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THE 55TH ANNIVERSARY OF THE ESTABLISHMENT OF BACH MAI MEDICAL COLLEGES (1968-2023) AND THE 10TH ANNIVERSARY OF COLLEGE-LEVEL TRAINING (2013-2023)

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A REVIEW OF 10 YEARS OF COLLEGE-LEVEL TRAINING AT BACH MAI MEDICAL COLLEGE AND VISION FOR DEVELOPING BACH MAI UNIVERSITY OF MEDICINE

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ABSTRACT

Bach Mai Medical College is a leading medical education institution in Vietnam with a long history dating back to 1968. In 2013, the school was officially upgraded to college status. After 10 years of operation, Bach Mai Medical College has made remarkable accomplishments in training, research and institutional development. This paper reviews the 10-year journey of college-level training at Bach Mai Medical College and proposes a vision for developing it into Bach Mai University of Medicine. The paper first summarizes the school's development process and organizational structure. It then analyzes the training results from 2013-2023 across different programs and majors. Over 19,000 students graduated during this period. The paper also examines the training programs, textbooks, facilities, and faculty. Quality assurance activities, learner support, and scientific research are highlighted. Key achievements include being selected for the national nursing competency-based training innovation project, increased infrastructure investment, stable organizational structure, strengthened faculty with over 600 lecturers, and expanded research output. Ongoing upgrading of facilities and development of new majors are also noted. The paper puts forward a roadmap for developing Bach Mai University of Medicine through 2032, starting with infrastructure upgrading and curriculum development, then expanding undergraduate programs and later postgraduate training. This vision leverages the school's link to Bach Mai hospital, experienced faculty, and modern facilities. In conclusion, Bach Mai Medical College has established itself as a leading medical education institution after 10 years of college-level training. The paper provides a comprehensive review of this journey and outlines a vision for the school's continued development into a full-fledged university. This direction will enable the school to train more highly-qualified healthcare personnel to serve the population.

Keywords: *training; developing; medical education; Bach Mai*

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1. INTRODUCTION

Bach Mai Medical College is a prestigious medical education institution with long-standing traditions in Vietnam. The school was established in 1968 under Bach Mai Hospital and has trained thousands of highly skilled medical staff for the healthcare sector. In 2013, the school was officially upgraded to Bach Mai Medical College according to Decision No. 3168/QĐ-BGDĐT issued by the Ministry of Education and Training. Up until now, after 10 years of operation as a college, the school has achieved remarkable accomplishments, affirming its position and prestige in the Vietnamese vocational education system.

To summarize the college-level training in the past decade and set directions for the next stage, the Board of Directors has compiled a report on the 10-year summary of College-level training and visions for developing Bach Mai University of Medicine. The report will thoroughly analyze and evaluate the school's achievements in the past 10 years regarding organization structure, training scale, training programs, faculty, infrastructure, quality assurance, student support, etc. On that basis, the report will propose a roadmap and specific solutions to upgrade the school into Bach Mai University of Medicine in the coming time, contributing to improving the training quality of healthcare human resources for the country.

2. RESULTS OF 10 YEARS OF COLLEGE-LEVEL TRAINING

2.1. Overview of development process

Bach Mai Hospital was established in 1911, from an infectious disease treatment hospital called Cong Vong Dispensary. In 1928, as the number of patients increased, the Governor-General of Tonkin decided to rebuild Cong Vong Dispensary into Bach Mai Hospital. The construction began

including the Round House which later became the main facility of Bach Mai College of Health, and from 1935, the Infectious Disease Hospital was called Rene Robin Hospital to serve the French army and local people.

On October 2, 1945, the Hospital Management Board was established with Dr. Dinh Van Thang as the Director of the hospital as President. With the dual role of President and Director of Bach Mai Hospital, Dr. Dinh Van Thang opened the first nursing class of the hospital to assist doctors in caring for and treating wounded soldiers and people. The North Viet Nam nursing class was born here.

From July 1949, Dr. Do Xuan Duc was appointed by the puppet government as Director of Bach Mai Hospital and concurrently Principal of Bach Mai Nursing School (1949-1956).

From 1964, Professor Luong Tan Thanh - Head of Biochemistry Department of Bach Mai Hospital proposed the Board of Directors of Bach Mai Hospital to open a 12-month Medical Technician training course under his management at Bach Mai Hospital.

On September 3, 1968, Decision No. 526/BYT-QĐ of the Minister of Health officially allowed Bach Mai Hospital to open Medical Technician classes in the form of full-time, long-term, specialized and in-service training. Since then, the school has taken 1968 as the milestone for its establishment.

On July 6, 1978, the Minister of Health issued Decision No. 775/BYT-QĐ, allowing the establishment of High School Nursing Class under Bach Mai Hospital.

On December 10, 2007, the Minister of Health issued Decision No. 5027/QĐ-BYT, allowing the establishment of Bach Mai Intermediate Medical School under Bach Mai Hospital.

On August 20, 2013, the Minister of Education and Training issued Decision No. 3168/QĐ-BGDĐT on August 20, 2013 of the Minister of Education and Training on the Establishment of Bach Mai College of Health.

In 2017, the school’s state management was transferred to the Ministry of Labor, Invalids and Social Affairs. The school has completed the registration dossier for vocational education activities in accordance with Decree No. 143/2016/ND-CP dated October 14, 2016 of the Government.

2.2. Organization structure

Bach Mai Medical College in the period 2013 - 2018, comprised: Council Board;

Executive Board; Training Department: including the tasks of Training Management, Scientific Research, Student Affairs, Administration

- Management, Supplies, Finance and Accounting; Nursing Faculty; Faculty of Medical Engineering: including Testing Division; Medical Imaging Technology Division; Physical Therapy and Rehabilitation Technology Division; Foreign Languages - Mathematics - Informatics Faculty.

From 2018 - 2023, the school continued to streamline the organizational structure and establish functional departments; faculties/ specialized subjects, by 2022 the organizational structure of the school was stabilized as follows: Council Board; Executive Board; 03 functional departments: Training Department, Quality Assurance - Student Affairs Department, General Administration Department; 05 faculties: Fundamental Sciences, Basic Medical Sciences, Nursing, Medical Engineering, Clinical Medicine; Party organizations, Trade Union, Youth Union, Student Association..

2.3. Results of 10 years of college-level training

Table 1. Training scale from 2013 to 2023

No	Training program	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1	Regular degree	106	325	651	965	1291	1443	1633	1803	1775	1888	1916
2	Part-time degree	0	0	0	364	743	749	720	405	96	35	0
3	Intermediate level	893	870	898	874	463	133	0	0	0	0	0
4	Elementary level	0	0	0	0	0	0	0	0	33	72	49
	Total	999	1195	1549	2203	2497	2325	2353	2208	1904	1995	1965

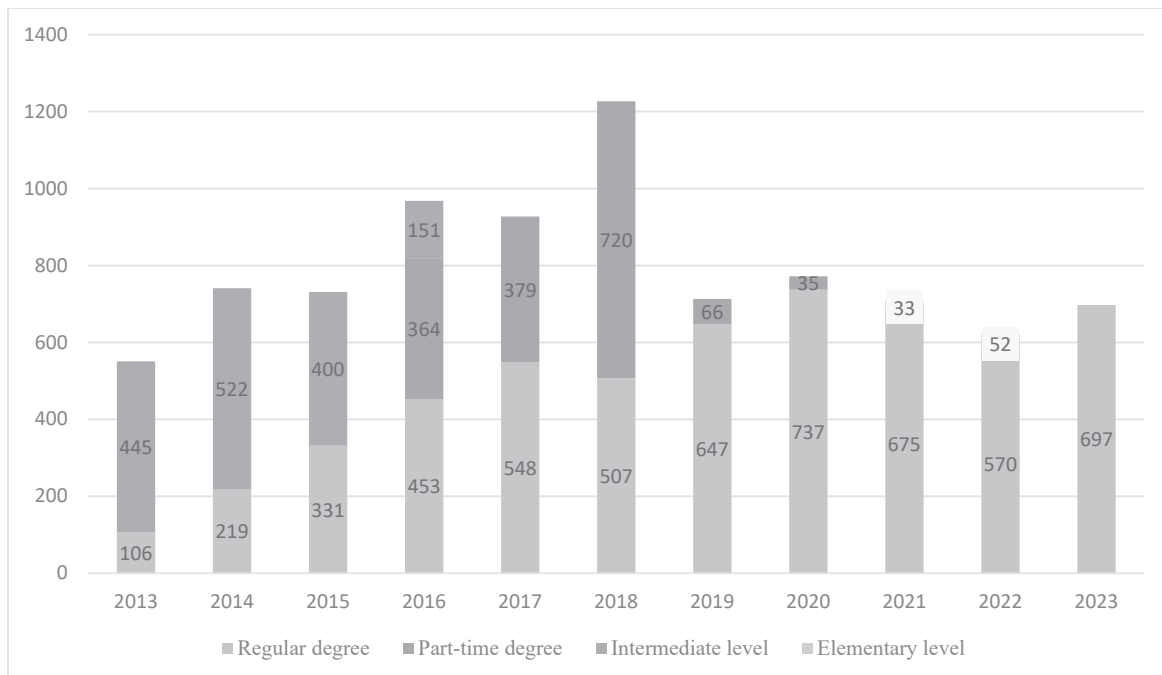


Figure 1. Admission results by training program from 2013-2023

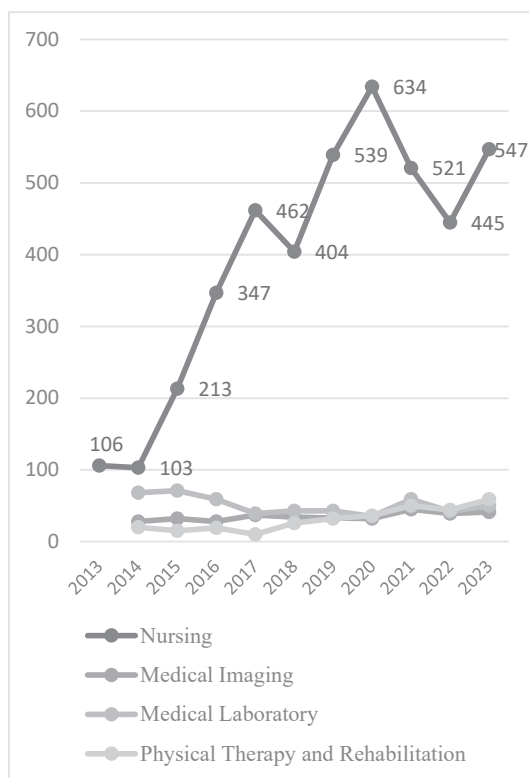


Figure 2. Admission results of regular college majors from 2013-2023

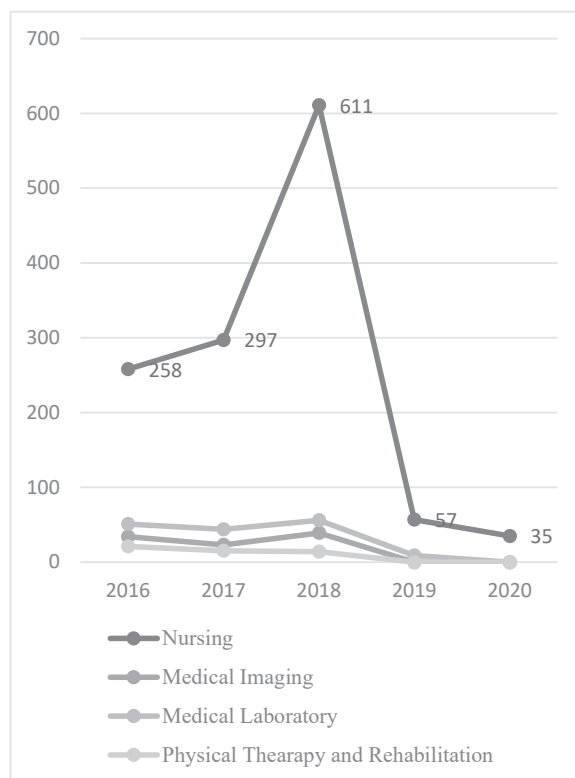


Figure 3. Admission results results of part-time college majors from 2016-2020.

