discrimination.<sup>30</sup> Counseling programs, seminars and talks, health and wellness programs of various HIV organizations, like The Project Red Ribbon, Pinoy Plus Association Inc., HIV/AIDS Support House, Inc., played an important role in developing various coping strategies among PLHIV. In addition, the study participants were not challenged by any neuropsychiatric illnesses and so, were not deprived of opportunities to improve their QOL.<sup>31</sup>

Results of this study also showed that the respondent PLHIV had good ATT, regardless of the degree of social stigma experienced. The level of social stigma that PLHIV received appeared not to significantly affect their ATT. This finding was incongruent with other studies that concluded that PLHIV who experienced high levels of social stigma were more likely to report poor access to care and exhibited poor health-seeking behavior.<sup>32-34</sup>

The fact that most respondent PLHIV were part of HIV/AIDS organizations or support groups could have influenced the results of this study. Being a member of these social networks implied an optimistic outlook for most Filipino PLHIV, and this attitude could affirmatively influence their positive health seeking behavior and subsequent good compliance to ART. These support systems provided by HIV/AIDS organizations also helped PLHIV gain better access to HIV treatment, on top of the benefits derived from the regular psychosocial support extended by organization members to each

other. A highly perceived social support had been associated with less perceived HIV/AIDS stigma. Moreover, individuals who received social support were more capable of effectively dealing with life stressors, such as discrimination.<sup>35</sup>

A weak association was noted between poor QOL and lower CD4 cell counts (PRR=1.15, 95% CI 0.38, 3.52) and among those who felt higher social stigma (PRR=1.48, 95% CI 0.49, 4.52), but the relationships were not deemed statistically significant. No association was noted between poor ATT and the selected biopsychosocial factors.

A weak association was noted between poor QOL and low CD4 cell counts and among those who felt higher social stigma, but the relationships were not significant. The association between poor ATT and the selected biopsychosocial factors was not significant.

The current study had limitations that need to be addressed in future research. First, data were gathered only from PLHIV who were affiliated with Klinika Bernardo. Accordingly, generalization of the findings of this study to other PLHIV should be done with caution. Moreover, recruiting PLHIV participants from different organizations and regions within the Philippines can ensure a better approximation of the Filipino PLHIV population. Second, this study focused on the associations of CD4 cell count, self-stigma, and social stigma to QOL and ATT, without considering other pertinent biopsychosocial factors, (i.e., presence of comorbid conditions and opportunistic infections, family dynamics and socio-economic profile of the subjects). In the future, a more exhaustive inquiry on other biopsychosocial factors should be probed on. Lastly, the current study utilized a cross-sectional design, making it difficult to formulate causal relationships among variables. Future research efforts could use a mixed method qualitative-quantitative longitudinal design.

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# A cross-sectional descriptive study on the earthquake preparedness of selected highly vulnerable barangays in Metro Manila

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## Abstract

**Introduction** A 7.2 magnitude earthquake arising from the West Valley Fault will result in thousands of lives lost and severe damage to property and infrastructure. This study aimed to determine the disaster preparedness of barangays in Metro Manila along the West Valley Fault.

**Methods** This was a cross-sectional study of high risk barangays in six cities along the West Valley Fault using the Disaster Preparedness Audit. A total of 40 barangays were assessed on their levels of disaster preparedness in terms of percentage fulfilment of different criteria in the four thematic areas: 1) prevention and mitigation 2) preparedness 3) response and rehabilitation, and; 4) recovery.

**Results** None of the surveyed barangays could fulfil all the 27 criteria for disaster preparedness. Most were only able to satisfy 50-74% of the criteria. As per thematic area, no barangay met  $\geq 75\%$  of the criteria for prevention and mitigation whereas 87.5%, 67.5% and 80% satisfied  $\geq 75\%$  of the criteria for preparedness, response and recovery, respectively. In terms of overall disaster preparedness, less than half of the surveyed barangays satisfied  $\geq 75\%$  of the total criteria.

**Conclusion** Most of the barangays surveyed are inadequately prepared to cope with disaster arising from a major earthquake generated by the West Valley Fault.

**Key words:** Disaster preparedness, earthquake preparedness, emergency management

In the last 10 years, more than 2.6 billion people have been affected by natural phenomena such as

earthquakes, tsunamis, landslides, floods, and extreme weather. Although the occurrence of natural disasters in Asia declined from an average of 158 in 2000-2008 to 135 in 2009, among the continents, Asia still experienced the largest share of natural disaster at 40.3%.<sup>1</sup>

The Philippines ranked first in the top 10 countries that reported the most number of disaster events. One of the factors that increases the country's vulnerability to disasters, particularly those that are geophysical in nature, is its distinct tectonic setting. Due to numerous fault lines, the country experiences an average of 20 earthquakes per day and damaging

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earthquakes have been recorded in the past.<sup>2</sup> To set the parameters and magnitude of each earthquake, several earthquake catalogs have been developed. These catalogs revealed that the greatest concern for Metro Manila is the Valley Fault System, which runs a stretch of 90-135 km and is cited to pose the most significant threat.<sup>3</sup> The human impact of the movement of the Valley Fault System among areas of highest regional vulnerability was determined in the 2004 Metropolitan Manila Earthquake Impact Reduction Study (MMEIRS) conducted by the Japan International Cooperation Agency (JICA) in conjunction with the Philippine Institute of Volcanology and Seismology (PHIVOLCS). The MMEIRS found that an earthquake with a magnitude of 7 or more along the West Valley fault is expected to occur and would cause collapse of 40% of total residential buildings in vulnerable areas, and result in 34,000 deaths and 114,000 injured.<sup>4</sup>

Due to the threat, a list of barangays with high regional vulnerability was publicly released by the PHIVOLCS in 2015. The National Disaster Risk Reduction and Management Council (NDRMMC), the national agency governing the implementation of disaster preparation and response in the country, established a national guide through the National Disaster Risk Reduction Management Plan (NDRRMP) which outlines strategies and activities that aim to strengthen the capacity of both the national and local governments in disaster risk reduction and management. However, literature suggests that implementation of disaster preparedness plans is either discontinuous or only done during a disaster.<sup>2</sup> A direct relationship was also observed to exist between the prevalence of a natural event and disaster preparedness. The less often a natural event occurs, the less likely disaster managers prepare.<sup>5</sup> Although considered the smallest political unit, the barangay is expected to be the frontline of emergency measures during disasters per the Local Government Code of 1991. Moreover, a community's mutual support systems and reliance on its own resources have been found to result in least damage and fast recovery from disasters.<sup>7</sup> Survival strategies in the community level are used to cope with the impacts of disaster before outside help is available.<sup>8</sup> Hence, a study on the barangay's disaster preparedness was undertaken.

This study aimed to determine the level of disaster preparedness for a major earthquake generated by the West Valley Fault among vulnerable barangays in Metro Manila. Specifically, the study aimed to determine percentage of criteria complied with in each of the four thematic areas of prevention and mitigation, preparedness, response, and recovery, determine overall compliance, and determine compliance by city. Results of the study would contribute to existing literature on disaster preparedness at the community level and to the planning of sustainable community-based disaster preparedness programs and policies.

### Methods

The study employed a cross-sectional descriptive design involving highly vulnerable barangays based to their location along the West Valley Fault from a list released by PHIVOLCS. Key informants identified to be members of the Barangay Development Council (BDC) served as study respondents. The investigators conducted face-to-face interviews using the Community Profile Questionnaire and the Disaster Preparedness Audit. The study was approved by the Ethics Review Committee. Informed consent was obtained from each of the respondents.

Using the formula for estimation of a population proportion with a desired precision of 0.05 at 0.05 level of significance and 95% confidence interval, a sample size of 384 barangays was computed. Since the computed value was greater than 5% of the available population size, i.e., 42 highly vulnerable barangays, a finite population correction was used and the final required sample size was computed to be 38 barangays. The number of barangays per municipality was obtained through proportionate sampling.

Disaster preparedness was related to the community's compliance to the different criteria under the thematic areas of prevention and mitigation, preparedness, response and recovery. Level of preparedness was defined as percentage of fulfillment of the criteria under each dimension categorized as <50%, 50-74%, and ≥75%.

The instruments used were the Community Profile Questionnaire, which captured community demographics, and the Disaster Preparedness Audit

(DPA) tool condensed from the original tool of the Department of the Interior and Local Government (DILG).<sup>9</sup> The DPA contained 27 criteria under the four thematic areas of disaster preparedness: preparedness, prevention and mitigation, response, and recovery. Each thematic area contained different criteria to assess disaster preparedness: 11 criteria under prevention and mitigation, 8 under preparedness, and 4 each under response and recovery. Pretesting of the tool was done in Laguna, which is also one of the highly vulnerable areas identified by PHIVOLCS.

Data from the barangays were collected through face-to-face interviews with members of the BDC. Observation and records review were also done to validate data obtained from key informants. Data were then encoded in MS Excel and processed using the Statistical Package for the Social Sciences (SPSS) version.<sup>13</sup> Frequency tables were generated to show the distribution of the barangays in terms of demographic data, i.e., available facilities, services, and economic activities, and in terms of disaster preparedness. The barangays were evaluated based on percent fulfillment of the criteria under each thematic area as less than 50%, 50 to 74% and  $\geq 75\%$ .

## Results

Majority (40%) of the respondents were barangay office staff, while the rest were disaster team leaders and coordinators, barangay captains and barangay councilors. The mean age of the respondents was 52 years; there were more male (75%) respondents, as seen in Table 1.

**Table 1.** Characteristics of respondents from the 40 participating barangays.

Characteristics of Respondents	Barangays No. (%)
Age (years)	
20-39	4 (10.0)
40-59	27 (65.5)
60-79	9 (22.5)
Sex	
Male	30 (75.0)
Female	10 (25.0)
Position	
Barangay Captain	8 (20.0)
Kagawad	7 (17.5)
Disaster Team Leaders and Coordinators	9 (22.5)
Barangay office staff	16 (40.0)

More than half of the barangays had a population density of 10,000 to 49,999 persons per square kilometer. The public jeepney/tricycle was the dominant mode of transportation while the main access route was the national road in most of the barangays. The most common source of drinking water was private waterworks. Less than half of the barangays had a sewerage system. Almost two-thirds of barangays had a flush toilet system but most of the barangays surveyed in Muntinlupa and Taguig City used the pail system (Table 2).

More than two-thirds of respondent barangays in every city had a fire station but less than half had a police station. At least 70% of the barangays had a senior citizens center, livelihood training, alternative learning, and health and nutrition programs. All barangays had access to landline and cellphone service. Public hospitals were found in only four of the barangays surveyed and less than half had private hospitals. Private clinics, drug stores and public health centers were present in at least 80% of barangays (Table 2).

The major economic activities of community members varied across the barangays. Although professional work and services were most common followed by trade, it occurred in less than half of the selected barangays in each municipality. Trade was most predominant among the barangays in Marikina, Makati and Quezon City; fishing and services for Muntinlupa; trade and manufacturing for Pasig. Almost all barangays had organizations which could be mobilized for volunteer work (Table 2).

Among the 11 criteria under prevention and mitigation, compliance was at least 75% in information and communications, clean-up and dredging of canals, waste segregation, inventory of sources of pollution and presence of a clinic. Compliance was moderate in the presence of a maintenance area, collaboration with other agencies, and identification of local and foreign agencies for support and response operations. None of the barangays met the requirement for a management team with two members per 300 people (Table 3).

In the area of preparedness, all barangays surveyed had a LDRRM plan and communication protocols with the municipal government. The other criteria with at least 80% compliance were community-based disaster risk management and LDRRM plan based on Hazard Vulnerability and

## Earthquake preparedness of selected highly vulnerable barangays in Metro Manila

**Table 2.** Socio-demographic characteristics of 40 barangays surveyed.

Socio-demographic Characteristics	Total Barangays No. (%)
Population density	
<10,000	4 (10.0)
10,000 - 49,999	23 (57.5)
50,000 - 99,999	9 (22.5)
≥100,000	4 (10.)
Transportation	
Private car/jeepney	7 (15.0)
Public jeepney/tricycle	29 (72.5)
Others (e.g. <i>padyak</i> , pedicab)	4 (10.0)
Main access route	
National road	38 (95.0)
Seasonal road	1 (2.5)
Alley	1 (2.5)
Drinking water	
Private waterworks	32 (80.0)
Purchased	8 (20.0)
Sewerage system	14 (35.0)
Toilet facility	
Flush toilet	23 (57.5)
Pail system	17 (42.5)
Services	
Fire station	28 (70.0)
Police station	19 (47.5)
Senior citizens center	29 (72.5)
Livelihood training program	35 (87.5)
Alternative learning system	31 (77.5)
Health and nutrition program	37 (92.5)
Infrastructure and communication	
Landline	40 (100.0)
Cellphone service	40 (100.0)
Public hospital	4 (10.0)
Private hospital	13 (32.5)
Private clinic	35 (87.5)
Drug stores	38 (95.0)
Public health centers	37 (92.5)
Economic activities of residents	
Professional work	14 (35.0)
Trade	7 (17.5)
Fishing	3 (7.5)
Manufacturing	1 (2.5)
Services	10 (25.0)
OFW	2 (5.0)
Space rental	1 (2.5)
Economic activities in the community	
None	2 (5.0)
Farming	4 (10.0)
Fishing	7 (17.5)
Manufacturing	10 (25.0)
Trade	26 (65.0)
Service	14 (35.0)
Organizations for volunteer work	39 (97.5)

**Table 3.** Percentage distribution of disaster preparedness per thematic areas among 40 selected barangays.

Thematic Areas	Total Barangays No. (%)
<b>Prevention and Mitigation</b>	
Management team with 2 members per 300 people	
Relief	0
Health and Medical	0
Security/Peace and Order	0
<b>Evacuation Center</b>	
Clinic	30 (75.0)
Information and communication area	38 (95.0)
Maintenance area	29 (72.5)
Practicing waste segregation	34 (85.0)
Nearby open dumpsites, polluted rivers, factories, piggery, poultry or other sources of pollution are listed	23 (79.3)
Clean-ups and dredging of canals	37 (92.5)
With identified and established local and foreign agencies for financial and "in kind" support and response operation	24 (60.0)
With established collaborative efforts with NGAs, NGOs, PSOs, CSOs or other partners	26 (65.0)
<b>Preparedness</b>	
LDRRM plan on prevention/mitigation, preparedness, response, recovery/rehabilitation	40 (100.0)
LDRRM plan based on Hazard Vulnerability and Capacity Assessment	33 (82.5)
Established RDANA (Rapid Damage Assessment Needs Analysis) plan	30 (75.0)
Community-based Disaster Risk Management (CBDRM) practiced	39 (97.5)
Established communication protocols between municipal to barangay level	40 (100.0)
Established communication protocols between barangay level to municipal level	40 (100.0)
Disaster resilient architecture and engineering incorporated to infrastructures	21 (52.5)
Architecture of buildings modified to adapt to multiple hazards	20 (50.0)
<b>Response</b>	
Established evacuation centers	5 (12.5)
Identified open ground/area to serve as an encampment for tent and other mobile temporary shelter (in cases there are no established evacuation center facility)	34 (85.0)
People to monitor water sources during a disaster	32 (80.0)
Environmental watchers deployed during a disaster	36 (90.0)
<b>Recovery</b>	
Accessible health facilities (i.e. health center, public/ private hospitals/ clinics)	35 (87.5)
Vulnerable groups (i.e. sick, elderly, disabled, women and children) prioritized in terms of health needs	43 (85.0)
Clean and adequate supply of drinking water ensured after a disaster	26 (65.0)
Regular clean-up drives	38 (95.0)

Earthquake preparedness of selected highly vulnerable barangays in Metro Manila

**Table 4.** Percentage distribution of 40 barangays according to level of preparedness for each thematic area.

Dimensions	Level of Preparedness		
	<50% No. (%)	50-74% No. (%)	≥75% No. (%)
Prevention and mitigation	11 (27.5)	29 (72.5)	0
Preparedness	0	5 (12.5)	35 (87.5)
Response	4 (10.0)	9 (22.5)	27 (67.5)
Recovery	2 (5.0)	6 (15.0)	32 (80.0)
Overall	2 (5.0)	23 (57.5)	15 (32.5)

**Table 5.** Frequency distribution of barangays according to level of preparedness per city.

Dimension	City					
	Makati (n=4)	Marikina (n=4)	Muntinlupa (n=7)	Pasig (n=2)	Quezon City (n=11)	Taguig (n=12)
Prevention and mitigation						
<50%	0	0	0	0	3	8
50-74%	4	4	7	2	8	4
≥75%	0	0	0	0	0	0
Preparedness						
<50%	0	0	0	0	0	0
50-74%	0	0	0	0	2	3
≥75%	4	4	7	2	9	9
Response						
<50%	0	0	0	0	1	3
50-74%	0	2	3	0	1	3
≥75%	4	2	4	2	9	6
Recovery						
<50%	0	0	0	0	0	2
50-74%	1	0	0	0	2	3
≥75%	3	4	7	2	9	7
Overall						
<50%	0	0	0	0	0	2
50-74%	2	1	4	0	7	9
≥75%	2	3	3	2	4	1

Capacity Assessment. Only 52.5% and 50% reported incorporation of disaster resilient architecture and engineering to infrastructures and modification of structures, respectively (Table 3).

In the area of response, there was 80 to 90% compliance with environmental watchers during disaster, open grounds or areas for evacuation identified and people assigned to monitor water sources. Only five barangays had established evacuation centers (Table 3). Under the last thematic area, which is recovery, there was 85 to 95% compliance with regular clean up drives, identified health facilities that could be accessed, and

prioritization of vulnerable groups. A lower proportion reported availability of clean and adequate drinking water source after a disaster (Table 3).

Overall, a third of the barangays surveyed met more than 75% of 27 criteria on disaster preparedness, more than half of barangays fulfilled 50-74%, and two barangays, both in Taguig met less than half of the criteria. None of the barangays fulfilled 75% of the criteria for prevention and mitigation and 11 barangays had less than 50% compliance. The percentages of barangays that satisfied at least 75% of criteria were 88% in preparedness, 80% in recovery and 68% in response (Table 4). At the level of the

city or municipality, Pasig and Marikina had the highest percentage of barangays which were most prepared. At least 57% of barangays from all cities satisfied at least 75% of criteria for preparedness, response and recovery. More than half of the barangays in Makati, Muntinlupa, Quezon City and Taguig were considered as moderately prepared (Table 5).

## Discussion

In this study, four thematic areas of overall disaster preparedness were evaluated. Prevention and mitigation entail reduction of vulnerabilities and hazards, and enhancement of the community's capacity, while preparedness refers to the creation of disaster plans and systems, incorporation of disaster-resilient designs, and modification of architectural buildings to adapt to hazards. Response includes provision of basic needs whereas recovery involves restoration or continuity of community activities post-disaster.

Despite the national initiative of formulating disaster risk reduction strategies through an LDRRM plan in every barangay, gaps were found in mainstreaming the plan in respective LGUs. The study found gaps in the implementation of disaster preparedness plans as shown by less than 75% percent fulfillment of the disaster preparedness criteria by most barangays (57.5%). This corroborates research on community-based disaster preparedness which revealed that despite the potential of increasing the capacity and disaster resilience of communities, limited practice of community-based disaster preparedness is observed.<sup>10</sup>

In this study, several gaps in the implementation of disaster preparedness plans were found. In the area of prevention and mitigation, management team for relief, health and medical, security/peace and order, with two members per 300 population, identification and establishment of local and foreign agencies for support and response operation, and collaborative efforts with non-governmental and civic society organizations were the principal criteria that were primarily unmet. The absence of having a management team of two members per 300 population may be attributed to the lack of available and trained personnel. The absence of public health centers in three barangays and public hospitals in 36 barangays contributed to the inability to meet the

proposed health management team to population ratio of 2:300 since there may be no public health personnel to train. In the same way, the lack of police stations in 21 of 40 barangays resulted in the scarcity of officers to lead the security/peace and order team. Barangays form their disaster management team from members of their own community and when deficient in number of personnel, the ratio of two management team members to 300 population would be unmet. In addition, the high population density of some barangays could have been a factor in meeting the required ratio.

However, the number of trained personnel may not necessarily be the most important factor in disaster preparedness. In a study on a terrorist gas attack in Tokyo, it was reported that despite the insufficient number of the management team, the disaster response was considered a success.<sup>11</sup> Efficiency and capability of response teams offset the lack of manpower. In a report by Tayag and Insauriga on the response in the 1990 Luzon earthquake, it was also found that although rescue teams were present, capability in disaster response was more emphasized.<sup>12</sup>

Another gap found was identification and establishment of local and foreign agencies for external support. Apart from creating a LDRRM plan, the BDC should also report other funding sources and support aside from LGUs. Forty percent (40%) of barangays reported absence of other local or foreign funding sources while the remainder identified local groups such as homeowners' associations, Rotary Clubs and fraternities. Political dynamics was identified to play a role in having external support in times of disaster. Typically, a government favors spending in areas that are politically aligned with the party in power. Moreover, a government that lacks external support can also exhibit a ratchet effect, where the government intentionally neglects to support a population to draw attention and then steal humanitarian aid during a disaster as international organizations are more likely to tolerate theft in times of disaster as they are more focused on providing needed aid.<sup>13</sup> Another reason for the absence of external support is the perceived capability of the barangays with high economic status to support themselves.

In the area of preparedness, incorporation of disaster resilient architectures and engineering in infrastructures and modification of architectural buildings to adapt to multiple hazards were a

challenge reported in nearly half of the barangays surveyed. Numerous structures had been built before the 1991 National Building Code of the Philippines. Although there is an existing law, its implementation remains a challenge. A Filipino architect and urban planner, Palafox stated that the country is still lacking in the provision of resilient and sustainable infrastructures.<sup>14</sup> For instance, in the aftermath of the Bohol and Cebu earthquake in 2015, most buildings were discovered to be structurally unfit to withstand a high intensity earthquake. The deficit resulted from use of cheap substandard materials, shortcuts in labor procedures and irregular processes in acquiring building permits. Modification of buildings was reported to be difficult as it required funds and involved a lengthy and tedious process of securing permits.