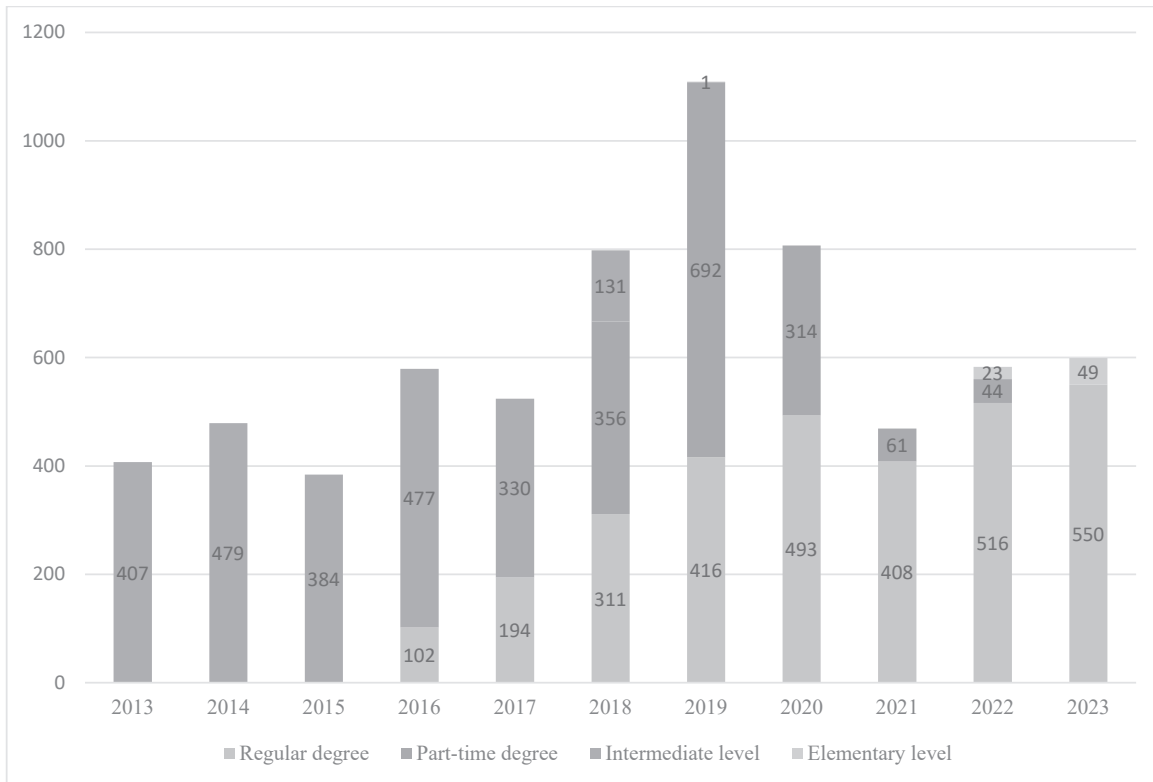


Figure 4. Graduation results by training program from 2013-2023

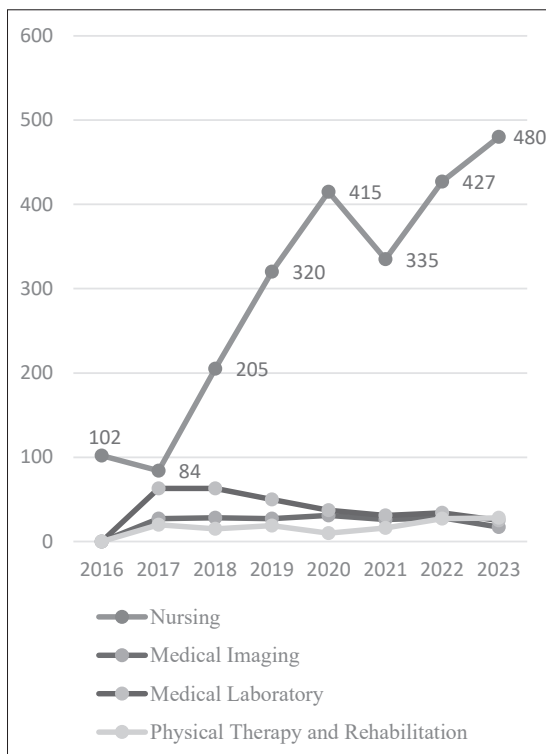


Figure 5. Graduation results of regular college majors from 2016-2023

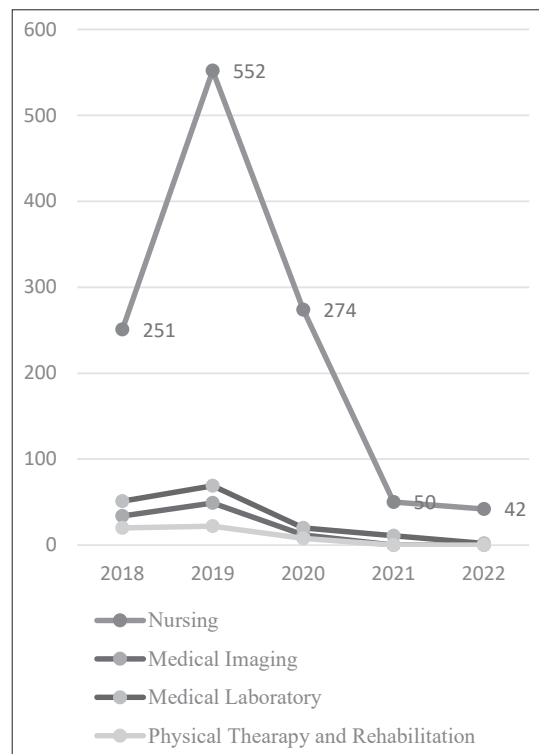


Figure 6. Graduation results of part-time college majors from 2018-2022

2.4. Training programs

In 2013, right after the decision to establish Bach Mai College of Health, the school completed the dossier for opening majors for approval from authorities. In 2014, completed the dossier and admitted students into 03 majors of Medical Engineering. From 2014-2017, the school organized training based on the curriculum framework for health majors by the Ministry of Education and Training.

In 2017, the Ministry of Health issued Decision No. 4387/QĐ-BYT dated 29/9/2017 approving the content of Nursing training program innovation package based on competency implemented by Bach Mai College of Health, under sub-component 1.2, Health workforce education and training project for health system reform (HPET). Bach Mai Medical College was one of 8 colleges nationwide with nursing training participating in this project. The project aimed to innovate and improve the training quality of college nursing based on Vietnam's Basic Nursing Competency Standards to train nurses capable of safely providing health care in many fields and meeting patients' satisfaction.

In 2017, the school's state management was transferred to the Ministry of Labor, Invalids and Social Affairs. The school developed, appraised and promulgated the program; organized the compilation, selection, appraisal of textbooks for intermediate and college training in accordance with Circular No. 03/2017/TT-BLĐTBXH dated 01/3/2017 of the Minister of Labor, Invalids and Social Affairs.

In 2018, the competency-based nursing training program was officially used to train Nursing at college level. In 2020, 2021 the school continued to revise and supplement the Training program to meet the development of Medicine and social needs. In 2023, the school updated and rebuilt the Output standards and training program

according to the basic competency standards for Vietnamese nurses promulgated in 2022.

In 2019: registered to train 02 elementary majors of Medical Secretary and Caregiver Assistant.

In 2020 - 2021, the school continued to update, revise and supplement the training programs of Medical Engineering majors.

In 2023, Bach Mai Medical College is completing the dossier to register the opening of 03 college-level majors: Pharmacy; Midwifery; Beauty Care and 01 elementary-level major: Skin Care.

2.4. Training textbooks

From 2013 up to now, the school's training textbooks have been constantly compiled and updated. By 2023, all majors of the school have issued training textbooks and published 75% of the training textbooks according to the 2023 plan. Nursing: issued 25/25 textbooks for Courses/Modules; Medical Imaging Technology: issued 13/13 textbooks for Courses/Modules; Medical Laboratory Technology: issued 11/12 textbooks for Courses/Modules; Physical Therapy and Rehabilitation Technology: issued 14/14 textbooks for Courses/Modules.

2.5. Infrastructure and learning materials

In the early stages of college-level training, the school's infrastructure was inadequate, with few lecture halls and classrooms. In recent years, with the investment of the Ministry of Labor, Invalids and Social Affairs, the Party Committee, the Director Board of Bach Mai Hospital, Bach Mai Medical College has been better equipped to ensure quality training.

Up to 2023, the School has constructed works with a total used area of 27,500 m², specifically: Office area and administration area: 2,000 m² - Lecture rooms: 21 rooms with a total area of 5,500 m²; Practice rooms: 46 rooms with an area of 3,731 m²; Library: 46 m²; Physical education

area: 1,500 m²; Medical room: 30 m²; Other utility works (parking, canteen, warehouse, garden, etc.): 14,773 m².

Especially, the school has been able to use the entire D3 building, and is deploying the project to renovate, upgrade construction and repair to ensure spacious, modern working rooms,

classrooms, and practice rooms creating a friendly pedagogical environment for lecturers and students. The school has invested in equipment and teaching aids in all 04 majors with a total of nearly 560 categories, equipment and materials with more than 6000 units.



Figure 7. Perspective of Bach Mai Medical College in 2024

2.6. Faculty

Table 2. Number of lecturers from 2013 - 2023

No	Qualification	Period 2010-2013	Period 2013 - 2018	Period 2018 – present
1	Professors, Associate Professors	06	07	16
2	PhD/Second-degree Specialist	19	27	73
3	Masters/First-degree Specialist	35	71	252
4	Bachelors	45	119	265
5	College	0	6	0
		105	230	606

In the period 2013 - 2023, the Board of Directors proactively built plans, arranged, recruited sources to build and develop the faculty in

terms of quantity, structure, and quality as a basis for training plans, management, use and development of lecturers to meet the

requirements of education, training and scientific research. Thanks to that, over the past years, the School has built generations of lecturers with sufficient quantity, increasingly high quality, reasonable structure and gradually standardized.

The school regularly organizes and supports lecturers to participate in training courses on active teaching methods, clinical teaching methods, training quality management. Promote the emulation movement of renovating teaching methods, observing teaching periods, excellent teacher contests, updating new knowledge. Proactively apply active teaching methods with the support of information technology, building e-lesson plans to improve teaching quality. Continue to focus on and effectively implement scientific research, emphasizing practicality, identifying and selecting scientific research topics towards renovating teaching and learning methods, innovating the management of scientific research.

In the past 10 years, 10 teachers have participated in teacher contests at all levels, including 02 first prizes at the national level, 04 first prizes; 02 second prizes; 03 third prizes at the Hanoi city level. Many teachers have been honored to receive Certificates of Merit from the Prime Minister, Ministries and sectors for their high achievements in teaching; lecturer fostering; students participating in exams at all levels and educational management activities.

2.7. Quality Assurance

Since the early stages of college-level training, the school has had a quality assurance division, which later developed into the current Quality Assurance - Student Affairs Department.

The school has deployed and updated its vision and mission in stages. Perfected the quality assurance system according to vocational education accreditation criteria; Annually

conduct self-assessment of vocational education institutions and training program evaluation.

Regularly and periodically conduct surveys, evaluate the teaching quality of lecturers; evaluate graduate outcomes, collect opinions from departments, lecturers, students, alumni, employers on training quality and quality assurance factors in education.

Control and maintain the ISO quality management system of Bach Mai Hospital, currently issued 03 internal procedures; 03 regulations; 49 system procedures serving the management of the school's educational activities. The quality management system has been certified ISO 9001:2015 by the Accreditation Center (QUACERT) under the Directorate for Standards, Metrology and Quality. The external assessment completion plan is June 2024.

2.8. Learner support

Students across the school are fully informed of the Party's guidelines, the State's laws, the Constitution, Education Law, Vocational Education Law; disseminate and update subordinate legal documents: Decrees, Decisions, Circulars... regulations on training, examination, certification of graduation; student code of conduct, practice, scholarships, tuition reduction, boarding policy, financial support for studying, emulation, commendation, discipline... of the Ministry of Labor, Invalids and Social Affairs, governing ministries and related ministries. Information technology application activities in learner management, extracurricular course organization, soft skills, startup skills, school culture behavior, summer programs for students to do research, community service practice are regularly organized and highly effective.

Strengthen contact, survey employers' demands, survey students' employment needs. There have

been many domestic and foreign recruiting units coordinating with the School to organize Workshops, Job Day. The annual employment rate of the School's students is always around 90%

Results of student contests at all levels: The school fully participates in the City Student Contest and achieves many achievements, continuously winning first prize for many years. Since 2017, the General Directorate of Vocational Education has organized the National Skills Competition, the school has participated in 02 contests and achieved high results: 01 gold medal; 03 silver medals.

2.9. Project participation

In 2013, Bach Mai Medical College participated in the National Foreign Languages Project.

In 2017, participated in the Health workforce education and training project for health system reform (HPET).

In 2017, Bach Mai Medical College has 03 key occupations at two levels: 01 ASEAN level occupation (Nursing) and 02 national level occupations (Medical Laboratory Technology and Physical Therapy and Rehabilitation Technology) according to Decision No. 1836/QĐ-LĐTBXH dated 27/11/2017.

In 2018, the school was assigned by the Ministry of Labor, Invalids and Social Affairs to develop regulations on minimum knowledge, competence requirements for intermediate and college graduates majoring in Nursing; The school's leaders and lecturers participated in the council to appraise the regulations on minimum knowledge, competence requirements for intermediate and college graduates majoring in Medical Laboratory Technology and Medical Imaging Technology.

In 2021, the school was assigned by the Ministry of Health to develop regulations and specialized

criteria for opening nursing majors at college level.

2.10. Scientific research and international cooperation

The school's lecturers and staff actively participate in scientific research activities; improve the quality of education. Many articles have been published in prestigious domestic and foreign scientific journals:

08 national-level projects

18 ministerial-level projects

80 institutional-level projects

47 international articles

64 domestic journals

The school has successfully organized over 30 conferences, seminars on fostering, training to improve teaching methods; quality assurance; testing; students and science.

In 2023, the school organized a scientific conference with the theme: "Updating modern educational methods and safe patient care" with a total of 16 scientific reports from agencies, hospitals, educational institutions such as: Society of Science & Technology Departments, Ministry of Health; Vietnam Nursing Teachers' Association; Bach Mai Hospital; Nam Dinh Nursing University; VinUni University; Thai Binh Medical College; Hanoi Medical College.

With the advantage of being under Bach Mai Hospital, in the past 10 years, Bach Mai Medical College has had many opportunities to cooperate and exchange with many domestic and international Universities, Colleges, hospitals such as: USA (REI, University of San Francisco; University of Texas Women's University, etc.); UK (University of London; Oxford University, etc.), Japan (Yokosuka Kyosai Hospital, Kanagawa University; Nagasaki University, etc.); Thailand,

etc. Domestic universities and colleges: Hanoi Medical University; Hai Duong Medical Technical University; Nam Dinh Nursing University; Thai Binh Medical College; Hanoi Medical College; Hai Duong Central Pharmacy College, etc

3. VISION TO UPGRADE TO BACH MAI UNIVERSITY OF MEDICINE

Along with the development of Bach Mai Hospital, Bach Mai College of Health is a unique model of a school under Bach Mai Hospital. Bach Mai Intermediate Medical School was established in 2007 and upgraded to Bach Mai College of Health in 2023, training 04 college majors; 02 elementary majors. The school has many advantages: a large faculty with 493 full-time and long-term contract lecturers including Professors (17); PhD/Second-degree Specialists (60); Masters/First-degree Specialists (193); Bachelors (225). All lecturers have experience in medical examination and treatment, patient care, especially a lot of experience in training medical staff from college level and above. The school has Bach Mai Hospital as a practice facility, which is the first special-grade general hospital in the country, with modern infrastructure and practice facilities covering a total area of 15.5

ha, fully equipped with modern facilities on par with countries in the region, with a diverse disease spectrum, applying the world’s most advanced scientific techniques with high-tech teams including professors, doctors, nurses, and skilled technicians saving many patients with serious illnesses. The school always has a good tradition of teaching and learning. Therefore, the school has been highly appreciated by the Ministry of Health, the Ministry of Education and Training, the Ministry of Labor, War Invalids and Social Affairs and hospital managers as one of the best quality training schools.