Apart from issues on the safety of infrastructures, barangays also reported resistance and lack of cooperation from families whose houses lie on or within 500 meters from the fault line. This was attributed to unrealistic optimism bias, where people believe they are at less risk of experiencing a disaster compared to others. Moreover, people do not perform actions despite having the motivation when effects of hazards are perceived as fundamentally unbeatable, when they perceive themselves having low efficacy, or are not entirely disposed to cope with the situation. A sense of fatalism or belief that the disaster may be too catastrophic that preparedness may be inefficient can also influence the lack of preparedness.<sup>15</sup>

The findings also revealed that establishment of evacuation centers was the second criteria least met. Although the DILG's DPA tool includes assessment on existence of evacuation centers in barangays, the NDRRMP clearly states that safe and timely mobilization of affected community members is the LGU's principal role during disaster. Addressing shelter needs is a task assigned to the Department of Social Welfare and Development (DSWD) with the LGUs serving as partner agencies. This may explain the low percentage of surveyed barangays reporting presence of evacuation centers in their communities. Despite the lack of evacuation centers, temporary shelters exist and the top three were schools, basketball courts and streets. The use of temporary shelters is commonly observed in developing countries due to lack of resources. Unfortunately, ventilation, space, cultural and social issues and integration of sanitation and hygiene that are all critical to disaster

recovery are not usually considered in these temporary shelters.<sup>16</sup>

Aside from shelter, it is expected that after a disaster, utility services such as water supply could be disrupted. Access to clean and adequate supply of drinking water after a disaster was reported by the barangays to be a challenge. This was observed to result from total reliance on private waterworks. Despite awareness on the need for alternative water source, increased dependence on private water companies and supply from evacuation centers was reported.

Although gaps exist in the implementation of disaster management plans, there were criteria which nearly all barangays satisfied. These include the presence of LDRRM plan, practice of CBRDM, establishment of communication protocols, assignment of environmental watchers, and prioritization of vulnerable groups particularly the elderly, sick, disabled, pregnant, and children. The NRRMC mandates barangays to create a LDRRM plan to which all surveyed barangays complied. Practice of CBRDM was also observed. Community participation, on the other hand, was reflected by the high percentage of barangays with existing community groups and organizations tapped for volunteer work and service. All barangays surveyed reported existence of established communication protocols between the municipal and barangay level. Presidential Decree No. 1 mandates the Office of the Civil Defense to establish standard procedures on the communication system in municipal and barangay disaster risk reduction and management councils.<sup>17</sup>

Among the thematic areas in disaster preparedness, criteria under prevention and mitigation were identified as the most difficult to meet. Prevention and mitigation entail resources, particularly, manpower for the proportional distribution of disaster management team and support from external sources were found lacking in most barangays. On the other hand, preparedness was the thematic area where more than 75% of the criteria were met by most barangays.

Despite being aware that they are at high risk for a large-scale earthquake, not a single barangay was able to meet all the 27 criteria of disaster preparedness. Majority were only able to fulfill at least half of the criteria. The study likewise revealed that the key challenge in disaster preparedness at the barangay level lies in the implementation of local disaster preparedness plans. The creation of a disaster

plan is not the final step in preparing for a disaster. Implementation and community integration are key to the success of disaster preparedness. Although considered the smallest political unit, the barangay plays a crucial role in disaster response. Survival strategies at the barangay level are used to cope with impacts of disaster before outside help is available. Therefore, its role in mitigating the impact of disaster is crucial. Even though a legal framework through the NDRRM plan exists, the lack of financial and human capacity still undermines disaster preparedness efforts thereby resulting to failure in the achievement of its goals.

More local studies on disaster preparedness should be undertaken. Study designs that can provide evidence of association or causation between factors such as community characteristics and level of disaster preparedness are recommended. Qualitative studies like focus group discussions should also be employed to be able to generate a rich discussion on key issues identified in this study.

Further policies that would prescribe mobilization and engagement of community officials and members should be in place since community actions are observed to be influenced largely by existing policies and laws. Disaster preparedness plans should be adoptable, feasible, and tailored to the needs, strengths, and weaknesses of communities. This can be achieved through continuous dialogue with community members. Disaster planning should be continuous, collaborative, data-driven, and most importantly, useful for end-user communities as these translate to effective and more sustainable disaster preparedness plans. Lastly, as partners of the barangay, the government and its agencies should establish and strengthen monitoring and reporting mechanisms to be able to assess implementation of LDRRM plans and address any existing gaps.

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# The efficacy of okra (*Abelmoschus esculentus*) in decreasing blood sugar levels among patients with impaired fasting glucose in Antipolo City

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## Abstract

**Introduction** Previous studies have shown conflicting results on the efficacy of okra on lowering blood sugar levels. This study aimed to determine the efficacy of okra in decreasing blood sugar among patients with impaired fasting glucose.

**Methods** This was a randomized double-blind trial among patients with impaired fasting blood glucose from three clinics in Antipolo City. Potential subjects were identified from records of the three clinics, recruited and screened using the Finnish Diabetes Risk Score (FINDRISC) and fasting blood sugar (FBS). Eligible patients were randomly assigned to receive okra or placebo capsules twice daily for one month. The blood sugar after 30 days was compared with the baseline and the difference between the okra and placebo groups was compared.

**Results** There was a significant difference between the pre-treatment and post-treatment FBS levels, respectively, of both the okra and placebo groups (p-value <0.01). However, the difference between the mean difference of the okra and placebo groups was not significant (p = 0.06).

**Conclusion** The present study showed that okra capsules are not efficacious in lowering blood sugar levels.

**Key words:** Pre-diabetics, impaired fasting glucose, okra

The prevalence of diabetes mellitus (DM) is a global concern that cuts across geographical boundaries, regardless of status, race, age, or sex. It is considered as one of the most common public

health problems in the 21st century. According to the World Health Organization, approximately 180 million people worldwide are affected with type 2 DM, which will likely double by the year 2030.<sup>1</sup> In the Philippines, DM is ranked as the eighth leading cause of mortality.<sup>2</sup> Type 2 diabetes accounts for 90 to 95% of all cases of DM, which is almost always preceded by pre-diabetes.<sup>3</sup> Without intervention, 15 to 30% of pre-diabetics will develop type 2 diabetes in five years.<sup>4</sup> As such, early screening and intervention of pre-diabetics is the first step towards decreasing the incidence of diabetes. According to the American Diabetes Association, pre-diabetes is also known as impaired fasting glycemia (IFG).<sup>5</sup> This

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is a state of elevated blood glucose levels during periods of fasting; however, these levels do not reach the threshold that prompts a diagnosis of diabetes. It is characterized as fasting plasma glucose levels between 100 and 125 mg/dl. In the Philippines, the total prevalence of IFG is 7.2%.<sup>6</sup> The public health burden of diabetes remains enormous. The magnitude of the epidemic prevalence, long term complications, costly treatment, and adverse effects make the prevention of diabetes a critical public health goal.

There have been an increasing number of people who have been taking okra for its purported ability to decrease blood sugar levels. Previous studies showed that *Abelmoschus esculentus*, or okra, reduces the absorption of sugar in the intestinal tract. One study explored the anti-diabetic potential of *A. esculentus* peel and seed powder in diabetic rats.<sup>7</sup> Results showed that okra was effective in lowering the rats' blood sugar levels. Findings from another study revealed that the viscous soluble dietary fiber of *Abelmoschus esculentus*, significantly reduced the intestinal absorption of glucose in fasting rats.<sup>8</sup>

However, another study showed that okra retarded the absorption of metformin, suggesting that diabetic patients taking metformin should be advised against adding okra to their diet. This contradicting interaction is the reason behind why this study did not support the addition of okra as an adjunct to metformin. One study that made use of human subjects focused on the effects on diabetic nephropathy which showed that okra has an effect on diabetic nephropathy than on plasma globulin and cholesterol.<sup>9</sup>

The general objective for this study was to determine the efficacy of okra in decreasing blood sugar among patients with impaired fasting glucose. Specifically, this study aimed to determine the mean decrease between post-treatment FBS and pre-treatment FBS of both treatment and control groups.

## Methods

This was a randomized double-blind trial among patients with impaired fasting blood glucose from three clinics in Antipolo City comparing okra with placebo in decreasing blood glucose. Potential subjects were identified from records of the three clinics, recruited and screened using the Finnish Diabetes Risk Score (FINDRISC) and fasting blood sugar (FBS). Eligible patients who had previously

given their consent were randomly assigned to receive okra or placebo capsules twice daily for one month. The blood sugar after 30 days was compared with the baseline and the difference between the okra and placebo groups was compared. The study was approved by the Ethics Review Committee.

The researchers reviewed the records at three private health clinics in Antipolo City after obtaining consent from the attending physicians. Patients with a history of at least two instances of elevated FBS levels for a period of one year from June 2014 to June 2015 were identified and recruited. Informed consent was obtained from those who agreed to join the study. To classify their risk of developing type 2 diabetes within 10 years, the Finnish Diabetes Risk Score questionnaire was used to assess these subjects based on their age, BMI, waist circumference, physical activity, diet, intake of anti-hypertensive medication, history of elevated blood glucose, and family history of diabetes. A minimum score of 7 indicated an elevated risk. The use of FINDRISC has been proven to be an accurate tool in screening for undiagnosed type 2 diabetes in the Philippines.<sup>10</sup>

Patients who satisfied the FINDRISC criteria underwent a fasting blood sugar (FBS) determination. Those whose FBS was 100 to 125 mg/dL were randomly assigned to the okra or placebo group. A subject was excluded from the study if he/she had: 1) been diagnosed with comorbidities known to elevate blood glucose levels, including thyroid disease, hormone imbalances (acromegaly, Cushing's disease), asthma, or chronic lung disease; 2) a history of cardiovascular disease; 3) not fully recovered from an infection; 4) been taking medication such as metformin, steroids, ciprofloxacin, thiazide diuretics, beta-antagonists, niacin, phenytoin; 5) failed to comply with the prescribed regimen for 30 days; 6) failed to follow up after 30 days; or 7) relocated residence. A sample size of 24 subjects was computed based on a difference to be detected of 8 mg/dL, SD = 98. Mg/dL, 95% CI = 0.05.<sup>7</sup>

Twelve kilograms of fresh okra pods were obtained from a local supermarket. The fresh okra pods were washed with tap water and seeds were discarded. They were then sent to the Institute of Pharmaceutical Sciences - National Institutes of Health at the University of the Philippines Manila for further processing. Peels were dried using an air-circulated oven at 50°C. The dried material was pulverized using a grinder then sieved under mesh

60, with a yield of about 120 g of powdered okra per 2 kg of fresh okra. The powdered material was weighed, stored in a dry and clean resealable plastic bag, and refrigerated under 4 °C. Each okra capsule contained 0.6 g of powdered okra, while each placebo capsule contained 0.6 g of cornstarch powder. Capsules were stored in amber bottles at 4 °C.

Each subject in the control group took 2 placebo capsules a day, amounting to only 0.04% of the recommended carbohydrate intake. The daily recommended total carbohydrate intake for ages 19-64 is 282-360 g/day.<sup>11</sup> Acute oral toxicity of *A. esculentus* based on a study on rats was determined at 2g/kg when converted to human toxic levels.<sup>7</sup> This would mean taking 100 tablets per day before reaching toxicity levels.

Subjects in the treatment group were given okra capsules and those in the control group were given placebo capsules. All subjects were then instructed to take one capsule twice a day after meals for the next 30 days. To ensure compliance, subjects were provided with a checklist and received daily text message reminders. Subjects were asked to follow up after one month for another FBS determination.

A paired t-test to compare the 30-day and baseline FBS within groups and an independent T-test was used to compare the mean difference in FBS between the okra and placebo groups. SPSS version 23 was used to process and analyze the data in this study.

## Results

Forty-five patients were identified from the records and 30 fulfilled the FINRISC and FBS criteria. Six subjects dropped out for various reasons leaving 24 subjects for the analysis. Comparing the demographics between the treatment and control groups, there were no significant differences in age ( $p = 0.12$ ), sex ( $p = 0.67$ ), BMI ( $p = 0.48$ ), daily physical activity for 30 min ( $p = 1.00$ ), and daily vegetable and fruit intake ( $p = 1.00$ ). There was no significant difference in the mean pre-treatment FBS levels between the treatment and control groups. The two groups were comparable at the time of treatment (Table 1).

Results showed a significant difference between the pre-treatment and post-treatment FBS levels, respectively, of both the okra and placebo groups ( $p$ -value  $< 0.01$ ). However, as seen in Table 2, the

difference between the mean difference of the okra and placebo groups was not significant ( $p = 0.06$ ).

**Table 1.** Sociodemographic and baseline data of 24 subjects with impaired fasting glucose.

	Okra Mean $\pm$ SD	Placebo Mean $\pm$ SD	p-value
Age	54 $\pm$ 9.9	48.3 $\pm$ 6.8	0.12
BMI	27.4 $\pm$ 2.6	26.8 $\pm$ 1.7	0.48
	n (%)	n (%)	
Sex			
Male	5 (41.7)	3 (25)	0.67
Female	7 (58.3)	9 (75)	
Physical activity			
Yes	0 (0)	0 (0)	1.00
No	12 (100)	12 (100)	
Diet			
Everyday	0 (0)	1 (8.3)	1.00
Not everyday	12 (100)	11 (91.7)	
Baseline FBS	106.1	107.3	0.54

**Table 2.** Comparison of mean difference between okra and placebo groups.

	Okra (mg/dL)	Placebo (mg/dL)	
Pre-treatment FBS	106.1	107.3	
Post-treatment FBS	88.5	96.8	
Mean difference	17.6	10.5	7.1
	( $p < 0.01$ )	( $p < 0.01$ )	( $p = 0.06$ )

## Discussion

This study looked into the efficacy of okra capsules in lowering blood sugar levels among patients with impaired blood sugar level using a double-blind randomized clinical trial. The results of this study are not consistent with previous studies.<sup>12,13</sup> A study on obese mice subjected to a high-fat diet showed reduced blood glucose levels after administration of okra, implying that okra may serve as dietary therapy for hyperglycemia.<sup>12</sup> An in vitro study which measured the effects of viscous soluble dietary fibers of okra in lowering intestinal glucose absorption showed that when diffusion systems were compared to control in a concentration-dependent manner, ( $p < 0.05$ ) a potential role of viscous soluble dietary

fibers (VSDF) of okra in lowering postprandial serum glucose was demonstrated.<sup>13</sup> Possible confounding variables that may have affected the outcome of post-treatment FBS levels of both treatment and control groups include: 1) subject demographics, 2) drying temperatures of okra peels, 3) form of okra preparation, 4) alcohol consumption, 5) Hawthorne effect.

The data showed that the two groups were comparable at the time of the study. The decrease in post-treatment FBS levels therefore cannot be attributed to discrepancies in subject demographics. The drying temperature of the okra peels is a possible factor that affected post-treatment FBS levels. Drying okra at 60°C significantly ( $p < 0.05$ ) increases all quality parameters, including protein, ascorbic acid, and fiber content.<sup>14</sup> The fiber content of dried okra (34.5%) has been shown to be higher than that of the raw okra (28.6%).<sup>15</sup> After drying its peels at 60°C, the fiber content in 100g of raw okra can be increased from 6.9g to 22.3g.<sup>16</sup> The rich fiber content helps improve or stabilize blood glucose levels by reducing the absorption of sugar in the intestinal tract.<sup>7</sup> The okra used for this study was dried at 50°C. It is possible that this temperature failed to yield a sufficient amount of fiber to make a significant impact on blood glucose levels. This may explain the insignificant decrease of post-treatment FBS levels between treatment and control groups. Different okra preparations have been shown to have varied effects on blood glucose levels. A study showed that okra juice was effective in reducing blood sugar levels in humans, suggesting its use as a simple but effective method for diabetes control; in contrast, subjects in this study were given okra powder.<sup>16</sup>

According to the American Diabetes Association, alcohol can cause hypoglycemia for up to 24 hours after drinking. Since subjects were not instructed to restrict their alcohol intake, the possible hypoglycemic effects of alcohol were not controlled.<sup>17</sup>

The FBS levels decreased significantly after treatment. Without having been advised to make lifestyle modifications, the subjects may have exhibited the Hawthorne effect: "the mere awareness of being under observation can alter the way in which a person behaves."<sup>18</sup> In most experimental research studies, subjects tend to modify their behavior when they are aware that they are part of an experiment.<sup>19</sup> The subjects in this study may have modified or improved an aspect of their lifestyle (i.e., diet and exercise) in

response to the awareness of their FBS levels being observed.

The researchers used only one parameter, fasting blood sugar, to quantify the efficacy of okra. In contrast to other studies with similar objectives, this study excluded other measuring tools including OGTT and HbA1c due to financial constraints. For future studies, the use of different parameters will provide a more accurate depiction of the subjects' blood sugar levels. Purposive sampling criteria may be modified to accommodate these additions.

One study concluded that lifestyle changes were significantly more effective than metformin in reducing the incidence of type 2 diabetes.<sup>20</sup> To control for this confounding variable, subjects in this study were advised not to make any lifestyle changes (i.e. diet and exercise) throughout the course of treatment. This means patients were not required to make any necessary adjustments on the aspect of their usual lifestyle while taking the okra capsules. Future studies may implement closer management of lifestyle patterns before and during the course of treatment to minimize its effect on blood sugar levels.

Despite the intervention of okra capsules in this study, uncontrolled blood sugar levels may be attributed to unavoidable mental or physical stress. During times of stress, adrenal glands secrete hormones such as epinephrine and norepinephrine to help prepare the body for stress. Epinephrine is responsible for converting glycogen stores into glucose, which often leads to elevated levels of glucose in the blood.<sup>21</sup> For future studies, assessment of subject's complete well-being including mental and physical stress before and during the treatment phase may be taken into consideration.

This study randomly assigned subjects into two groups (treatment and control) without using demographics as deciding factor. Assigning the subjects into treatment groups based on characteristics such as age and gender may yield more pronounced effects of treatment among the different groups. Any significant findings regarding this can help specify the therapeutic effects of okra as a blood sugar lowering agent.

The present study showed that okra capsules are not efficacious in lowering blood sugar levels. Although results showed that there is a significant decrease in pre-treatment and post-treatment fasting blood sugar of both treatment and control groups, the mean difference between two groups was not

statistically significant. Evidence is still insufficient to prove the efficacy of okra capsules in decreasing fasting blood sugar; thus, warranting the need for further studies, probably using other preparations.

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# Retinal microvascular abnormalities in different stroke subtypes: A cross-sectional study

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## Abstract

**Introduction** This study aimed to describe retinal microvascular changes in patients diagnosed to have stroke and determine the association between retinal microvascular changes and type of stroke (lacunar and non-lacunar).

**Methods** This is a cross-sectional descriptive study conducted among stroke patients seen at the Neurology Ward and Neurology Out-Patient Clinic of the UERM Memorial Medical Center. The patients' demographic characteristics and risk factors were obtained through a standardized questionnaire. Retinal photographs of both eyes were taken in eligible patients who consented to join the study. Retinal vascular changes were identified and their association with the type of stroke was determined.

**Results** Thirty-seven patients, 64% of whom had small artery occlusion type of lacunar stroke, were enrolled in the study. The most prevalent retinal abnormalities for each type of stroke were AV nicking and focal arteriolar narrowing. The prevalence of abnormal retinal findings between patients with lacunar stroke and non-lacunar stroke were compared and showed insufficient evidence to demonstrate a statistical significance between abnormal retinal findings and lacunar stroke.

**Conclusion** There is no significant association between abnormal retinal findings and lacunar stroke.

**Key words:** Stroke, lacunar stroke, retinal vascular abnormality

**L**acunar strokes, a disease of small perforating arteries 40-200  $\mu\text{m}$  in diameter, are estimated to

make up 25% of all ischemic strokes.<sup>1-3</sup> The etiology for this type of stroke remains elusive but some suggestions include atherothromboembolism, large intracranial artery stenosis, microvascular atheroma or endothelial dysfunction.<sup>1</sup> Lindley stated that there are three plausible pathologic mechanisms: 1) lipohyalinosis; 2) hyaline arteriosclerosis; and 3) microatheroma.<sup>2</sup>

Cerebral blood vessels and retinal vessels share structural similarities, having almost the same diameters (50-250 micrometers) and are both end arteries.<sup>2,4</sup> The two are also closely linked during embryologic development.<sup>1</sup> More importantly, they are known to be affected by identical vascular risk factors (i.e., hypertension and diabetes).<sup>4</sup> Thus, retinal

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vessel changes are likely to reflect similar changes in cerebral vessels.<sup>5</sup> The retinal vessel changes therefore have the potential to serve as markers for cerebral vascular disease and may provide clues in understanding cerebrovascular diseases such as stroke. The Atherosclerosis Risk in Communities Study (ARIC) showed that generalized arteriolar narrowing and generalized venular widening correlated with incident lacunar strokes.<sup>5</sup> This study aimed to describe retinal microvascular changes in patients diagnosed to have stroke and determine the association between retinal microvascular changes and type of stroke (lacunar and non-lacunar).

## Methods

This is a cross-sectional descriptive study conducted among stroke patients seen at the Neurology Ward and Neurology Out-Patient Clinic of the UERM Memorial Medical Center from July to September 2016. Retinal photographs of both eyes were taken in eligible patients who consented to join the study. Retinal vascular changes were identified and their association with the type of stroke was determined. The study was approved by the Ethics Review Committee of the Medical Center.