With the advantages of infrastructure, practice and internship facilities, especially teaching equipment and high-level management and teaching staff, the Party Committee, the Board of Directors of the Hospital and the Board of Directors of the School are determined to orient the upgrading of Bach Mai College of Health into Bach Mai University of Medicine with the goal of training and providing young healthcare staff and scientists for society, community and international market to meet the task of caring for and protecting people’s health.

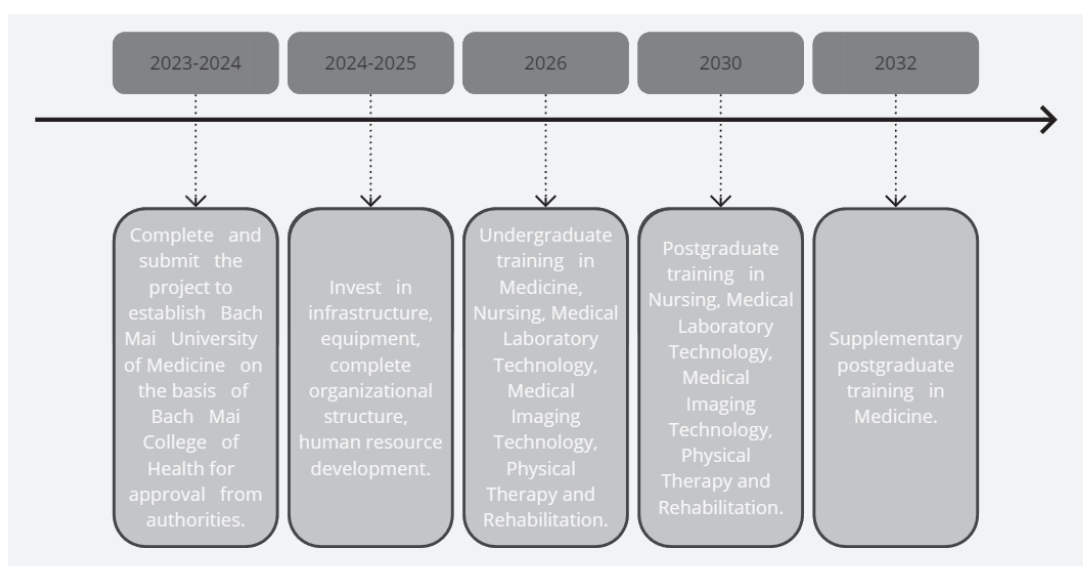


Figure 8. Timeline for developing Bach Mai University of Medicine

The specific roadmap is as follows:

Phase 2023 - 2024: Complete and submit the project to establish Bach Mai University of Medicine on the basis of Bach Mai College of Health for approval from authorities.

Phase 2024 - 2025: Invest in infrastructure, equipment, complete organizational structure, human resource development.

From 2026: Undergraduate training in Medicine; Nursing; Medical Laboratory Technology; Medical Imaging Technology; Physical Therapy and Rehabilitation.

From 2030: Postgraduate training in Nursing; Medical Laboratory Technology; Medical Imaging Technology; Physical Therapy and Rehabilitation.

From 2032: Supplementary postgraduate training in Medicine.

4. CONCLUSION

In conclusion, over the past 10 years since being upgraded to Bach Mai Medical College, the school has made significant achievements in college-level training and scientific research, contributing high-quality health workforce to the nation. With a clear roadmap and strong determination, the school is poised to be upgraded to Bach Mai University of Medicine in the coming years. The development of the school into a prestigious medical university will enable it to train more healthcare professionals at undergraduate and postgraduate levels, conduct advanced scientific research, and expand domestic and international cooperation. This will help meet the growing demand for healthcare human resources and advance the healthcare sector in Vietnam.

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TELEMEDICINE DURING THE COVID-19 PANDEMIC: BENEFITS, CHALLENGES AND FUTURE DIRECTIONS

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ABSTRACT

The COVID-19 pandemic triggered an unprecedented surge in telemedicine utilization worldwide, overcoming longstanding barriers to virtual care adoption. This rapid implementation enabled continued healthcare delivery while mitigating viral transmission risks. This article reviews the global growth patterns, strengths, limitations and future implications of telemedicine adoption during the pandemic. Usage surged across healthcare systems, with outpatient visits and chronic disease management transitioning faster than emergency or surgical care. Key benefits included maintaining care access during lockdowns, optimizing scarce resources like hospital capacity and personal protective equipment, workforce flexibility through remote work options, and high satisfaction ratings by both patients and providers. However, notable limitations included inequitable access for underserved groups facing technical barriers, inadequate physical examination capabilities compared to in-person visits, data privacy concerns, and lack of supportive policies and regulations in many countries. To sustain telemedicine growth, thoughtful integration within coordinated healthcare models is required rather than implementing it in silos. Comprehensive policies, legal frameworks and strategic investments must promote ethical and equitable telemedicine delivery, particularly for marginalized populations. Lessons from this global experience can inform the evolution of telehealth from an emergency modality to a routine pillar of resilient, value-based healthcare systems if challenges are addressed through systemic changes enabling its inclusive and ethical integration.

Keywords: Telemedicine, COVID-19, Virtual care, Digital health, Healthcare delivery

1. INTRODUCTION

The COVID-19 pandemic caused by the novel coronavirus SARS-CoV-2 emerged in late 2019 and rapidly spread globally. By March 11,

2020, the World Health Organization declared COVID-19 a pandemic as sustained community transmission was established across multiple continents. Widespread transmission of this highly infective respiratory virus put enormous

strain on health systems worldwide. By December 2022, over 6.6 million deaths and over 640 million confirmed cases have been reported globally [1]. To curb viral spread, unprecedented measures including largescale testing, contact tracing, social distancing, lockdowns, and border closures were implemented in most nations [2]. Healthcare capacity was overwhelmed in many countries, with shortages of hospital beds, medications, oxygen supplies, and healthcare workers. Elective procedures were deferred to devote resources to COVID-19 management. The resulting disruption of normal healthcare delivery disproportionately affected those with underlying chronic conditions. The pandemic also highlighted glaring health disparities and the need for more equitable access to healthcare globally.

Telemedicine refers to the delivery of healthcare services remotely using information and communication technologies. It provides a means for patients to access medical expertise without requiring an in-person visit. Telemedicine solutions encompass a wide range of modalities including live video-based consultations, store-and-forward transmission of medical data and images, remote patient monitoring, and mobile health applications. Core capabilities that enable telemedicine include videoconferencing platforms, peripheral medical devices like digital stethoscopes and otoscopes, and internet-connected monitoring devices for vital signs and chronic health parameters [3]. These technologies facilitate remote delivery of key healthcare services such as diagnosis, treatment, education, monitoring, and follow-up. Telemedicine has demonstrated the potential to increase healthcare access, improve outcomes, and lower costs for patients, especially those in rural and underserved areas. However, adoption of telemedicine was limited prior to the COVID-19 pandemic, with only

about 10-20% of healthcare systems offering some telemedicine services [4]. The emergence of COVID-19 led to an unprecedented global need for remote healthcare delivery. Widespread lockdowns, social distancing mandates, and risks of viral transmission made many in-person healthcare visits challenging or unsafe [12]. This generated an urgent impetus worldwide to rapidly implement and scale telemedicine solutions to screen, monitor, and care for both COVID-19 and non-COVID-19 patients. Thus the pandemic profoundly disrupted existing models of healthcare delivery and catalyzed exponential growth in telemedicine adoption globally [5].

The COVID-19 pandemic generated an unprecedented global need for remote healthcare services and accelerated adoption of telemedicine worldwide. However, the rapid implementation also surfaced challenges and ethical concerns regarding equitable access, privacy, data security, and integration with in-person care. This review aims to holistically summarize the literature on the spread, effectiveness, benefits, and limitations of telemedicine implementation globally during the COVID-19 pandemic. It will focus on covering the range of telemedicine modalities employed, patterns of adoption across different countries and care settings, factors enabling and hindering uptake, and implications for integrating telemedicine into routine healthcare delivery in an ethical and equitable manner.

2. GLOBAL UPTAKE OF TELEMEDICINE DURING THE PANDEMIC

The COVID-19 pandemic triggered an unprecedented surge in telemedicine adoption across the world. In the United States, telehealth visits increased from around 10,000 per week before the pandemic to over 8 million per week by mid-April 2020 [6]. The number of telehealth

visits in 2020 was 38 times that of 2019, with over 280 million visits delivered [7]. Similarly, in Canada telehealth usage jumped from 0.15% of clinical visits in 2014 to 70% during April-June 2020 [8]. Australia saw an overnight increase from less than 1% to 30% of all primary care consultations being done remotely [9]. The United Kingdom witnessed a meteoric rise from 12% pre-pandemic to over 90% of primary care consultations utilizing telephone, video or online modalities during April 2020 [10]. India

enabled over 100,000 free teleconsultations in just 10 days for COVID-19 [11]. Across Asia, Europe and the Americas, healthcare systems rapidly implemented or expanded telemedicine services to screen and treat COVID-19 patients while ensuring continuity of care for non-COVID conditions. This abrupt shift was enabled by temporary policies expanding telemedicine coverage, lifting geographical restrictions, permitting audio-only visits and relaxing privacy regulations in response to the pandemic [12].

Table 1. Comparative analysis of telemedicine adoption across countries during COVID-19

Country	Pre-Pandemic Telemedicine Usage	Peak Pandemic Telemedicine Usage	Source
United States	10,000 visits/week	8 million visits/week (mid-April 2020)	[6]
Canada	0.15% of clinical visits (2014)	70% of clinical visits (April-June 2020)	[8]
Australia	<1% of primary care consultations	30% of primary care consultations	[9]
United Kingdom	12% of primary care consultations	>90% of primary care consultations (April 2020)	[10]
India	-	100,000 free teleconsultations in 10 days for COVID-19	[11]

The rapid uptake of telemedicine during COVID-19 exhibited significant variability based on the country context and health system characteristics. Wealthier nations like the United States, Germany, and Switzerland with advanced digital infrastructure and existing telemedicine policies saw massive growth, with the US witnessing an unprecedented 154-fold increase in telehealth claim lines [6]. However, baseline telemedicine utilization in these countries was still relatively low before COVID-19, representing less than 1% of clinical encounters [4]. In contrast, lower-income countries in Africa, Asia and Latin America faced greater barriers

to adoption like lack of broadband access, high telemedicine costs, medico-legal restrictions, and low digital literacy [13]. Uptake also differed across care settings within healthcare systems. Outpatient visits and mental health consultations switched faster to telemedicine compared to procedures or emergency care which required in-person presence. Primary care providers rapidly moved their non-acute visits to telephone or video modalities, while surgical specialties were slower to transition given the hands-on nature of care [14]. Public health systems tried to expand telemedicine access to underserved groups but grappled with

digital divide and care integration challenges. Patients' attitudes further modulated adoption - those with greater health risks due to COVID-19 or existing chronic conditions showed higher telemedicine engagement. Thus the COVID-19 pandemic universally catalyzed telemedicine expansion, but adoption patterns worldwide were shaped by the complex interplay of technological capabilities, medical culture, regulations, and population needs of a given healthcare ecosystem.

The surge in telemedicine encompassed a broad spectrum of health services, spanning preventive, acute, chronic, critical and post-acute care. Simple video or telephone consultations enabled remote screening, triage, diagnosis and prescription refills for new illnesses [6]. Telemonitoring programs helped manage chronic conditions like diabetes, hypertension, COPD and mental health disorders. Digital counseling and therapy supported mental wellbeing during lockdowns. Remote patient exams and wound care enabled post-operative follow-ups while limiting hospital visits. Web-based self-assessment tools facilitated initial triage of potential COVID cases. In-home devices for patient telemetry eased hospital discharges and recovery monitoring. Specialist teleconsultations and online case reviews improved COVID care in ICUs and emergency departments. Hybrid models blending virtual and in-person visits provided safe access to necessary physical exams, tests and procedures. AI-powered chatbots and interactive apps disseminated health information and facilitated self-care [15]. Thus telemedicine expanded across the care spectrum, from primary screening to critical care. This facilitated public health surveillance, chronic disease management, mental healthcare, post-operative care and patient education alongside direct COVID-19 care during the pandemic. Integration of

telemedicine services within existing delivery models involved redesigning workflows, training staff, investing in technology and addressing regulatory issues. Significant innovation and reorganization enabled healthcare systems worldwide to rapidly transition various elements of routine care to telemedicine platforms when in-person services were unsafe or overburdened.

3. BENEFITS AND OPPORTUNITIES PROVIDED BY TELEMEDICINE

The rapid adoption of telemedicine helped optimize scarce resources and expand workforce capacity, which were crucial benefits during the COVID-19 crisis. By shifting non-urgent care to virtual platforms, telemedicine reduced unnecessary visits to healthcare facilities, lowering contagion risk and avoiding overcrowding. This allowed conservation of scarce resources like hospital beds, ICU capacity, oxygen supplies, medications, blood products, and PPE for only the most critically ill patients [16]. Telemedicine also enabled continued care delivery amidst workforce shortages and restrictions. Physicians and nurses diagnosed with COVID-19 or quarantined could safely work remotely. Cross-state licensure waivers tapped additional providers to meet surging care demands. Tele-ICUs enabled centralized monitoring of patients across hospitals by critical care specialists. Online case discussions engaged a broader expert network for collaborative COVID-19 management. Medical trainees provided supervised telehealth services when traditional clinical rotations were curtailed. Non-physician providers like nurses, pharmacists and psychologists took on expanded roles. Thus telemedicine offered staffing flexibility that expanded workforce capacity despite high clinical volumes and constraints. However, this also risked overburdening healthcare workers - appropriate staffing ratios had to be maintained even with remote care models [17].