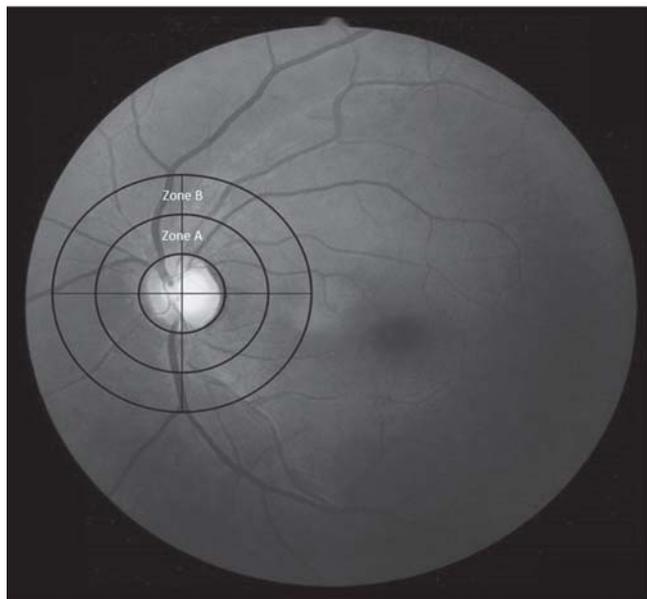
Male or female pay or service patients above 18 years diagnosed to have a stroke in the past year, whether first episode or not, with or without risk factors for stroke, admitted at the Neurology Ward or consulting at the Neurology Out-Patient Clinic were recruited. An informed consent was obtained from those who agreed to join the study. Those who were comatose or medically unstable, could not tolerate retinal imaging, had a history of ocular trauma or whose retinal photographs could not be evaluated (due to media opacities or small pupils) were excluded. Stroke cases that were cryptogenic, or due to hypercoagulable, inflammatory causes, and cerebrovascular bleeds due to arteriovenous malformation or subarachnoid hemorrhage were likewise excluded. A sample size of 91 patients was initially calculated for this study, with 80% power to detect an effect size of 0.72 based on a study by Baker at 0.05  $\alpha$ -level of significance.<sup>3</sup> However, due to the number of patients admitted or seen at the Out-Patient Clinic (20 patients per month), the computed sample size was adjusted accordingly. Given an estimated population size of 60, the sample size was adjusted to 37.

A standardized questionnaire used to obtain the subject's demographic data and risk factors for stroke was filled up by the neurology resident. A neurological examination was performed on all patients. Strokes were classified as ischemic or intracerebral hemorrhage. Ischemic strokes were further classified into large artery atherosclerosis, cardioembolism and small artery occlusion based on the TOAST Classification.<sup>6</sup> Small artery occlusion and cardioembolism were categorized as lacunar stroke, while large artery atherosclerosis and cerebrovascular bleed, as non-lacunar stroke. The following risk factors were identified: hypertension, type 2 diabetes, prediabetes, coronary artery disease, dyslipidemia, smoking and frequent alcohol intake. These factors were defined as appropriate to the requirements of the study.<sup>7</sup>

A 45-degree non-mydratic retinal photograph of both eyes centered on the optic disc and macula was taken using a Zeiss FP-450 IRU Fundus Camera with Visupac System (220vac) 430c and printed using photo-paper, providing documentation of the optic disc, macula, substantial portions of the temporal arcades, and about two disc diameters of retina nasal to the optic disc. The ophthalmology resident, blinded to the type of stroke, read the photographs and identified specific retinal findings based on the Atherosclerosis Risk in Communities Carotid (ARIC) MRI Study Retinal Photograph Grading Protocol.<sup>8</sup> Specific parts of the ARIC Grading Form were simplified and used to grade the retinal microvascular abnormalities. A retinal specialist confirmed the accuracy of the findings. Patients with a fundus photograph judged to have a treatable pathologic condition that posed an imminent threat to vision were referred to a retinal specialist for appropriate management.

The retinal photograph was viewed under a fluorescent lamp 14 inches away from the table where the photo was read. A grid produced on a transparent film was overlaid on the retinal photograph. The grid had three circles outlining an average disk, the zone from the disk margin to 0.5 disk diameter (DD) from the disk margin (Zone A), and from 0.5 DD to 1 DD from the disk margin (Zone B). Four lines radiating from the central circle were used to divide the part of the photograph outside zone A into four quadrants centered on the disk: superior temporal, superior nasal, inferior nasal, and inferior temporal (Figure 1). Retinal microvascular changes were identified by

the photograph reader without the aid of a computer program.



**Figure 1.** Retinal photograph grid

The specific retinal microvascular changes of interest and their definitions were: 1) arterial focal narrowing - marked constrictions located at Zone A and Zone B defined as a constricted artery that has a caliber less than or equal to 1/2 the caliber of proximal and distal vessel segments; 2) arterio-venous nicking (AV nicking) - arterio-venous crossings found outside of Zone A where tapering or narrowing of both sides of the venous blood column occurs as it crosses an artery; arterial sheathing; greyish or whitish sheath enveloping retinal vessels; 3) microaneurysms - described as typically round, red capillary ballooning, usually having smooth margins and a diameter of less than 150  $\mu\text{m}$ ; 4) hemorrhage - encompassing blot and flame-shaped hemorrhages; blot hemorrhages appearing as slightly larger than microaneurysms, which may or may not have distinct borders; flame-shaped hemorrhages occur over the retinal fiber layer, coursing through the pattern giving it its flame/splinter-like shape; 5) hard exudates - lipid deposits within the retina, characteristically bright yellow-white deposits with sharp margins, appearing waxy, shiny, or glistening, arranged as individual dots, confluent patches, or in rings surrounding zones of retinal edema and/or groups of microaneurysms; 6) soft exudates - indicating areas of ischemia in the

retina appearing as superficial white, pale yellow-white or grey-white areas with feathery edges, frequently showing striations parallel to the nerve fibers; soft exudates were graded as present or absent; 7) intraretinal microvascular abnormalities (IRMA) - tortuous intraretinal vascular segments varying in caliber; may be difficult to distinguish IRMA from new vessels; in general, IRMA are more delicate, more angular or jagged in their tortuosity, less likely to cross themselves or other retinal vessels, and more likely to occur in relatively open areas between major vessels; 8) venous beading (VB) - referring to localized increases in the venous caliber (segmental dilation), sometimes resembling a string of beads; 9) new vessels on the disc (NVD) - new vessels originating on the surface of the optic disc or on the retina within 1 DD of the disc margin (Zone B) or in the vitreous cavity anterior to this area. New vessels originating elsewhere but extends within 1 DD were considered as NVE; 10) new vessels elsewhere (NVE) - any new vessels on the surface of the retina or further forward in the vitreous cavity were considered new vessels elsewhere.<sup>8</sup>

Descriptive statistics was used to summarize the clinical characteristics of the patients. Frequency and proportion were used for nominal variables, median and IQR for ordinal variables, and mean and SD for interval/ratio variables. A p-value ascertained whether any baseline differences existed between the two groups. Independent sample T-test, Mann-Whitney U test and Fisher's exact/chi-square test were used to determine the difference of mean, median and frequency between groups, respectively. Odds ratios and the corresponding 95% confidence intervals were computed to determine the association of retinal microvascular abnormalities to the occurrence of lacunar and non-lacunar stroke. STATA 12.0 was used for data analysis.

## Results

Thirty seven (37) stroke patients in this study with a mean age of 55.9 years consisting of a similar number of men and women. Almost two-thirds had a lacunar small artery occlusion type of stroke; among the non-lacunar strokes, there were three times more cerebrovascular bleeds. Hypertension was the most common comorbidity in both lacunar and non-lacunar types of stroke. A family history of stroke was the most common risk factor in both lacunar

and non-lacunar strokes (Table 1). No correlation between the risk factors and stroke types was identified, however there was a statistically significant association between diabetes mellitus and large artery atherosclerosis and small artery occlusion.

The prevalence of specific retinal abnormalities for each type of acute stroke are shown in Table 2. AV nicking was among the most common retinal finding in both lacunar and non-lacunar stroke followed by focal arteriolar narrowing. The authors compared the prevalence of abnormal retinal findings between patients with lacunar strokes versus non-lacunar types. The odds of abnormal retinal findings among lacunar stroke patients was 2.4 and 5.5 for non-lacunar stroke patients. However, there was insufficient evidence to demonstrate a statistically significant association between lacunar and non-lacunar type strokes and retinal abnormalities ( $p = 0.44$ ), as seen in Table 3.

**Discussion**

Certain retinal findings have been associated with cerebrovascular accidents in several large-scale studies. The Atherosclerosis Risk in Communities (ARIC) Study established that patients with hypertensive retinopathy findings such as microaneurysms, hard and soft exudates, and retinal hemorrhages were significantly more likely to have MRI-detected silent cerebral infarcts.<sup>4</sup> Furthermore, it reported that focal arteriolar narrowing, enhanced arteriolar light reflex, AV nicking, and widening of retinal venules were common in patients with lacunar infarction.<sup>3</sup> With the different stroke types combined, the most frequent retinal microvascular abnormalities seen in this study are focal arteriolar narrowing and AV nicking, both of which are early signs of hypertensive retinopathy. In the present study, 56.5% of the patients with lacunar stroke had arteriovenous nicking while 30.4% have focal

**Table 1.** Clinical characteristics of 37 patients diagnosed with acute stroke at UERM Medical Center.

Characteristic	Lacunar stroke		Non-lacunar strokes		P-value
	Small artery occlusion (n=23)	Cardioembolism (n=1)	Large artery atherosclerosis (n=3)	Cerebrovascular bleed (n=10)	
	Frequency (%); Mean ± SD; Median (Range)				
Age (yr)	55.5 (33-75)	49	53 (28-60)	58.5 (45-69)	0.37*
Sex					1.00+
Male	11 (47.8)	1 (100)	2 (66.7)	5 (50)	
Female	12 (52.2)	0	1 (33.3)	5 (50)	
Educational attainment					0.05+
Below college	19 (82.6)	1 (100)	1 (33.3)	10 (100)	
College	4 (17.4)	0	2 (66.7)	0	
Comorbidities					
Hypertension	15 (65.2)	1 (100)	2 (66.7)	7 (70)	1.00+
Diabetes mellitus Type 2	15 (65.2)	0	1 (33.3)	0	<0.01+
Dyslipidemia	13 (56.5)	1 (100)	1 (33.3)	3 (30)	0.41+
Hypertension					
SBP (n=17)	130 (120-170)	-	135 (120-150)	130 (120-180)	0.92*
DBP (n=17)	90 (70-100)	-	60 (40-80)	80 (80 to 150)	0.25*
Smoking History	8 (36.4)	1 (100)	1 (33.3)	3 (30)	0.78+
Cardiovascular History*					
Angina	3 (13.0)	1 (100)	0	0	0.10+
Atrial fibrillation	6 (26.1)	0	1 (33.3)	2 (20)	1.00+
Family history of stroke	11 (47.8)	1 (100)	0	5 (50)	0.35+
Previous stroke	6 (26.1)	0	1 (33.3)	2 (20)	1.00+

## Retinal microvascular abnormalities in different stroke subtypes

**Table 2.** Prevalence of retinal abnormality among patients diagnosed with acute stroke at UERM Medical Center, 2016.

Retinal change	Lacunar stroke		Non-lacunar strokes	
	Small artery occlusion (n=23)	Cardioembolism (n=1)	Large artery atherosclerosis (n=3)	Cerebrovascular bleed (n=10)
	Frequency (%)			
Absent retinal findings	6 (26.1)	0	2 (66.7)	1 (10)
Focal arteriolar narrowing	7 (30.4)	1 (100)	1 (33.3)	4 (40)
AV nicking	13 (56.5)	0	1 (33.3)	7 (70)
Arteriolar sheathing	2 (8.7)	0	1 (33.3)	0
Hard exudates	2 (8.7)	0	1 (33.3)	0
Hemorrhages	3 (13.0)	0	0	1 (10)
Microaneurysms	2 (8.7)	0	0	2 (20)
Soft exudates	2 (8.7)	0	0	1 (10)
NVD	2 (8.7)	0	0	0
Venous beading	1 (4.4)	0	0	0
Tortuous veins	0	0	0	0
IRMA	0	0	0	0
NVE	0	0	0	0

**Table 3.** Association between lacunar strokes and abnormal retinal findings.

	Lacunar stroke (n=24)	Non-lacunar stroke (n=13)	Odds Ratio (95% CI)	P-value
	Frequency (%);			
With abnormal retinal findings	17 (70.8)	11 (84.6)	0.44 (0.04 - 3.00)	0.45
Without retinal findings	7 (29.2)	2 (15.4)		

arteriolar narrowing. This high frequency of focal arteriolar narrowing and AV nicking in lacunar strokes is similar to the findings of Yatsuya, which showed a significant association.<sup>5</sup> The results did not show a significant association. Thus, this study could not conclude that retinal microvascular changes are particular for lacunar strokes. The results were also different in that even non-lacunar strokes (particularly bleeds) showed a predominance of focal arteriolar narrowing and AV nicking.

The results on focal arteriolar narrowing and arteriovenous nicking were similar results to those of Cooper.<sup>4</sup> Subjects in Cooper's study however did not manifest with clinical stroke but instead had "silent strokes" detected on MRI. This investigation, on the contrary, included patients who already sustained clinical strokes. A prospective study showed that focal arteriolar narrowing and AV nicking were

the retinal findings found to be most associated with stroke; the association was significant.<sup>4</sup>

For this study, the high occurrence of focal arteriolar narrowing and AV nicking in all stroke types in general, and not to lacunar strokes in particular, may be related to the co-morbidities of stroke. It had been previously claimed that these two particular retinal microvascular abnormalities are associated with hypertension as well as atherosclerosis.<sup>9</sup> In line with this, hypertension, as known, is not particular to lacunar strokes but is associated with all strokes in general, including hemorrhages. Thus, it would be difficult to claim that presence of focal arteriolar narrowing and AV nicking would predispose one to a particular stroke type, i.e., lacunar stroke. It could only be said that these microvascular abnormalities are small vessel manifestations of hypertension and a general state

of atherosclerosis. While hypertension has a strong association with lacunar strokes, studies have shown only a marginal excess of hypertension in the lacunar type of stroke versus non-lacunar types.<sup>9</sup> This could explain why both lacunar and non-lacunar strokes, by having hypertension as a common comorbidity, would present with such hypertension-related microvascular changes.

These two retinal findings are microvascular abnormalities that, in previous studies, have been strongly correlated with hypertension.<sup>4</sup> In this study's population, majority of the lacunar stroke patients were hypertensive. The other types of strokes also show hypertension as a prevalent risk factor, especially bleeds where 70% were hypertensive. This study did not further evaluate whether the increased frequency of focal arteriolar narrowing and AV nicking in lacunar and non-lacunar strokes is an effect of hypertension rather than as an independent risk factor of the stroke type. Focal arteriolar narrowing, in particular, has a high association with hypertension, specifically with present blood pressure elevations. It results when autoregulation fails, and the arteriolar pressures reach 130-160 mmHg. This uncontrolled increase in blood pressure causes structural damage in the intima of the arteriolar wall. The overall result is breakdown of the blood-retina barrier.<sup>3</sup> However, although there is a pathophysiology explaining the effect of hypertension on retinal vessels, there are other variables that are contributory. These include genetic, embryologic, environmental and lifestyle factors such as diet. It has been further suggested that these factors may modify the effect of hypertension on microvascular circulation.<sup>10</sup>

Among the comorbidities for cardiovascular disease evaluated in this study, it is diabetes mellitus that is significantly associated with all stroke types. Diabetes mellitus, by promoting atherosclerosis in both large and small arteries, increases stroke risk by as much as two times.<sup>7</sup> The ARIC study has found that there is a six-fold higher risk of incident stroke, and a two-fold higher risk of stroke mortality in people with type 2 diabetes.<sup>10,11</sup> In this study, the mild non-proliferative diabetic retinopathy finding of retinal microaneurysms was present only in 8.7% of lacunar stroke in patients with small artery occlusion, and 20% in patients with cerebrovascular bleeds.

For this study, there was a higher frequency of abnormal retinal findings in the non-lacunar type

(84.6 vs 69.6%) although this was not significant. Thus, a true microvascular link with non-lacunar or lacunar strokes could not be made. This is in strong contrast to a study which showed that retinal microvascular abnormalities are particular for lacunar stroke.<sup>4</sup> The latter study even made a suggestion that indeed, microvascular pathways were more important for lacunar stroke. Such cannot be said when the present study's results are interpreted. There is one study, however, showing focal arteriolar narrowing and AV nicking to be more common in intracerebral hemorrhage (deep penetrating type) as compared to lacunar stroke.<sup>3</sup> These results are similar to this study. Arteriolar narrowing had an odds ratio of 3.7 while AV nicking had a ratio of 2.6, in relation to cerebral bleeds. Deep penetrating hemorrhages, just like lacunar infarcts, involve small vessels; thus, it is likely that retinal microvascular abnormalities are also common to deep cerebral hemorrhages which often involve small vessels. In this study, for the intracerebral bleeds, 70% had AV nicking while 40% had focal arteriolar narrowing. It must be noted though that in this study, the intracerebral bleeds were not further classified into small, deep penetrating versus large vessel cortical bleeds. In future studies, the authors suggest that such classification of bleed be made.

Although the present study did not yield significant associations between stroke type and specific retinal microvascular abnormalities, it did show a high prevalence of the latter in stroke in general. Though for this study, retinal abnormalities did not seem to predict stroke type, future cohort studies examining retinal photographs and retinal microvascular changes in patients with risks for stroke is a notable endeavor. A limitation of this study is the sample size: although the calculated sample size was achieved, increasing this number could have resulted to more significant associations and better representation of all stroke types. Another limitation of this study was its cross-sectional design: because the sample taken were patients who had already stroked out, a cause and effect relationship could not be made. Hence, one could not infer from this study whether retinal microvascular changes preceded, hence predict, future stroke. Only associations could be made, at the least, and such was not shown in this study.

This investigation also raises the question on whether all stroke patients should undergo routine

ophthalmologic examination. While no concrete associations have been made, findings of retinal microvascular abnormalities in majority of lacunar and non-lacunar strokes (84.6 and 70.8%) provide some basis for advocating such practice. However, when such retinal microvascular abnormalities are determined, they may simply serve as reflections of the patient's comorbidities such as hypertension, diabetes, and atherosclerosis. It remains uncertain whether they may predict future cardiovascular events. To answer this, an investigation with a prospective design is probably indicated.

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# Relationship between functionality and depression among elderly patients with hip or femoral fractures

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## Abstract

**Introduction** The sudden loss of ability to perform one's role increases an elderly person's awareness of his dependency on others and creates emotional frustration. The study aimed to determine the relationship between functionality and depression among elderly persons with fracture of the hip or femur.

**Methods** This was a correlational study using the Geriatric Depression Scale and Barthel Index Tool to measure depression and functionality, respectively, among randomly sampled geriatric patients admitted in an orthopedic hospital. Spearman rho was used to determine the relationship between functionality and depression.

**Results** Majority of the 43 respondents were women and the mean age of the sample was 70 years. The respondents had a low level of functionality with a mean Barthel Index of 8.3. Around 85% had mild or severe depression. The Spearman's rho showed a moderate negative relationship between functionality and depression which was statistically significant ( $r = -0.51, p < 0.01$ ).

**Conclusion** Among geriatric patients with femoral or hip fractures, patients with low functionality tend to be depressed.

**Key words:** Functionality, depression, fracture

Functionality is the ability of a person to perform his or her regular function based on his/her specific role in the family and in society.<sup>1,2</sup> Functionality diminishes with age and a person tends to become more dependent to others. In 2003, more

than one third of the older population aged 65 years and above reported limitations in activities of daily living. Between 2015 to 2050, the World Health Organization projected that the older population 60 years and above would increase from 900 million to 2 billion. On a local standpoint, the elderly population (66 years above) numbered 5.9 million in 2012.<sup>3</sup>

One of the conditions that may limit functionality is a fractured extremity. The incidence of fracture increases with age. An individual above 85 years has a tendency to break a bone four times more than someone between 65 and 75 years old. One third of fracture cases involves hip fractures and mainly occurs in persons above 65 years. This is the

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most common type of fracture in the elderly, with an occurrence of 300,000 cases every year. This condition results diminished physical function leading to dependency to others. This dependency may lead to depression.

Depression is a common mental disorder, characterized by sadness, loss of interest or pleasure, feelings of guilt or low self-worth, disturbed sleep or appetite, feelings of tiredness, and poor concentration. Depression can be long-lasting or recurrent, substantially impairing an individual's ability to function at work or school or cope with daily life.<sup>3</sup> According to the World Health Organization, major depression is a commonly occurring, serious, recurrent disorder linked to diminished role functioning and quality of life, medical morbidity, and mortality.<sup>3</sup> The WHO has ranked depression the fourth leading cause of disability worldwide and projects that by 2020, it will be the second leading cause.<sup>4</sup> A local survey conducted by Perlas in 2014 showed that about 5.3% of respondents were suffering from depression.<sup>5</sup> Another study by Josef in the province of Rizal revealed that depression was present in 6.6% of the sample.<sup>6</sup>

The sudden loss of ability to perform one's role increases an elderly person's awareness of his dependency on others and creates emotional frustration. Thus, the study aimed to determine the relationship between functionality and depression among elderly persons with fracture of the hip or femur.

## Methods

This study attempted to determine the relationship between functionality and depression among randomly selected elderly patients confined at the Philippine Orthopedic Center for hip or femoral fracture. The Barthel Index of Activities of Daily Living and Geriatric Depression Scale were used to measure functionality and depression, respectively.<sup>7,8</sup> Spearman's rho was computed to determine the relationship between the Barthel Index and Geriatric Depression Scale scores. The study was approved by the Ethics Review Committee of the Medical Center.

Male or female patients 65 years or older with any type of hip or femoral fracture were recruited. Those who gave an informed consent were included. Patients who refused to cooperate or had disturbances in consciousness were excluded. The sample size of

43 was computed based on  $p = 0.5$ , 95% level of confidence and 15% dropout. They were randomly selected from the eligible patients. Those included were asked to answer Barthel Index of Activities of Daily Living (ADL) and Geriatric Depression Scale (GDS) questionnaires and given 30 to 60 minutes to do so.

The Barthel ADL Index is an ordinal scale used to measure performance in 10 activities of daily living and mobility: presence or absence of fecal incontinence, presence or absence of urinary incontinence, help needed with grooming, help needed with toilet use, help needed with feeding, help needed with transfers (e.g. from chair to bed), help needed with walking, help needed with dressing, help needed with climbing stairs, and help needed with bathing. Each performance item is rated on this scale with a given number of points (0 to 3) with a maximum total score of 20 points. A higher score is associated with a greater likelihood of being able to live at home with a degree of independence following discharge from hospital. The Barthel ADL Index has been shown to have fair to moderate reliability and high internal consistency among different populations.

The Geriatric Depression Scale was developed to determine presence of depression in the elderly aged 60 years old and above and consists of 30 items answerable by yes or no. The total score indicates the status of the respondent: no depression (0 to 9), mild depression (10 to 19), severe depression (20 to 30). The instrument has been shown to have high sensitivity and specificity in differentiating depressed from non-depressed patients.