A major benefit conferred by telemedicine was uninterrupted care for patients with chronic health conditions. With in-person visits restricted during lockdowns, telemedicine became critical for engaging patients needing ongoing care. Remote monitoring programs and video/telephone consultations enabled continuous prescription refills, counseling, and follow-up for mental health disorders, hypertension, diabetes, chronic kidney disease, COPD, and other chronic illnesses [18]. Telemedicine allowed cancer patients to continue oral chemotherapy and remote screening while avoiding exposure. It facilitated transfusions for blood cancer outpatients at home, improving continuity. Remote rehabilitation with exercises, speech therapy and nutritional counseling promoted function in neurology and stroke patients [8]. However, vulnerable populations like the elderly, rural residents, and those with disabilities or digital literacy barriers had difficulty availing telemedicine services. Targeted strategies were needed to prevent underserved groups from disconnecting from care during lockdowns [12]. Overall, telemedicine expanded continuity of care for many chronic disease patients when in-person visits were limited. But tailored support ensured groups at risk of being left behind also benefited from remote care options during the pandemic.

Despite the abrupt implementation, studies found high satisfaction with telemedicine among both patients and healthcare professionals during COVID-19. Patients valued the safety, reduced viral exposure risks, convenience and continued connection with caregivers that telemedicine provided. High satisfaction was reported with video consultations across diverse services including mental health, chronic disease management, post-operative follow-ups, and primary care [18]. Telemedicine enabled care access for vulnerable groups like

the elderly and those with limited mobility. Providers appreciated telemedicine's capacity to safely scale care delivery while conserving scarce institutional resources. Surveys of physicians and nurses found high acceptance of video visits, improved work-life balance, and interest in retaining telemedicine post-pandemic, despite initial unfamiliarity with the technology [19]. However, some concerns were noted regarding limitations in physical examination, physician-patient relationships, accessibility for digitally disadvantaged populations, reimbursement parity, overburdening staff, and security/privacy. While not universally endorsed, studies indicated unexpectedly high satisfaction among both patients and healthcare workers with rapidly implemented pandemic telemedicine services across care settings, demographics, and medical specialties.

4. CHALLENGES AND LIMITATIONS FOR TELEMEDICINE IMPLEMENTATION

While telemedicine expanded care access for many, technology barriers and digital divide issues affected access for some patient groups. Telemedicine relies on stable internet connectivity, device ownership and digital literacy, which are not universal. Low-income, elderly, disabled, rural and minority patients were less likely to have required technology for video consults. A US study found a third of elderly patients needed assistance setting up video visits [16]. Language barriers and disability accessibility also posed challenges. Many countries lacked nationwide broadband infrastructure to fully support remote care at scale. Connectivity issues like lagging video or audio cut-offs degraded the care experience. Health systems had to rapidly invest in technology upgrades and staff/patient education for smoother telemedicine adoption [20]. Thus while telemedicine holds promise for equitable access, overcoming technology

barriers and digital divides was vital to ensure underserved populations also benefited.

A major limitation of telemedicine is the inability to conduct a comprehensive physical examination, diagnostics or procedures compared to regular in-person consultations. Physical examination relies on visual inspection, palpation, percussion and auscultation which cannot be performed adequately without direct physical contact. Basic examination components like vital signs, cardiopulmonary status, abdominal palpation, musculoskeletal evaluation and neurological testing are challenging to perform remotely [21]. Similarly, diagnostic tests like phlebotomy for bloodwork, imaging studies like X-rays, CT scans or MRIs, and procedures like endoscopies or biopsies require trained personnel, sterile environments and specialized equipment only available at on-site facilities [22]. Lack of hands-on interaction can lead to incomplete or inaccurate assessment of symptoms, especially for new conditions with no prior medical records to reference. This could result in misdiagnosis or delays in diagnosis and treatment. However, telemedicine can play an adjunctive role through better care coordination, patient counseling regarding test results, managing stable chronic illnesses, and follow-ups to monitor response to treatment initiated during in-person visits. Overall, optimized care requires a blended care model integrating telemedicine and in-person care, with clear protocols on which patients require physical consultations versus those who can be managed remotely.

While telemedicine has proven invaluable during the COVID-19 pandemic, it cannot fully replace in-person care which remains essential for many aspects of healthcare. There are significant limitations in the scope of care that can be provided remotely. Physical examination is a cornerstone of clinical diagnosis and cannot

be replicated virtually. Complex chronic disease management often requires hands-on care and procedures best performed on-site [23]. Nonverbal cues, emotional rapport and human touch are integral to the art of medicine, but are diminished with virtual consultations. In-clinic visits facilitate better understanding of patients' priorities and values critical for shared decision-making. Direct physical proximity also enables point-of-care testing and immediate treatment that telemedicine cannot match. Therefore, while telemedicine expands healthcare access and convenience, it has to be thoughtfully integrated with, and not intended to substitute, traditional in-person care. Healthcare systems must determine optimal hybrid models for seamless coordination between telemedicine and on-site care.

Several key challenges have hindered wider adoption of telemedicine during the COVID-19 pandemic. Many insurance providers and government payers initially lacked reimbursement policies for telehealth services, reducing provider incentives to offer virtual care. Medicolegal concerns around liability and malpractice for online consultations discouraged uptake, given the lack of clear regulations governing telemedicine. Telehealth also presented limitations in conducting physical examinations virtually compared to in-person assessments, raising concerns about misdiagnoses. However, temporary waivers of licensure rules, enabling insurance coverage and malpractice protections for telehealth during the pandemic helped increase utilization. To sustain telemedicine growth, permanent supportive policies around reimbursement parity, interstate practice regulations, and updated malpractice guidelines are needed along with hybrid care models blending virtual and in-clinic care.

Table 2. Major Benefits and Challenges of Telemedicine during the COVID-19 Pandemic

Benefits of Telemedicine	Challenges of Telemedicine
1. Reduced risk of virus transmission among patients and healthcare workers.	1. Technical difficulties and platform limitations.
2. Accessibility for patients in remote or quarantined locations.	2. Limited physical examination capabilities.
3. Efficient resource utilization with fewer in-person visits.	3. Concerns about patient privacy and data security.
4. Flexibility in scheduling and reduced wait times.	4. Possible disparities in access for underserved populations.
5. Continuity of care for chronic patients.	5. Licensing and regulatory challenges across regions.

5. INTEGRATION OF TELEMEDICINE INTO ROUTINE HEALTHCARE

As telemedicine usage expands, it is critical to thoughtfully integrate it within existing healthcare infrastructure rather than treat it as a standalone service. Hybrid care models that blend virtual and in-person care are needed for optimal coordination. Telemedicine should supplement rather than replace traditional face-to-face care, with clear guidelines on which visits require physical examinations versus those amenable to remote consultations. Integrated

care models leverage the strengths of both traditional and telemedicine while minimizing their limitations [24]. For instance, telemedicine can facilitate triage, prescription refills and routine follow-ups, while in-person visits enable physical assessments and procedures when required. Effective integration requires shared health records, interoperable platforms, collaborative providers and protocols guiding appropriate telemedicine usage. This coordinated approach can deliver convenient, accessible and high-quality care.

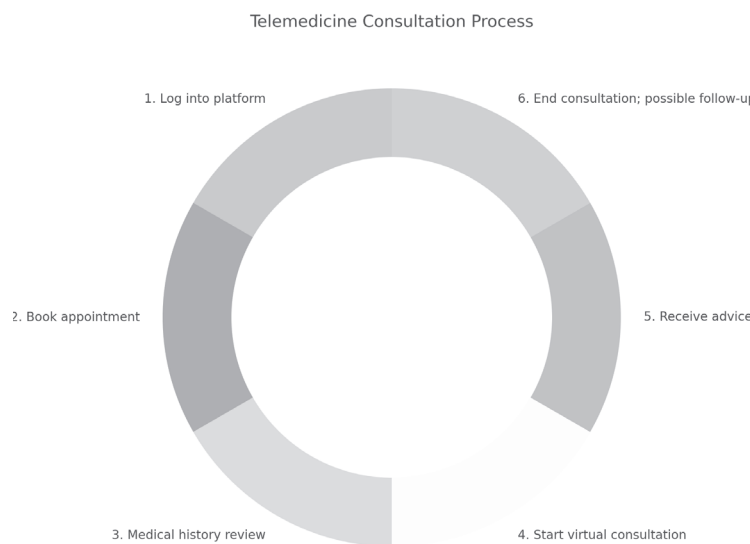


Figure 1. Sequential stages of the telemedicine consultation process

The rapid adoption of telemedicine during the COVID-19 pandemic has outpaced the development of guidelines and policies to govern ethical and equitable virtual care. Issues like privacy breaches, substandard online prescribing, and worsening healthcare disparities require urgent attention. Comprehensive national telemedicine policies and regulations are needed regarding provider licensure, reimbursement parity, malpractice liability, data security and reducing disparities in access. Professional medical societies must develop robust ethical guidelines for telemedicine practice spanning informed consent, continuity of care, and appropriate use criteria. Regulatory bodies have to create standards for telemedicine training, care quality and technical specifications. Legislative and policy solutions must ensure telemedicine improves access for underserved communities and narrowing, not widening, health inequities [25]. Ultimately, telemedicine integration must be guided by policies and regulations that promote patient-centered, ethical and equitable virtual healthcare delivery. Comprehensive national telemedicine policies should address provider licensing, reimbursement, malpractice liability, security standards and reducing disparities. Governments must develop legal frameworks to facilitate cross-border practice and data sharing while protecting privacy. Telemedicine promotion should be integrated into national digital health strategies for coordinated advancement. Significant investments are imperative to bolster technological infrastructure and digital literacy enhancing equitable access. Public-private partnerships can accelerate telemedicine innovation and integration with value-based care. Transitioning telemedicine from an emergency modality to routine delivery necessitates robust policies, system integration and cooperative strategies making virtual care an indispensable pillar of resilient healthcare systems worldwide.

Telemedicine can be leveraged to improve healthcare access and outcomes for underserved populations including rural communities, minorities, lower-income groups, elderly and those with limited mobility. It mitigates access barriers like transportation, cost, inconvenience and stigma that disproportionately impact these groups. Telemedicine facilitates timely access to providers, care coordination, medication management and remote monitoring for vulnerable groups. For instance, home-based telemonitoring programs for elderly patients with chronic illnesses can reduce rehospitalizations and nursing home admissions. However, the digital divide and language barriers may worsen disparities if solutions are not designed inclusively. Thoughtful telemedicine implementation, policy changes and digital literacy education are required to enhance care for marginalized communities rather than exacerbate disparities.

6. CONCLUSIONS

The COVID-19 pandemic catalyzed a massive global shift towards telemedicine, with virtual care adoption accelerating rapidly worldwide. Widespread lockdowns, social distancing mandates and fears of viral transmission drove providers and patients alike to embrace telehealth like never before. While telemedicine usage surged, key benefits emerged including reduced contagion risks, conservation of scarce resources, ensured continuity of care and high satisfaction reported by both patients and providers. However, notable barriers to access and equity still remain around technological readiness, infrastructure limitations and the digital divide across and within countries. As the post-pandemic future unfolds, sustaining telemedicine growth will require its thoughtful integration into traditional healthcare delivery systems, backed by enabling policies, legal frameworks and coordinated strategies making

virtual care an indispensable pillar. Key lessons from this unprecedented pandemic underscore telemedicine's immense potential to increase healthcare accessibility, resilience and value. But realizing this potential necessitates resolute efforts by policymakers, payers and healthcare organizations worldwide to embed ethically

designed telehealth solutions as a routine modality integrated with, not isolating from, vital in-person care. While the COVID-19 crisis catalyzed its widespread adoption, telemedicine must now evolve from a reactive emergency response to a proactive component of next-generation healthcare systems worldwide.

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DEVELOPMENT AND IMPLEMENTATION OF A TRIAGE STATION AT ONE OF THE LARGEST HOSPITALS DURING THE PEAK OF THE THIRD WAVE OF COVID-19 IN VIETNAM

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ABSTRACT

The Coronavirus disease 2019 (COVID-19) pandemic has greatly impacted healthcare systems and healthcare workers worldwide. Vietnam responded quickly to the epidemic with effective strategies, yet hospital-based transmission remained a major concern. Bach Mai Hospital (BMH) in Hanoi is the largest hospital in northern Vietnam. During the third wave beginning January 2021, BMH implemented an aggressive triage strategy to prevent nosocomial spread. All patients/caregivers were screened and tested for SARS-CoV-2 regardless of symptoms, a major change from testing only symptomatic individuals. This aimed to detect asymptomatic infections which may transmit the B.1.1.7 variant driving this wave. The triage clinic stratified people into risk groups, quarantined higher risk individuals in separate rooms, and restricted hospital entry. Capacity was expanded to handle increased volume. Within one month, over 3,500 people were screened with nearly 3,000 tests performed. Two positive cases were detected, and no nosocomial transmissions occurred despite the more transmissible variant. Challenges included overflow from at-risk individuals not isolating locally, resource waste from prolonged restrictive measures, and lack of effective vaccination. A cost-effectiveness evaluation could inform strategies for resource-limited settings. In conclusion, the triage clinic with expanded testing criteria helped prevent nosocomial spread and protect hospital patients and staff. This model may guide other resource-limited countries to control pandemic spread in healthcare settings. The findings support aggressive testing and monitoring to contain more transmissible variants. Continued evaluation is needed to balance infection control with service maintenance and cost.

Keywords: COVID-19, triage, nosocomial transmission, Vietnam

1. INTRODUCTION

Standing for the frontline in the fierce battle against the Coronavirus disease 2019 (COVID-19), the health care system, including all healthcare workers (HCWs), has been risky affected by this pandemic [1],[2]. Despite the fact that Vietnam responded quickly to the epidemic with effective infection management and prevention strategy [3-5], our HCWs are still the most affected since most of the cases were driven by hospital-based nosocomial transmission [3-5]. COVID-19 fever clinic or triage station has been reported and shown to be an effective strategy to prevent nosocomial transmissions in hospital settings. However, it was not well described and discussed whether this intervention is appropriated in the context of the emergence of new strains of SARS-CoV-2 and in a low-prevalence countries, such as Vietnam. Recently, the third wave of COVID-19 in Vietnam started in late January of 2021 in an industrial zone in the northern region, then spread to several provinces across the country. Bach Mai Hospital (BMH), is the largest tertiary hospital in the North of Vietnam with more than 2,000 beds, located in Hanoi capital. BMH has been greatly impacted by this third wave as this epicenter is very close to Hanoi and the hospital regularly receive patients from the epicenter area, which will carry a high risk of incurring nosocomial outbreaks. The COVID-19 triage station of BMH has been established in late January 2020, however with the confirmation of the emergence of the more transmissible B.1.1.7 lineage in this wave [6], a difference approach has been carried out to adapt with the new situation. This paper aims to describe the development and implementation of the COVID-19 triage clinic at Bach Mai Hospital to address the risk from the third wave of the COVID-19 pandemic in Vietnam.

2. IMPLEMENTATION OF COVID-19 TRIAGE CLINIC AND PREVENTIVE MEASURES DURING THE THIRD WAVE

From January to December 2020, the COVID-19 triage station of BMH had the task of screening for patients who came for care and treatment with suspected symptoms, including fever, cough, or shortness of breath. The SARS-CoV-2 testing was only provided if the patients self-reported as having close contact with confirmed cases or returning from the epicenter area. From January 2021, when the third wave dominated with the new variant from United Kingdom (UK) [6], we have been implemented a more aggressive strategy to prevent a further possible nosocomial outbreak.

Firstly, all the patients and people who came to the hospital were asked for health declaration, screened, and tested for SARS-CoV-2 if they had symptoms or epidemiological factors. All in-patients and their caregivers were tested regardless of whether they had the symptoms or not. The major difference of our approach was the expansion of SARS-CoV-2 testing criteria when basically everyone had tested negative for COVID-19 on an RT-PCR method before entered any other facilities or buildings of the hospital. In most of the cases of triage system observed in other settings, as well as stated in Vietnam national guideline, only suspected cases were required to have SARS-CoV-2 testing [7]. However, recent published documents indicated that the high prevalence of asymptomatic among COVID-19 patients [8], which raised a concern of omission cases if we only focused on symptomatic patients. Addition to that, experiences from previous nosocomial outbreaks in Vietnam showed that caregivers were a key driver of transmission in hospital environment as they frequently moved between different spots and might have lower compliance with preventive measures compared to patients or medical staff [3]. BMH is territory facility in the northern with many critical/severe patients of other non-COVID-19 diseases, and our priority in the implementation of this strategy is to protect them from nosocomial infections.

The triage clinic at BMH was designed and implemented using the same concepts as previous reports [7], [9], [10], but with several minor modifications. The overall principle was to stratified patients and people into groups based on the level of risk of SARS-CoV-2 infection, that in order from highest to lowest as follows: 1) Had direct contacts with confirmation cases; 2) Had suspicious symptoms and from epicenter areas; 3) Had suspicious symptoms but and from non-epicenter areas; 4) Patients without suspicious symptoms and from epicenter areas; 5) Patients without suspicious symptoms and from non-epicenter areas; and 6) Caregivers. All the patients/caregivers/people were asked for health declaration before entered the clinic. Patients from the first group were immediately determined, assigned directly to the sampling table, and quarantined in "Room 2A" (Figure 1).

Caregivers were also allowed to take samples immediately and moved to "Room 4B". Other patients were generally examined, interviewed epidemiological information, and classified according to the remaining four sub-groups. They were then sampled and waited in four separate rooms, corresponding to each group. Positive patients were moved to "Room 1A/1B" and waited to be transferred to designated hospitals. Patients in quarantined room even with negative results were transferred to centralized quarantine facilities by local CDC. Patients developed emergency condition were moved to an emergency room, received first aid, and transferred to designated area of emergency department or intensive care unit. Patients required in-patients care were transferred to isolation rooms in respective departments. All other the patients/caregivers must have negative results before leaving the clinic.

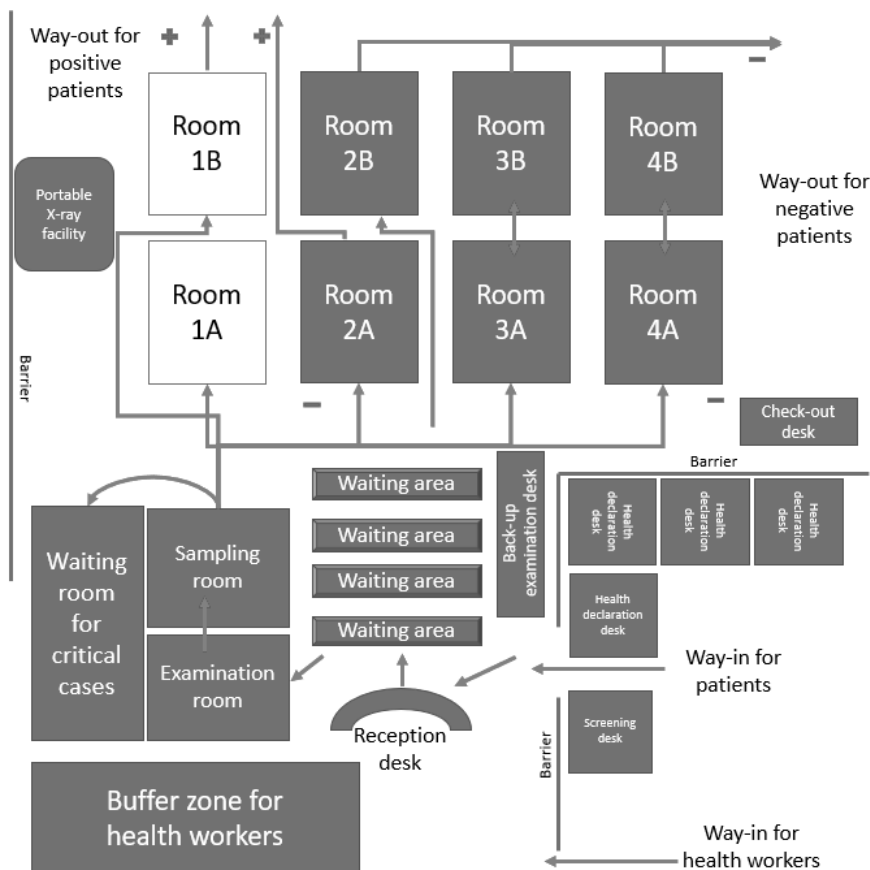


Figure 1. Structure of COVID-19 triage clinic at Bach Mai Hospital, 2021

Followed by the changes in patient’s management, the capacity of the COVID-19 triage clinic was also expanded, including: (i) installing a large waiting shelter at the beginning of a triage station; (ii) establishing a portable X-ray imaging diagnostic facility; and (iii) improving the human resources with a total of 08 physicians, 28 nurses, and 12 other staff on daily duty. Each clinical department set up a quarantine area with at least five beds. We also increased the laboratory capacity to a maximum of 500 RT-PCR tests per day and reduced the response time testing from 10 hours to 6-8 hours. Lastly, the distancing measures were more restricted, including temporary banned of caregivers in high-risk departments and all visitors, transferred mild patients to other lower-level hospitals, and reducing the admissions excepted for emergency or severe cases.

Within February 2021, more than 3,500 people had been screened for the COVID-19 with the peak days of up to 350-380 cases and nearly 3,000 SARS-CoV-2 tests has been performed.

3. CURRENT CHALLENGES AND IMPLICATIONS

Table 1. Key Challenges and Implications of COVID-19 Triage Implementation

Challenge	Implication
Insufficient communication to public about isolation procedures	Increased hospital burden from influx of untested high-risk individuals, heightened risk of nosocomial transmission
Prolonged highly restrictive policies	Resource waste, significant financial losses for hospitals
Persistent community transmission despite restrictions	Highlights need for widespread vaccination, continued genomic surveillance of new variants

The implementation of the COVID-19 triage station faced several key challenges. First, communication to the public about proper procedures was insufficient. Individuals who were at high risk or symptomatic continued coming directly to the hospital rather than

The average reception volume was around 125 people and 90 tests per day. The clients were mostly in-patients (33%), caregivers (30%), and out-patients (18%). Of which, two positive COVID-19 cases were found and transferred to COVID-19 designated hospitals. Meanwhile, nearly a hundred F1 cases (those had close contacts with a positive case) were put in a centralized quarantine area. F2 and F3 people (close contacts of F1 and F2, respectively) were asked to self-isolated at home and contacted with the local CDC for further management. The staff at the clinic were tested once per three days, whereas, all other health workers of the hospitals were tested once per month, and all negatives. After one month of the third wave occurred with a total of nearly 1,000 laboratory-confirmed cases in Vietnam, the management strategies of BMH were showed a favorable result with none being detected in nosocomial transmissions, especially when this wave was driven by the B.1.1.7, the variant has considered as increased transmissibility [11].

isolating at home and contacting local health authorities. This increased pressure on hospital staff who had to manage the influx, and also raised the risk of nosocomial transmission from these untested high-risk individuals entering the hospital. Clear communication is needed to

direct at-risk individuals to proper channels and prevent overburdening of hospital resources.

Second, prolonged implementation of highly restrictive policies created resource waste and financial losses. Measures like limiting non-emergency care and reducing admissions significantly impacted hospital revenue, aligning with reports of financial declines in hospitals globally during the pandemic [12,13]. However, loosening restrictions risks further spread. Cost-effectiveness analysis is critical to find the right balance between infection control and maintaining hospital operations. This is especially important for resource-limited health systems like in Vietnam. Evaluating the costs and benefits of different measures can inform optimized strategies for unfunded institutions. Further a cost-effectiveness evaluation of existing strategies should be conducted to determine the best approach for non-funded health care institutions and private hospitals [14].

Finally, community transmission remained a challenge even with extensive government restrictions. Cases without a known source suggested the virus was spreading silently despite control efforts. This highlights that

fully containing the pandemic likely requires widespread vaccination. Restrictions alone cannot completely stop community spread. Continued genomic surveillance is also critical to track emergence of new variants that may evade restrictions. Efforts are still needed to boost vaccination, maintain genomic monitoring, and balance economically sustainable restrictions. A multidimensional approach is required to address the diverse challenges of the evolving pandemic.

4. CONCLUSIONS

In conclusion, the implementation of COVID-19 triage station this triage station has been able to help prevent the COVID-19 spread through early screening, and protect individuals including HCWs within the hospital premise, while continuing to perform curriculum activities. Our model could guide other low- and middle setting nations to install a similar triage strategy to control the spread of this pandemic as well as protect individuals, particularly HCWs and patients with severe comorbidities who are at high risks of COVID-19 infection, within the hospital premises.

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INCIDENCE RATE AND RISK FACTORS OF CENTRAL VENOUS CATHETERIZATION-RELATED INFECTION AMONG PATIENTS AT THE INTENSIVE CARE UNIT IN VINH PHUC GENERAL HOSPITAL

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ABSTRACT

Objective: The purpose of the study was to identify and describe the incidence rates of central venous catheterization-related infection complications and to evaluate risk factors among patients with Central Venous Catheter at the Intensive Care Unit, Vinh Phuc General Hospital.

Methods: A prospective study was carried out among 320 adult patients who underwent CVC insertion in the Intensive Care Unit of Vinh Phuc General Hospital, Vietnam from August 2022 to August 2023. Any central venous catheterization-related infection complications during ICU stay were recorded, including occurrence time and outcomes. Univariate logistic regression was used to explore risk factors for the occurrence of complications.

Results: 43.75% of patients were reported with an exit-site catheter infection, and 1.25% cases were identified with bloodstream infections (BSI). Staphylococcus aureus was identified as the primary causative pathogen responsible for central venous catheterization-related infection. Further, several factors such as comorbidities, older age (>60 years), duration of catheterization (>7 days), insertion site, number of lumens, and number of attempts (more than three) can contribute to a significantly increased risk of infection complications ($p > 0.05$).

Conclusion: Significant incidence of exit-site catheter infections was high which highlights the need for increased attention to prevention and control measures, as well as showing the importance of rigorous monitoring and adherence to established protocols for catheter insertion and maintenance to minimize the risk of infection, particularly in ICUs where CVCs are frequently utilized.

Keywords: Central venous catheter infection, Intensive Care Unit, Vinh Phuc General Hospital.

I. INTRODUCTION

Central Venous Catheters (CVCs) are a commonly utilized intravascular device in intensive care units (ICUs) for the purpose of facilitating the intravenous administration of fluids, medications, blood products, and nutritional support, while also providing monitoring for hemodynamically unstable patients [1]. These catheters are especially valuable in emergencies when there is no permanent and viable venous access to treatment. Although such catheters provide necessary vascular access, their use puts patients at risk of being susceptible to hospital-acquired infections. Especially, central line-associated bloodstream infections (CLABSI), which is one of the most severe complications of infection are particularly prevalent among critically ill patients in ICUs [2], [3]. Previous studies have reported that the incidence of CLABSI in ICUs varied from 4.1 to 5.05 cases per 1,000 central line days [2] Europe, Eastern Mediterranean, Southeast Asia, and Western Pacific.