Mean and proportion were used to describe the demographic profile of the respondents. The relationship between Barthel Index and GDS scores was determined using Spearman's rho.

## Results

More than 80% of the respondents were women and one-third were more than 75 years old and another third were 65 to 66 years old, as seen in Table 1. Their mean age was 70 years. The respondents had a low level of functionality with a mean Barthel ADL Index of 8.3. Majority of the respondents had mild depression and almost 10% had severe depression based on the GDS scores (Table 2). Less than 15% had no depression. The Spearman's rho showed a

moderate negative correlation between functionality and depression which was statistically significant ( $r = -0.51, p < 0.01$ ).

**Table 1.** Demographic characteristics of respondents (N = 43)

Characteristic	
Male: female	7: 36
Mean age (yr)	71
Age distribution (yr)	No (%)
65-66	13 (30.2)
67-68	4 (9.3)
69-70	7 (16.3)
71-72	3 (7.0)
73-74	2 (4.7)
≥ 75	14 (32.6)

**Table 2.** Level of depression of 43 respondents

Level of depression	No (%)
None	6 (14.0)
Mild	33 (76.7)
Severe	4 (9.3)

## Discussion

Previous studies reported that the prevalence of depression among women is twice that of men.<sup>9,10</sup> Another study reported that women in the United States are about two-thirds more likely than men to be depressed.<sup>4</sup> In the present study, 80% of respondents were women; this could be an explanation for the high incidence of mild and severe depression (85%). The mean Barthel Index for the group was low at 8.3, indicating significant loss of function and implying a greater dependence on others for activities of daily living.

The results are consistent with literature that supports a significant relationship between functionality and depression. One study says that the immobilization consequent to the management of the fracture results in a change of role performance and functionality, putting the patient at risk to develop depression. This is the result of worrying about his future health, finances and family needs. Because of loss of functionality, the patient has more time to worry about his disability and level of health that increases the onset of his depression.<sup>11</sup> Another study

noted that disability greatly diminished quality of life and functioning which resulted in dependency on others, which could be a factor in developing depression.

The investigators conclude that among geriatric patients with femoral or hip fractures, those with low functionality tend to suffer from mild to severe depression.

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# Metastatic mammary carcinoma in a mature singleton placenta

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## Abstract

**Introduction** Placental metastasis from maternal malignancies is a rare occurrence with a significantly adverse prognosis on the mother with no known effect or established risk factors for the newborn. As such, characterization of these lesions is necessary to serve as a stepping stone for more exhaustive studies regarding this presentation.

**Case Summary** This is a case of a metastatic breast carcinoma in a mature singleton placenta in a 39 year old woman diagnosed with invasive breast carcinoma of no special type/invasive ductal carcinoma, not otherwise specified, during the second trimester of pregnancy. Also discussed are the immunohistochemistry studies done to confirm the origin of the tumor. A comparison of the ER, PR, and HER2/neu receptor status between the primary lesion and the placental metastasis was also done.

**Conclusion** Pregnancy-associated breast cancer is a lesion that carries adverse prognosis for the mother because of the delay in diagnosis attributable to confusion of symptomatology. The pertinent problem in pregnancy-associated breast cancer with placental metastasis is the deficiency of the placenta to induce tumor metastasis away from itself.

**Key words:** Placental metastasis, metastatic breast carcinoma, pregnancy-associated breast carcinoma, immunohistochemistry

**B**reast cancer in pregnancy comprises 10% of diagnosed cases of breast cancer in women under

40 years, and is the second most common pregnancy-associated malignancy after cervical cancer.<sup>1,2</sup> Although it is known that there is a significant adverse prognosis for the mother, no known established risks associated with the occurrence of placental metastasis have been described. Furthermore, no known risk factors for fetal extension or the lack thereof have been noted, and the impact of such on the newborn is likewise not known.<sup>3</sup> As such, characterization of these lesions is necessary to serve as a stepping stone for more exhaustive studies regarding this presentation.

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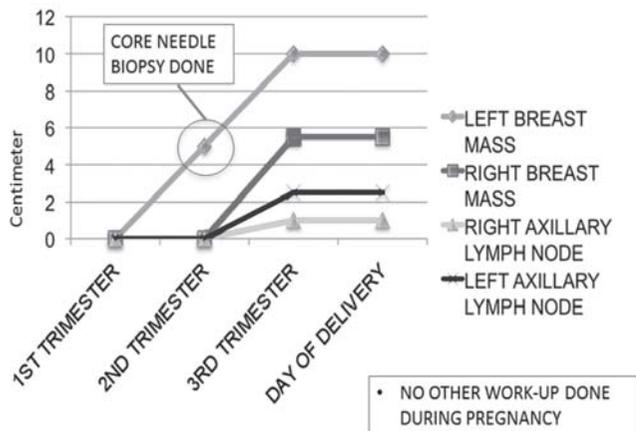
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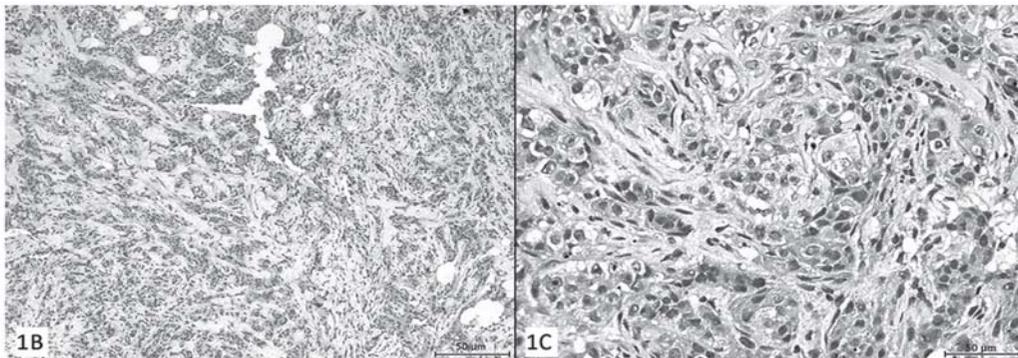
### The Case

This is the case of a 39 year old woman who presented with a left breast mass during the second trimester of pregnancy which was diagnosed as invasive ductal carcinoma/invasive carcinoma of no special type, left breast, by core needle biopsy. The patient subsequently also presented with a mass on the right breast during the third trimester of pregnancy, with no intervention done for both lesions, as per patient's choice, until the baby was delivered (Figure 1A). She underwent spontaneous delivery to a live full term girl at 36 1/7 weeks age of gestation, appropriate for gestational age, with a low birth weight of 2400 grams, Apgar score of 9 and 9 at 1 and 5 minutes. She also delivered a singleton discoid placenta with no identifiable gross lesions on delivery. The placenta was submitted for histopathologic evaluation. No other work-up was done regarding the patient's breast malignancy at this point as per the patient's prerogative.



**Figure 1A.** Progression of the disease during pregnancy.

The core needle biopsy of the left breast mass was retrieved and reviewed for possible comparison if a metastatic lesion would be detected in the placenta. The tumor in the biopsy specimen showed cords, nests, and clusters with moderate degree of pleomorphism and anisonucleosis (Figure 1B-1C). Gross findings showed a singleton placenta with a tan to dark brown, firm, maternal surface with complete cotyledons. The fetal surface was gray to tan and smooth. The cord was paracentrally attached and had two arteries and one vein. Cut sections showed a homogenous dark brown surface. No grossly identifiable tumor area was noted in the entire specimen (Figure 2A-2C). Histologic findings from the placenta showed sections with small chorionic villi with well vascularized stroma. Distinctly noted were proliferations of malignant neoplastic cells as multiple focal lesions in the intervillous space, with no evidence of direct chorionic villi involvement. The tumor was organized in clusters and sheets with attempts at glandular formation. The cells had enlarged, pleomorphic nuclei, prominent nucleoli, and irregular nuclear membranes. Mitosis was noted at 18-20 figures/10 high power fields, and areas of atypical mitosis and tumor necrosis were seen. The tumor was seen insinuating in the intervillous space with no extension into the fetal villous space (Figure 3A-3D). The umbilical cord and the chorioamniotic membranes showed no tumor involvement (Figure 3E). Thus, the diagnosis of metastatic mammary carcinoma in a mature singleton placenta was made, with strong correlation with the history of invasive breast carcinoma. The carcinoma was limited to the maternal intervillous component of the placenta, with no extension to the chorioamniotic membranes, and to the vessels and matrix of the umbilical cord.



**Figure 1B.** Microscopic findings of the core needle biopsy, left breast. (50x magnification)

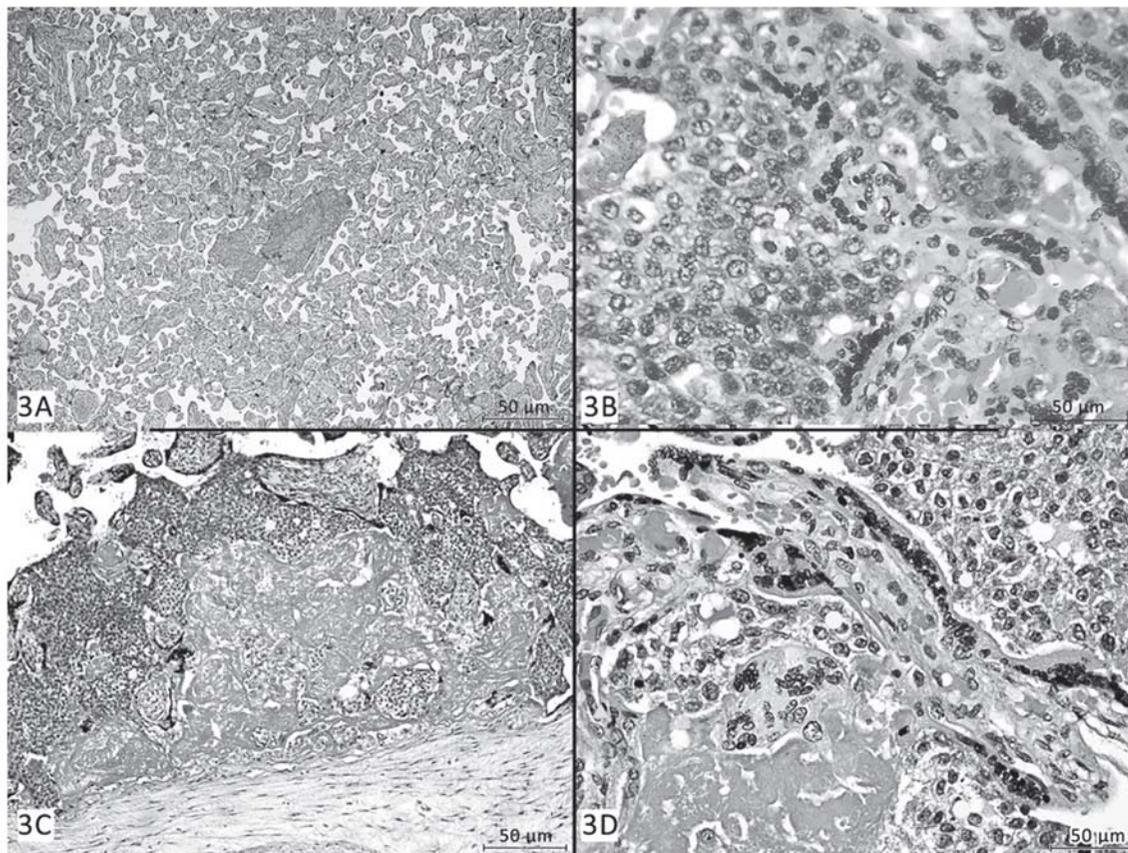
**Figure 1C.** Microscopic findings of the core needle biopsy, left breast. (400x magnification)