METHODS: During the 6-year study period, using Centers for Disease Control and Prevention National Healthcare Safety Network (CDC-NHSN, [4]Europe, Eastern Mediterranean, Southeast Asia, and Western Pacific.

METHODS: During the 6-year study period, prospective data from 532,483 ICU patients hospitalized in 242 hospitals, for an aggregate of 2,197,304 patient days, were collected through the INICC Surveillance Online System (ISOS). Another study conducted across nine countries in Asia revealed that incidence was 5.08 per 1,000 central line days [5]. Central venous catheterization-related infections not only prolong hospital stays but also significantly impact the cost, complicate treatment, and increase the risk of mortality for patients [1], [5]. Recent studies reported that certain factors contribute to an increased risk of central venous catheterization-related infections such as advanced age, comorbidities,

inadequate nutrition, insertion site, number of attempts, and duration of catheterization [6], [7], [8]. In the Intensive Care Unit (ICU) of the Vinh Phuc General Hospital, the majority of critically ill patients admitted undergo Central Venous Catheter (CVC) placement. Similar to many other medical facilities, hospital-acquired infections, including those related to central venous catheters, always pose a significant challenge and complexity for patient treatment and care. Therefore, the primary objective of this study was to identify the incidence rates of central venous catheter-related infections and evaluate the risk factors associated with the development of such complications.

2. MATERIALS AND METHODS

2.1. Study design and participants

The prospective study was carried out on 320 adult patients who underwent CVC insertion in the Intensive Care Unit of Vinh Phuc General Hospital, Vietnam from August 2022 to August 2023.

2.1.2. Inclusion criteria were as follows: patients who underwent CVC insertion in the Intensive Care Unit for more than 6 hours.

2.1.3. Exclusion criteria included: (1) patients with any previous infections, and (2) Catheter lines for central venous access inserted outside of our ICU.

2.2. Measurements

Patient demographic of the study such as maternal age, gender, and comorbidities.

Characteristics of Central Venous Catheters (CVCs) including the reason for PICC placement, insertion date, removal date, type of PICC, site of insertion, the reason for PICC removal, number of lumens, number of attempts and

Central venous catheterization-related infection complications: To evaluate infections

associated with central venous catheterization by the Ministry of Health's 2012 guidelines, titled "Guidelines for the Prevention of Intravascular Catheter-Related Infections" (Ministry of Health, 2012 [9]).

+ **Central line-associated bloodstream infections (CLABSI):** (1) occurrence of either bacteremia or fungemia during the 48-h period surrounding catheter removal (or a suspected diagnosis of CLABSI when the CVCs is not removed immediately); (2) and either a positive culture with the same microorganism on one of the following samples: insertion site culture, or catheter culture $\geq 10^3$ CFU/mL or positive central and peripheral blood cultures with the same microorganism, with a central/peripheral positive blood culture lag time > 2 h, with central blood cultures being positive earlier than the peripheral ones.

+ **Exit-site catheter infection:** (1) a quantitative catheter culture $\geq 10^3$ CFU/mL and (2) signs of local infection (purulent discharge from the CVC insertion site or tunnel infection); or systemic signs such as fever $> 38^\circ\text{C}$, chills, etc.

2.3. Data collection

Patient's demographic, clinical, and biological data were collected from the hospital's medical record. When a bloodstream sample was diagnosed positive by the microbiology laboratory, more information was collected on the laboratory software (number of samples collected, number of positive samples, central and peripheral blood culture results, insertion site culture and catheter culture results, lag time between central and peripheral positive blood cultures, microorganism identification). For each case of BSI, alternative sources of infection were carefully checked. In case of discrepancy, they were discussed with the physician for diagnosis confirmation.

2.4. Statistical analysis

SPSS 22.0 software (IBM Corp., Armonk, NY, USA) was used to analyze the data. Descriptive statistics and continuous data were expressed in the form of mean \pm standard deviation (SD), and discrete data were expressed as counts and percentages. Associations between risk factors with central venous catheterization-related infection complications assessed by Chi-square test. A p-value of less than 0.05 was considered statistically significant.

2.5. Ethical considerations

The study followed strictly toward the Vietnam Ethical Guideline for Biomedical Research involving Human Subject. The study protocol was approved by Science Committee of Vinh Phuc General Hospital and the Institutional Review Board of Hanoi Medical University (No.2514/QĐ - ĐHYHN).

3. RESULTS

Socio-demographic characteristics

320 participants with central venous catheterization (CVC) were observed. The mean age of the participants was $66,69 \pm 17,22$ years ranging from 11 to 95 years and was predominantly male ($n=212$, 66.25%). Among the comorbidities presented by the patients, the majority of patients reported 37.8% had systemic arterial hypertension, and 30.9% had diabetes mellitus.

The incident rate of central venous catheterization-related infection

Table 1 Incident rate of central venous catheterization-related infection (n=320)

Complications	Number (n)	Proportion (%)
Bloodstream infections BSI	4	1.25
Exit-site catheter infections	140	43.75

43.75% of them experienced exit-site catheter infections with sign and symptoms of infection, while only 1.25% developed bloodstream infections (BSI).

Clinical signs for central venous catheterization-related infection

Table 2 Clinical signs & Symptom for central venous catheterization-related infection (n=320)

Clinical signs	Number (n)	Proportion (%)
Signs and symptoms at insertion site		
Pain	77	24.1
Rash	93	29.1
Purulence	55	17.2
Swelling	135	42.2
Systemic signs		
Fever	17	8.2
Chills	16	7.7
Hypotensive	27	13.0

Clinical signs of catheter exit-site infections were experienced as localized swelling (42.2%), rash, pain, and purulence. Hypotensive was the most common clinical sign of patients who had a venous catheterization-related infection (13.0%), followed by fever and chills, with rates of 8.2% and 7.7%.

Pathogens

Table 3. Characteristics of the species involved in infectious complications (n=208)

Species	Number (n)	Proportion (%)
Central line catheter tip		
Positive (+)	7	2.5
Staphylococcus aureus	4	57.1
Klebsiella pneumonia	1	14.3
Acinetobacter sp	2	28.6
Negative (-)	201	97.5
Bloodstream infections (BSI)		
Positive (+)	4	1.0
Staphylococcus aureus	2	50.0
Burkholderia cepacia	1	25.0
Klebsiella pneumonia	1	25.0
Negative (-)	204	98.1

Blood cultures was conducted among 208 patient showed that Staphylococcus aureus was the most prevalent species responsible for bloodstream infections (BSI) (n=2, 50,0%), followed by Burkholderia cepacia (n=1, 25.0%),

and Klebsiella pneumonia (n=1, 25.0%). The results of central line catheter tip cultures showed that 7 cases tested positive for bacterial agents, with Staphylococcus aureus being the primary causative agent (n=2, 5.0%).

Factors associated with central venous catheterization-related infection

Table 4. Analysis of the risk factors related to central venous catheterization-related infection

Variables	CVC-Related Infection Complications at insertion site		OR (95% CI)	p-value
	Yes n (%)	No n (%)		
Age				
≤ 60 years old	27 (28.7)	67 (71.3)	1	0.001
> 60 years old	113 (50)	113 (50)	2.5 (1.48 – 4.16)	
Duration of catheterization				
≤ 7 days	61 (34.3)	117 (65.7)	1	<0.001
> 7 days	79 (55.6)	63 (44.4)	2.4 (1.53- 3.78)	
Insertion site				
Internal jugular (IJ)	89 (34.8)	167 (65.2)	1	<0.001
Subclavian vein (SV)	51 (79.7)	13 (20.3)	7.4 (3.8- 14.26)	
Number of attempts				
Less than three	97 (39.0)	152 (61.0)	1	0.001
More than three	43 (60.6)	28 (39.4)	2.4 (1.4 – 4.13)	
Number of lumens				
≥ 3 lumens	63 (85.1)	11 (14.9)	12.6 (6.27-25.2)	<0.001
< 3 lumens	77 (31.3)	169 (68.7)	1	
Comorbidities				
Hypertension				
Yes	74 (61.2)	47 (38.8)	3.2 (5.26 – 15.5)	<0.001
No	66 (33.2)	133 (66.8)	1	
Diabetes mellitus				
Yes	83 (76.9)	25 (23.1)	9.0 (5.26 – 15.5)	<0.001
No	57 (26.9)	155 (73.1)	1	

Patient with CVC showed higher risk of CVC related infection among patient over 60 years old (OR=2.4) over 7 day of catheterization duration (OR=2.4), Subclavian Vein insertion site (OR=7.4), 3 lumens connections (OR=12.6), more than 3 attempts of insertion (OR=2.4). Patient with Hypertension and Diabetes mellitus showed higher risk of CVC related infection (OR=3.2 and OR=9.0 respectively)

4. DISCUSSION

The incident rate of central venous catheterization-related infection

The study results revealed that 43.75% of patients presented with an exit-site catheter infection, and 1.25% developed bloodstream infections (BSI). *Staphylococcus aureus* was the main microorganism involved in infections. Compared to previous studies in Vietnam, the incidence rate in this study was higher than reported previous studies [10], [11]. For example, in the study of Bui Thi Thanh Huong, the incidence rate of exit-site catheter infection was found to be 12.9% [10] and in Vo Thi Kim Ha it was found to be 18.8 [11]. Some of these variations may be explained by the majority of participants being elderly patients who had multiple comorbidities. However, the disparity in rates becomes evident when comparing to the study conducted by J. A. A. S. Jayaweera and colleagues (2020) in children implanted with long-term indwelling CVC, which showed that the incident rate of exit-site catheter infection was 6.7%, and tunnel infections were at 4.8% [12]. Therefore, it is imperative to closely monitor the condition of inflammation at the CVC placement site in order to take timely action and mitigate the risk of central line-associated bloodstream infections (CLABSI).

Characteristics of infections related to CVC.

Infection at the CVC insertion site: Research shows that CVC's signs and symptoms include

swelling, redness, pain, and pus discharge at relatively high rates: 42.2%, 29.1%, 24.1%, and 17.2%. This result is higher than the study by author Bui Thi Thanh Huong whose CVC foot inflammation was 13,8% [10]. The cause may be due to many objective factors such as: the proportion of patients with a history of diabetes is high, so CVC feet are at higher risk of inflammation, especially the study participants were mainly elderly people over 60 years old and live mainly in rural areas. Therefore, we need to closely monitor the inflammation at the CVC insertion site to promptly treat and avoid CVC-related septicemia.

Systemic manifestations of research subjects with catheter implants: In 208 cases of CVC removal, 17 patients had fever, accounting for 8.2%, followed by chills, chills accounting for 7.7%, and hypotension in 27 people, accounting for 13%. The reaction of patients with fever in this study is higher than the study conducted by Luong Ngoc Quynh & Ngo Dinh Trung in 2014 at the Intensive Care Department of Central Military Hospital 108, with the body temperature of patients with fever > 38.5 degrees is 4.3% [13]. This difference may be related to the difference between the severity of the patient and the patient treatment method between Vinh Phuc Provincial General Hospital and Hospital 108. Besides, it may also depend on some factors. Other objective factors such as: sample size, different data collection process

Results of bacterial isolation at CVC tip and in peripheral blood

Results of bacterial isolation at CVC tip: In 208 times of culturing fluid at the catheter tip, the result was (+) 7 times, accounting for 2.5%. This result is lower than Luong Ngoc Quynh's (2012) study, which was 7.2% [13] Of the 7 positive cases when the tip was cultured in the catheter, 4 cases grew *Staphylococcus aureus* (57.1%).

Isolating *S.aureus* in large numbers can suggest that the cause is due to the bacterial flora on the skin of patients or medical staff. It can be seen that the agents causing CVC infections are mainly gram-positive and gram-negative bacteria, which reside mainly on the skin and nasopharynx. Therefore, the need for nurses to follow the skin hygiene care process and protect the CVC from being absorbed by oropharyngeal fluid is an urgent issue and needs to be given more attention.

Results of bacterial isolation in peripheral blood: Positive peripheral blood culture results are very low. Out of 208 blood cultures with positive results, 4 times accounted for 1.9%, 2 cases grew *S. aureus* (50%), 1 case grew *K. pneumoniae* (25%), 1 case grew *B. cepacia* (25%). The results showed that the proportion of bacteria causing infection in peripheral blood was mainly gram (+). This result may be due to the fact that most of the patients participating in the study were given antibiotics right from the time they entered the department because most of the patients who went to the ICU department were very seriously ill and could have many other diseases at the same time. It is also possible that the sampling process may have errors at some stage because the doctor's instructions for sampling are at many different times. It is challenging to manage all sampling times effectively.

Factors associated with central venous catheterization-related infection

Elderly age over 60 years old has the risk of increasing the rate of local infection by 2.5 times. This result is similar to the study by author Nguyen Ngoc Sao in 2014 that patients ≥ 60 years old have a higher rate of infection than age groups < 60 years old with $p < 0.05$ [14]. This can be explained by elderly patients with aging skin structure and blood vessels, and poor

skin elasticity. This makes CVC placement more painful. Coupled with the reduced resistance of the elderly, conditions are favorable for bacteria to attack and develop, increasing the risk of infection.

In the study, it was shown that patients with CVC retention time > 7 days were 2.4 times more likely to have inflammation at the CVC insertion site than the group with CVC retention time ≤ 7 days, with $p < 0.001$. Similar to the study of Luong Ngoc Quynh (2012), bacterial infections increase when CVC is kept for more than 7 days [13]. Studies show that the risk of infection is low in the early days. Therefore, the catheter needs to be carefully evaluated and removed when not needed, the CVC should not be left in for too long and daily CVC foot care must be strictly carried out.

The group of patients with CVCs connected to more than 3 lumens has a 12.6 times higher risk of inflammation at the CVC insertion site. According to Le Ngoc Sao's 2014 research, it is 2.7 times higher [14]. This result is completely reasonable because when using many lumens, it means more access points, so the risk of infection from the outside to the inside of the tube will be higher. So the use of multiple lumens is still considered very carefully.

The number of times the needle is inserted through the skin depends on many factors, but the important factor is especially the experience of the doctor performing the procedure. In our study, patients with > 3 skin needle punctures had a 2.4 times higher risk of inflammation at the CVC insertion site. This result is lower than Bui Thi Thanh Huong's study of $OR = 9.2$ [10]. This can be explained by the fact that when the needle puncture procedure is performed multiple times, it damages many soft tissues, causing hematoma and decreased nutrition at the area. The site causes inflammation and

edema in the catheter base area, leading to a high risk of infection.

According to our research, patients with CVCs placed at the subclavian vein have a 7.4 times higher risk of inflammation at the CVC insertion site than patients with CVCs placed at the internal jugular vein with $p < 0.001$. This result is 1.3 times higher than Le Ngoc Sao's 2014 research [14]. The reason for the higher infection rate at the jugular site is thought to be related to difficulty keeping the dressing in place and contamination with oropharyngeal secretions. Therefore, for catheters inserted into the internal jugular vein, operations should be performed with more caution and the oropharynx should be carefully cleaned to prevent secretions from contaminating the catheter.

Chronic diseases such as diabetes and hypertension increase the risk of local infection by up to 9 times and 3.2 times. This result is similar to the study of author Khalil Shaaban Nahla, which is that diabetes has an increased risk of infection with $p < 0.05$ [15]. Patients with diabetes have a weakened immune system and poor blood circulation, increasing the risk of

infection. High blood sugar levels impair white blood cell function, making the body less or no longer able to fight bacteria. Therefore, we need to closely monitor the condition of CVC legs and comply with aseptic procedures during dressing changes and CVC placement to reduce the risk of infection for patients.

5. CONCLUSION

The results of the study have revealed a substantial incidence of patients at risk of developing central venous catheterization-related infection complications, in which several factors such as comorbidities, older age (>60 years), duration of catheterization (>7 days), insertion site, number of lumens, and number of attempts (more than three) can contribute to a significantly increased risk of infection complications ($p > 0.05$). Consequently, this highlights the need for increased attention to prevention and control measures, as well as shows the importance of rigorous monitoring and adherence to established protocols for catheter insertion and maintenance to minimize the risk of infection, particularly in ICUs where CVCs are frequently utilized.

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COMPUTED TOMOGRAPHY PERFUSION (CTP) AND THE ALBERTA STROKE PROGRAM EARLY CT SCORE (ASPECTS) AS PREDICTORS OF FAVORABLE OUTCOMES IN ACUTE ISCHEMIC STROKE PATIENTS FOLLOWING MECHANICAL THROMBECTOMY

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ABSTRACT

Aim: This study evaluates the prognostic value of ASPECTS score recovery compared to perfusion imaging in acute anterior circulation cerebral infarction patients undergoing thrombectomy.

Materials and Methods: We conducted a combined retrospective and prospective study involving 87 patients with symptom onset within 6-24 hours who underwent non-contrast CT scans, CTA, CTP, and mechanical thrombectomy at Bach Mai Hospital from January 2022 to May 2023. Stroke outcomes were categorized as good (0-2 points) or poor (3-6 points) based on the modified Rankin functional recovery score (mRS) at 3 months. ROC curves were used to compare the prognostic value of ASPECTS, infarct core, penumbra, and mismatch ratio for predicting stroke outcomes.

Results: The study included 87 patients. At 90 days, 54% of patients achieved good mRS function (0-2), while 46% had poor mRS function (3-6). ROC curves revealed that, among the ASPECTS, infarct core, penumbral tissue, and mismatch ratio indices, only ASPECTS exhibited strong predictive ability for stroke outcomes ($p < 0.001$), with an area under the curve of 0.727. The cutoff value for ASPECTS was determined to be 6, with a sensitivity of 74.7% and specificity of 57.5%.

Conclusion: ASPECTS demonstrates robust predictive capabilities for favorable functional recovery in AIS patients undergoing thrombectomy within an extended time window. This suggests that ASPECTS ≥ 6 may serve as an alternative to CTP in selecting patients for mechanical thrombectomy in facilities lacking advanced imaging capabilities.

Keywords: stroke after 6 hours, thrombectomy, ASPECTS, CT perfusion.

1. INTRODUCTION

Stroke is the most common cause of disability in developed countries [1]. Treatment decisions for acute ischemic stroke patients depend on the time of onset [2]. The current global recommendations limit treatment to within 4.5 hours for intravenous thrombolysis and 6 hours for mechanical clot retrieval [3-5]. Beyond these timeframes, the risk of intracerebral hemorrhage upon vessel reperfusion increases. However, due to traffic conditions and transportation limitations, the percentage of stroke patients reaching the hospital in time for these critical window is very low, even in advanced countries. Approximately 90% of patients arrive at hospital after the 4.5 hours from onset.

Recent studies, such as DAWN and DEFUSE3, have demonstrated the efficacy of clot retrieval interventions beyond the 6 hours from onset, based on infarct core CT perfusion and MRI diffusion [6],[7]. Nevertheless, accessibility to MRI diffusion or CT perfusion imaging is limited in many stroke centers worldwide, particularly in Vietnam.

Currently in Vietnam, research on clot retrieval beyond 6 hours primarily focuses on the effectiveness of intervention methods, with minimal emphasis on fundamental imaging studies. Therefore, the question of whether non-contrast CT (NCCT) imaging alone can be sufficient for selecting mechanical clot retrieval patients in an extended time window remains unanswered. If the prognostic value of NCCT imaging is comparable or superior to CT perfusion, could it replace CT perfusion in patient selection for clot retrieval? Thus, we conducted this study with the objective: "To compare the prognostic value of the ASPECTS score with CT perfusion imaging in acute ischemic stroke

patients undergoing mechanical thrombectomy before the extended time window".

2. MATERIALS AND METHODS

This retrospective study received approval from the institutional review board for medical research involving human subjects, and informed consent was waived. The study included patients with confirmed acute ischemic stroke due to anterior circulation large vessel occlusion in CTA, presenting within a 6-24 hours. These patients had their infarct core, penumbral tissue, and mismatch ratio assessed by CTP, and they underwent mechanical thrombectomy treatment at Bach Mai Hospital between January 2022 and May 2023.

Clinical variables included age, gender, underlying medical conditions (strokes, atrial fibrillation, hypertension), and baseline NIHSS. Imaging variables comprised the baseline ASPECTS determined from non-contrast enhanced CT, as well as the site of occlusion (ICA, M1, M2, or tandem occlusion) observed in CTA, and infarct core, penumbral tissue and mismatch ratio assessed by CT perfusion. Outcome variables included the reperfusion results at the conclusion of the procedure, assessed according to the modified Treatment in Cerebral Infarction (mTICI) scale, and the functional outcome at the 3-month follow-up. A favorable outcome was defined as an mRS score between 0 and 2.

CT angiography and CT perfusion acquisition

Non-contrast CT, CTA and CTP imaging were conducted using a 128-detector CT scanner (Definition Edge, Siemens). The scan parameters were as follows: detector configuration of 64 x 0.6 mm; tube potential of 100 kV for NCCT and CTA, 80 kV for CTP; tube current of 160 mAs for NCCT, CTA and 100 mAs for CTP.

Patients received an intravenous injection of Iopaque 350 mg/ml (Iopaque 350, Bayer) through an 18 or 20-gauge catheter inserted into a right forearm vein using a power injector. For CTA, a fixed dose of 50 ml of contrast was administered at a flow rate of 5 ml/s, followed by a 40 ml saline flush delivered at the same rate as the contrast media. Bolus tracking in the ascending aorta with a threshold of 80 HU was performed, and image acquisition began automatically two seconds after attenuation reached the threshold.

For CTP, 40 ml of contrast agent was injected at a flow rate of 6 ml/s, and image acquisition occurred continuously, starting 7 seconds after contrast injection and continuing until 60 seconds.

CT data analysis

Images were processed using commercially available CTP software (Rapid, Version 4.5.1), which is fully automated. This software was employed to identify and differentiate potentially salvageable ischemic penumbra, characterized by a delay in the maximum of the tissue residue function of more than 6 seconds

and a time-to-maximum exceeding 6 seconds, from the irreversibly infarcted core, defined by relative cerebral blood flow (rCBF) of less than 30% compared to normal tissue.

The evaluation of the ASPECTS format on non-contrast CT involved the assessment of 10 areas supplied by the middle cerebral artery territory, spanning both the ganglionic and supraganglionic levels, across all axial CT slices. More specifically, the slices located at or below the caudate head were specifically defined as the ganglionic level, while any slices located above the caudate head were consistently categorized as the supraganglionic level.

Early signs of ischemic stroke on CT scans typically manifest as areas of hypoattenuation and a diminished distinction between gray and white matter, often accompanied by localized swelling. Within the ASPECTS regions that display initial ischemic changes impacting two consecutive slices, the cumulative score of ten is reduced by one. Consequently, a score of zero signifies infarction that affects all ten areas (Figure 1).

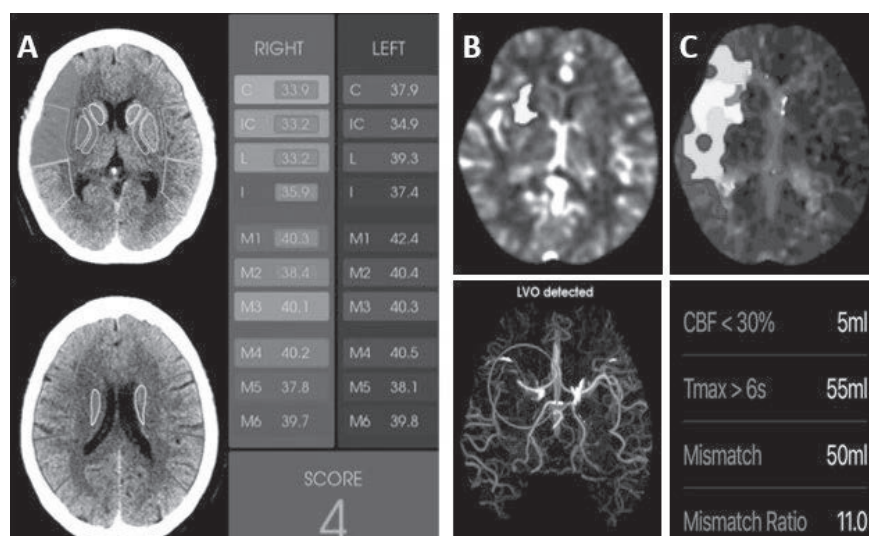


Figure 1. An 53 year-old woman who presented with right MCA M1 occlusion. Axial non-contrast CT and ASPECTS (A); CTP - CBF (B); CTP - Tmax>6 (C) and Mismatch ratio

Mechanical thrombectomy

A procedure executed by a senior neurointerventionalist with over four years of experience, often involved the collaboration of a junior doctor. This procedure was carried out using a DSA monoplane (Philips Allura Xper FD20) for imaging guidance. The choice of anesthesia, whether it to be conscious sedation or general anesthesia, was determined based on the patient's clinical condition and the preference of the interventionist, following the guidelines outlined in the 2018 American Stroke Association recommendations (2). To identify the occlusion site, a large long-sheath (Neuron Max 088, USA) was introduced into the carotid artery for angiography. Subsequent thrombectomy was executed utilizing a second-generation stent retriever (such as Solitaire, Medtronic, USA) or aspiration devices, or a combination of techniques as determined by the neurointerventionist. The procedure was concluded using the Angio-Seal 8F device (Terumo Interventional Systems, USA) or manual compression for femoral artery closure.

Outcome evaluation

Reperfusion outcomes were graded using the mTICI scale, with the final angiogram serving as the basis for evaluation. Functional recovery at the 3-month follow-up was assessed by means of the modified Rankin Scale (mRS), either during a prearranged in-person appointment or via telephone communication.

Statistical analysis

The data were analyzed by easyR software (version 4.0). Descriptive statistics included

the presentation of data as mean \pm standard deviation (SD) and median. Comparative analyses for continuous variables involved either one-way ANOVA or the Kruskal-Wallis test, followed by post hoc analysis if necessary. Categorical data comparisons were carried out using the chi-squared test.

The relationship between ASPECTS and outcomes was assessed through Spearman correlation. Correlations between ASPECTS and modified Rankin Scale (mRS) scores were quantified using partial correlation coefficients (r). The determination of the cutoff value for ASPECTS was performed through a Receiver Operating Characteristic (ROC) curve analysis. Finally, logistic regression analysis was conducted to evaluate the predictive capability of the identified cutoff value as an independent variable.

In all statistical analyses, a significance level of ≤ 0.05 was considered statistically significant. Logistic regression analysis was employed to estimate adjusted odds ratios and 95% confidence intervals for various risk factors' prognostic value in predicting the outcome.

3. RESULTS

From January 2022 to May 2023, there were 87 acute ischemic stroke patients with anterior circulation large vessel occlusion who underwent mechanical thrombectomy within the 6-24 hour window at Bach Mai Hospital. The mean patient's age was $64,5 \pm 11,4$ years, and 45/87 (55%) were male. 55 (67,1%) patients had hypertension, 30 (36,6%) patients had atrial fibrillation.