**Figure 2A.** Gross specimen of the maternal surface of the placenta with the corresponding dimensions

**Figure 2B.** Gross specimen of the fetal surface placenta and umbilical cord with the corresponding dimensions

**Figure 2C.** Cut sections of the placental parenchyma

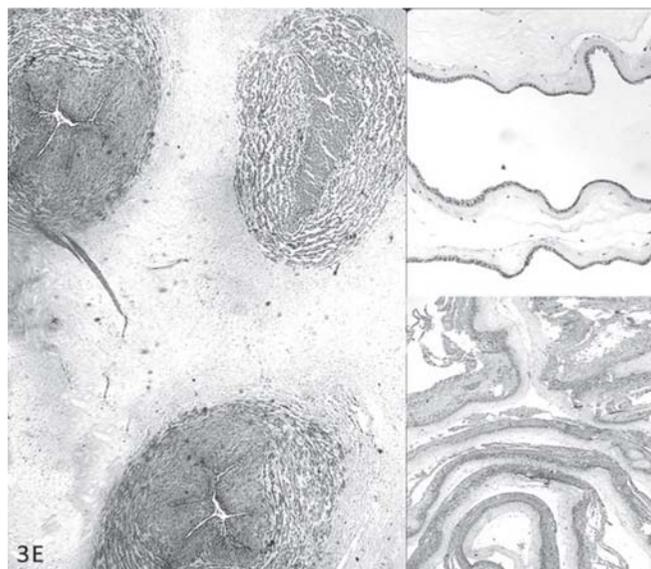


**Figure 3A.** Metastatic tumor cells surrounded by mature chorionic villi. (50x magnification)

**Figure 3B.** Metastatic tumor cells adherent to the trophoblastic cells of the chorionic villi. green triangle - chorionic villi; yellow circle - tumor cells. (400x magnification)

**Figure 3C.** Metastatic tumor cells confined to the intervillous space. green triangle - chorionic villi; yellow circle - tumor cells. (100x magnification)

**Figure 3D.** Metastatic tumor cells confined to the intervillous space. green triangle - chorionic villi; yellow circle - tumor cells. (400x magnification)



**Figure 3E.** Umbilical cord with two arteries and one vein, chorion, and amnion. (50x magnification)

Immunohistochemistry studies were done and showed differential positive expression for CK7 and negative CK20 expression which is consistent with the cytokeratin profile of breast carcinoma. Estrogen receptor determination was positive (ER+) with an intermediate nuclear expression in approximately 33% of tumor cells. GCDFP-15 and mammaglobin were also negative. TTF-1 was negative and an occult metastatic lung adenocarcinoma, which is also known to occur in pregnancy was ruled out. Comparison of the ER, PR, and HER2 receptor profile showed a positive ER and PR expression in both primary and metastatic lesions. HER2/neu expression was equivocal on immunohistochemistry and negative in HER2/neu dual in-situ hybridization in the primary tumor, with the placental metastasis also showing negative HER2/neu expression (Table 1A).

The patient was subsequently advised to undergo evaluation for tumor metastases because of the rapid progression of symptoms during her pregnancy, which she agreed to after the delivery. During this time, she already had back pain and dyspnea, and was under the care of the medical oncology service at the time this report was made. The pediatric service was also informed of the status of the placenta; evaluation of the newborn showed no clinical findings of malignancy. No imaging studies were done since there were no indications to do so.

**Table 1.** Comparison of the ER/PR and HER2 tumor antigen expression profile of the breast carcinoma and the placental metastasis.

Antigen	Tissue	
	Left breast core needle biopsy	Placental tissues with metastatic carcinoma
ER (IHC)	Positive	Positive
PR (IHC)	Positive	Positive
HER2/neu (IHC)	Equivocal	Negative
HER2/neu (DDISH)	Negative	----

IHC - immunohistochemistry

DDISH - dual-hapten in situ hybridization

## Discussion

Defined as breast cancer within pregnancy, or one to two years after delivery, and more commonly known as "pregnancy-associated breast cancer" (PABC), this lesion presents as a palpable mass that has suffered delayed diagnosis due to confusion with pregnancy associated changes and is generally associated with an adverse prognosis for the mother with no established risks for the newborn.<sup>3,4</sup> Pregnancy-associated cancer occurs in 89.6-172.6/100,000 maternities.<sup>5</sup> In contrast, pregnancy-associated breast cancer occurs in 1 out of 3,000 maternities.<sup>6</sup> Among all cases of pregnancy-associated cancer, 100 cases have been reported in scientific publication since 1951, and the most common of which is melanoma with 28 cases, with breast cancer coming in second at 16 cases. None of the 16 cases of breast cancer with placental metastasis documented fetal extension.<sup>7-9</sup>

Shochet expounded on how the placental extracellular matrix induces metastasis away from the placenta and directs metastasis to other organs thru modulating the ER $\alpha$ , TGF- $\beta$ , Smad3/JNK phosphorylation, and integrin- $\alpha$ 5 expression.<sup>8</sup> This is in correlation with the essential role of TGF- $\beta$  in promoting the tumor growth and metastasis of breast cancer.<sup>10</sup> It can be hypothesized that placental metastasis may be a failure of regulation of the crosstalk in the TGF- $\beta$ , Smad3/JNK pathway to inhibit migration of tumor cells towards and into placental tissues.

Among documented cases, placental metastases have been noted in the intervillous stroma only.<sup>3,8,9</sup> As to why there is no fetal extension of the tumor in

breast carcinoma among all 16 documented cases of placenta with metastatic carcinoma, when compared to metastatic melanoma which has the highest occurrence of placental metastasis and fetal extension with six of 28 cases having fetal extension, it is hypothesized that the difference in cell adhesion molecule and the probable lack of ability of  $\alpha\beta 1$  integrin to induce tumor disruption of the materno-fetal vascular interface when compared to the ability of melanoma conferred hypothetically by the melanoma cell adhesion molecule MUC18 may explain the lack of fetal vessel metastasis.<sup>3,7,9</sup> This may explain the lack of involvement of the fetus in breast carcinoma. This is in the setting of both tumors having VEGF involvement in angiogenesis, and the presence of MMP2 and MMP9 as matrix metalloproteinases common in both tumor types.<sup>10,11</sup>

According to AJCC staging, having placental metastasis classifies this patient as Stage 4 which has 15% 5-year survival rate. But the expression of ER, mammaglobin, and GCDFP-15 also affects prognosis, possibly worsening the already dismal situation. Investigation regarding the ER expression and the lack of mammaglobin and GCDFP-15 led the authors to consider the role of the absence of expression. Although ER as a metastatic marker has a sensitivity of 75% and a specificity of 33%, while mammaglobin has a sensitivity of 76% and a specificity of 90%, and GCDFP-15 has a sensitivity of 74% and a specificity of 99%,<sup>12,13</sup> Yang documented a decreased sensitivity for ER, mammaglobin, and GCDFP-15 in the metastasis when compared to the primary lesion.<sup>14</sup>

Luo and Eun Ha, and Nunez-Villar had described how a positive mammaglobin expression is associated with a more favorable prognosis.<sup>14,15</sup> For this case particularly, a negative mammaglobin is associated with higher nuclear grade, and a higher risk of migration and invasion. Likewise, a negative GCDFP-15 is associated with a higher grade and an elevated Ki-67 index, indicating a less favorable prognosis.<sup>15,16</sup>

A patient with an ER+/PR+ and HER2- receptor status has a median survival of 24.4 months after diagnosis of metastasis which is less than the survival of an ER+/PR+, and HER2+ patient of median 34.4 months.<sup>17</sup> HER2/neu in-situ hybridization confirmatory testing was done to determine the HER2/neu status, given an initial equivocal IHC because of the impact of receptor discordance in prognosis.

When considering the impact to prognosis, ER discordance and loss as well as HER2 discordance

and loss are important factors in the prognosis of patients with metastatic breast carcinoma. Yu-Feng showed that as much as 20% of patients had converted to an ER negative metastatic carcinoma from a previously ER positive status, and as much as 38.1% of patients had converted to a PR negative metastatic carcinoma from a previously PR positive primary carcinoma. The HER2/neu loss in the metastasis when compared to the primary tumor confers statistically significant worse overall survival for the patient, with Yu-Feng showing statistically significant worse overall survival and post-recurrence survival if with HER2/neu receptor discordance. However, in such report, only 6.7% of cases showed HER2/neu receptor discordance, suggesting that a greater population of breast cancer cases will retain the original receptor status of the primary tumor.<sup>18</sup> For this patient, there was no shift in receptor profile which may contribute to the prognosis, in relation to pregnancy and the stage of the breast carcinoma.

Compared to non-pregnant cases, Amant showed no difference in 5-year disease free survival and overall survival between pregnant and non-pregnant breast cancer cases although mortality rate appears to be doubled in the study of Johansson in 2011: the mortality rate among pregnant patients with breast cancer being 77/1,000 person per year, compared with mortality rate of 37.6/1,000 person per year among non-pregnant patients.<sup>19,20</sup>

As such, all the information provided can aid in determining the prognosis and in the decision making for treatment. Unfortunately, long term adverse effects and prognosis of the baby, whether with placental metastasis or otherwise, have not yet been documented. In conclusion, pregnancy-associated breast cancer carries adverse prognosis for the mother. An issue causing problems for pregnant patients with breast cancer in those not presenting with placental metastasis is the inherent mechanism of the placenta to indirectly induce tumor metastasis to other organs by signaling the tumor away from the placenta. Such situation is commonly seen in other pregnancy-associated breast cancers with no placental metastasis. The pertinent problem in pregnancy-associated breast cancer with placental metastasis is the inability of the placenta to induce tumor metastasis away from itself.

Another concern in this lesion is that it carries yet unknown risk factors for newborns with no evidence of tumor extension. Given such situation,

the evaluation of the placenta for tumor metastasis is necessary to provide an insight on the possible impact of the malignancy to the newborn, such as invasion to the fetal vessels or proliferation into the maternal tissues such that infarction and thrombus may ensue. Likewise, the probable defect in the mechanisms inherent to the tumor and the placenta that allowed the tumor cells to invade the maternal side of the placenta may be important in future studies on pregnancy-associated breast cancer. This report provides additional information to the fund of knowledge regarding a very rare presentation of what is supposed to be a very common malignancy. Such information may, in the future, have tremendous impact, not only in the women who get them, but the offspring they carry.

### Disclosures

This case report has no studies performed to animal or human participants. This case re-port includes only the specimen submitted by the patient for surgical histopathology evaluation to the section of anatomic pathology with consent for specimen evaluation and non-profit academic discussion or report. The authors of this case report have no conflict of interest in relation to the conduct of this case report and the publication thereof. This report did not receive funding from the institution nor from any service provider related to the processing of the histopathology specimen and the ancillary immunohistochemistry done. No funding was provided for the creation of this case report.

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