Table 1. Patients characteristics

Gender	Good outcome	Poor outcome	P value
Male (n,%)	25 (53%)	24 (60%)	0.5
Femle (n,%)	16 (47%)	22 (40%)	0.3
Age (years)	68 ± 10.6	61.5 ± 11	0.001
Medical history			
Hypertension (n,%)	55 (67.1%)		
Atrial fibrillation (n,%)	30 (36.6%)		
Diabetes mellitus (n,%)	38 (46.3%)		
Location vessel occlusion			
ICA occlusion (n,%)	23 (28%)		
M1 occlusion (n,%)	46 (56.1%)		
M2 occlusion (n,%)	5 (6.1%)		
Tandem occlusion (n,%)	8 (9.8%)		
ASPECTS (mean, sd)	7.5 ± 1.47	5.9 ± 1.96	0.00006
Infarct core (ml,sd)	18.4 ± 18.6	31.2 ± 26.3	0.009
Penumbra tissue (ml,sd)	106.5 ± 44.8	123.1 ± 51.9	0.11
Mismatch ratio	26 ± 40	20.5 ± 41	0.53
Outcome (n,%)	47 (54%)	40 (46%)	
NIHSS (score, sd)	12.5 ± 4	13.67 ± 2.8	0.13

Indeed, a significant difference in the age of patients was observed between the group with good outcomes and the group with poor outcomes. Furthermore, the mean ASPECTS was higher in the favorable outcome group compared to the unfavorable group, with means of 7.5 ± 1.47 and 5.9 ± 1.96, respectively (p<0.001). The mean infarct core was also lower in the favorable outcome group compared to the unfavorable group, with means of 18.4 ± 18.6 and 31.2 ± 26.3, respectively (p<0.001). However, there were no significant differences in terms of penumbra tissue, mismatch ratio, or NIHSS scores between the group with good

outcomes and the group with poor outcomes (all p >0.05). (Table 1)

The association between ASPECTS and CT perfusion

There was a significant negative correlation between the infarct core volume and ASPECTS value (r = -0.569, p < 0.0001). Furthermore, there was a positive correlation between the mismatch ratio and ASPECTS value (r = 0.385, p < 0.001). However, no significant correlation was observed between penumbra tissue volume and ASPECTS value (p > 0.05). (Table 2)

Table 2. Relationship of ASPECTS with Infarct core, Penumbra tissue, and mismatch ratio

	R	95% Confidence interval	P value
Infarct core (ml)	- 0.569	-0.677 - -0.377	<0.0001
Penumbra tissue (ml)	- 0.187	-0.383 – 0.024	0.08
Mismatch ratio	0.385	0.189 – 0.551	<0.001

Predicting prognostic outcomes based to ASPECTS, CT perfusion and clinical factors

A prognostic model, employing regression analysis with mRS, revealed that independent factors associated with poor outcomes included

older age (OR = 1.06, p = 0.01), a higher initial Glasgow score (OR = 0.61, p = 0.01), a larger infarct core volume (OR = 1.03, p < 0.01), and a lower ASPECTS (OR = 0.6, p < 0.001). (Table 3)

Table 3. Prognostic model using a regression analysis with mRS.

	OR	95% Confidence interval	P value
Age (years, sd)	1.06	1.01 – 1.1	0.01
NIHSS (mean, sd)	1.1	0.97 – 1.24	0.13
Glasgow score (mean, sd)	0.61	0.41 – 0.9	0.01
Infarct core (ml)	1.03	1.01 – 1.05	0.01
Penumbra tissue (ml)	1.01	0.99 – 1.02	0.11
Mismatch ratio	0.99	0.98 – 1.01	0.53
ASPECTS (mean, sd)	0.6	0.45 – 0.79	0.0003

This study illustrates that the determined ASPECTS cutoff value for predicting unfavorable outcomes achieves a high level of sensitivity and specificity, both exceeding sixty percent. When comparing the ROC curves for ASPECTS, infarct core, penumbra tissue, and mismatch ratio values, it becomes evident that only ASPECTS displays a robust predictive capability. The area under the

curve reaches 0.727, with a cutoff threshold at ASPECTS = 6, resulting in a sensitivity of 74.4% and specificity of 57.5%. Consequently, an ASPECTS score of ≥ 6 has the potential to forecast a positive prognosis for patients with anterior circulation large vessel occlusion undergoing thrombectomy within the extended time window. (Table 4 and Figure 2)

Table 4. The prognostic value of ASPECTS, CT perfusion for good outcome

	Cutoff value	Sensitivity	Specificity	AUC (95%CI)	p-value
ASPECTS	> 6	57.5%	74.4%	0.727 (0.619 – 0.835)	0.03
Infarct core	< 15	67.5%	57.4%	0.641 (0.523 – 0.758)	0.11
Penumbra tissue	< 157	30%	91.4%	0.575 (0.452 – 0.698)	0.113
Mismatch ratio	> 8.2	70%	57.4%	0.606 (0.485 – 0.727)	0.15

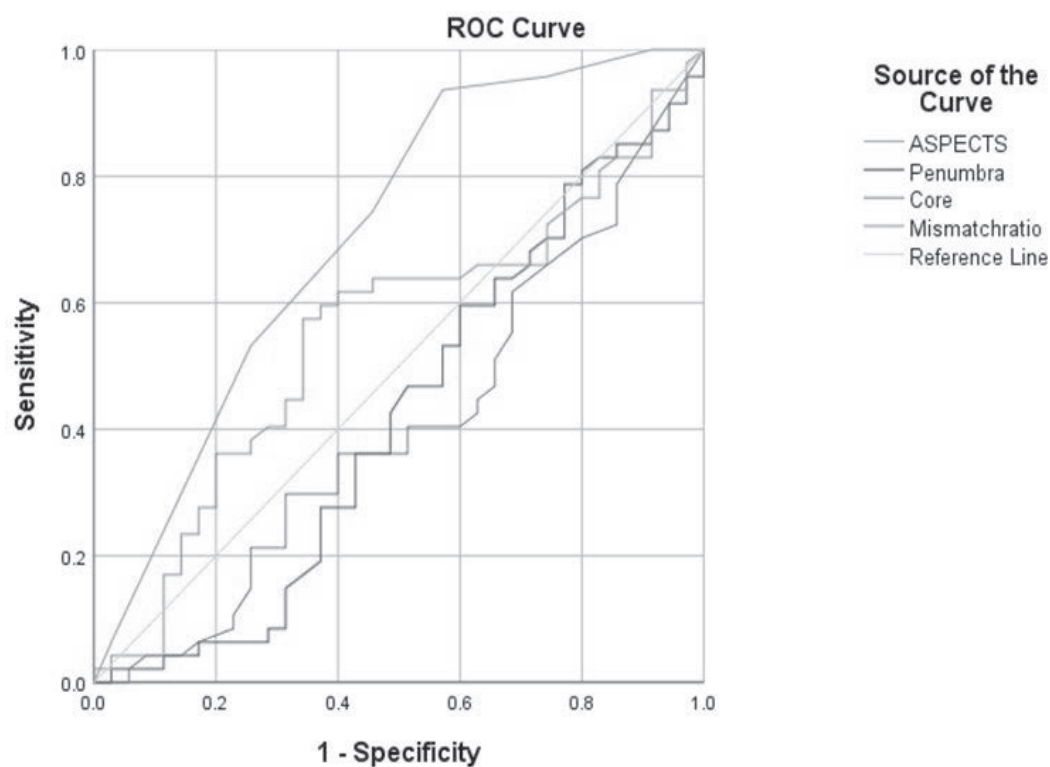


Figure 2. ROC curves for estimation of cutoff value of ASPECTS, CTP for the outcome of acute ischemic stroke

4. DISCUSSION

Acute patients necessitate prompt diagnosis and treatment. Non-contrast CT is a frequently employed tool for distinguishing between hemorrhage and infarction in stroke patients due to its simplicity and the potential to save time for early treatment and rapid intervention if necessary [8]. Furthermore, the baseline ASPECTS serves as a dependable predictor of prognosis and has been integrated into the decision-making process and assessment of neurovascular interventions in patients with AIS within a time window of less than 6 hours [9], [10]. In this study, we aimed to explore whether ASPECTS or CT perfusion can predict the prognosis outcome and whether these factors can be utilized in the decision-making process for mechanical thrombectomy in AIS patients within a time window of 6-24 hours.

In this study, the most prevalent risk factors for AIS were hypertension (67%), diabetes mellitus (46.3%), and atrial fibrillation (36.6%). These traditional risk factors align with findings from another study [11-13].

This study reveals that older age, higher ASPECTS, a smaller infarct core volume are associated with a favorable outcome in acute ischemic patients undergoing mechanical thrombectomy treatment. Patients who present with minor ischemic stroke typically experience a rapid recovery with minimal or no inpatient complications. Consequently, cases with higher ASPECTS scores > 7 tend to recover more quickly, experience fewer inpatient complications, and have shorter hospitalization durations. Additionally, an ASPECTS score of more than 7 is associated with lower NIHSS scores and higher Glasgow scores at admission, indicating a minor

stroke, and is indicative of favorable outcomes. These results are consistent with previous studies [14, 15].

Our study demonstrated that the ASPECTS cutoff value established for predicting favorable outcomes achieved both good sensitivity and specificity, which corresponded to a score of > 6 . Therefore, patients with a CT ASPECTS score < 6 were linked to a unfavorable prognosis. Also, infarct core volume less than 15 ml was predicting good outcome with both high sensitivity and specificity. The functional outcome following ischemic stroke is influenced by various factors, including age, gender, comorbid diseases, the severity of the neurological impairment, and the subtypes of stroke. The prognostic model, using regression analysis with mRS, revealed that the independent

factors associated with good outcomes were higher ASPECTS and a smaller infarct core. These results suggest that both ASPECTS and infarct core volume can be utilized to predict the prognosis in AIS patients within 6-24 hours following mechanical thrombectomy treatment.

5. CONCLUSIONS

ASPECTS demonstrates a strong predictive ability for good functional recovery after stroke in patients with acute anterior circulation cerebral infarction undergoing thrombectomy within the extended time window. This suggests that $ASPECTS \geq 6$ may be considered as an alternative to CTP in selecting patients for mechanical thrombectomy in medical facilities lacking advanced imaging diagnostic capabilities.

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STUDENT'S FEEDBACK IN PRE-CLINICAL INTERGRATED TEACHING ACTIVITIES OF INSTRUCTORS AND ASSOCIATED FACTORS

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ABSTRACT

Introducion: Student's feedback on instructors' teaching and learning activities is a reliable source of information that helps instructors adjust teaching activities and enhance instructors' sense of responsibility. Integrated pre-clinical practice teaching is a new method implemented for the first time at the College to equip students with medical knowledge, skills, and attitudes when communicating with patients before student's clinical internships.

Objectives: The study aims to survey students' feedback on pre-clinical integrated teaching activities and to learn some factors related to instructors' integrated pre-clinical teaching activities.

Material and Methods: A cross-sectional descriptive study was conducted on 211 nursing students to the stratified random sampling method, and 12 instructors participated in pre-clinical integrated teaching. The questionnaire used is based on the research of author Mahvash Salsali and referenced according to the instructions of the Ministry of Education and Training of Vietnam. The tool sets are standardized with Cronbach's alpha > 0.8.

Results: Research results showed that: The average score of student feedback on classroom organization skills is 4.39 ± 0.56 , on teaching methods is 4.37 ± 0.56 ; caring for students is 4.37 ± 0.57 ; The test evaluation method is 4.31 ± 0.58 , the general assessment of teaching activities is 4.36 ± 0.57 .

Conclusions: Students are satisfied and appreciate the effectiveness of the lecturer's integrated pre-clinical teaching activities. Instructors's gender and age are factors that influence integrated preclinical teaching activities.

Keyword: *Integrated teaching, student feedback, pre-clinical*

1. INTRODUCTION

To every country in the world as well as Vietnam, education and training is always the top national policy, in college and university education plays an important role, because it is the place that creates knowledgeable human resources to build and develop the country. Therefore, assessing the quality of training in educational institutions is one of the concerns of the education and training industry. Training quality is the result of many processes and is affected by many objective and subjective factors. One of the factors affecting the quality of training is the teaching activities of instructors [1].

Students' evaluation of instructors' teaching activities and the quality of training as well as many other areas of the school has been conducted for a long time around the world. This is a form commonly and regularly used in education in schools in countries with developed education systems such as the United States, Europe, Australia and Asian countries such as Japan, Singapore, Thailand... Since 1980, there have been more empirical studies on methods of evaluating teaching effectiveness and instructors' activities with 4 methods used for evaluation from student, colleagues, dean and the self lecturer. Around the world, there have been many studies on students' evaluation of instructors. Most experts appreciate the value of feedback from students [2],[3].

Evaluating instructors' teaching activities through students' feedback is a relatively new concept in Vietnam. The Ministry of Education and Training only started regulating this practice in 2010. Some schools have conducted research on this topic, which shows that most instructors and students recognize the importance of student evaluations. The feedback received from students has been proven to be highly reliable and valuable. [4],[5],[6]. In 2017, Bach Mai Medical College was one of the

seven colleges nationwide that participated in a project aimed at innovating the competency-based nursing training program. The program emphasizes the importance of integrating preclinical practice into the teaching module, especially for the nursing profession, as it trains nursing skills for students before they practice on patients in departments. To contribute to building a team of high-quality, ethical, and professionally qualified instructors as well as to create more information channels to help instructors adjust their teaching activities and enhance their sense of responsibility, we conducted research to survey students' feedback on pre-clinical integrated teaching activities and identify some factors related to instructors' integrated pre-clinical teaching activities.

2. METHODOLOGY

2.1. Location and time of participating

- Time duration: 12 months (from June 2020 to June 2021)
- Study location: Pre-clinical center, Bach Mai Medical College

2.2. Research design: Cross-sectional descriptive study

2.3. Research sample

2.3.1. Nursing college students

2.3.1.1. Inclusion criteria

- Nursing college students
- Completed pre-clinical practice program
- Students voluntarily participate in research

2.3.1.2. Exclusion criteria

- Students who are not present during the time of collecting research data such as absent from school, sick leave...
- Students voluntarily participated in the research but did not cooperate during the research process

2.3.2. Lecturer at Bach Mai Medical College

Select 12 instructors to participate in pre-clinical integrated teaching who meet the criteria for selection into the research.

2.4. Sample and sample size

2.4.1. Select sample and sample size of students

- Sample size: The study applied the sample size calculation formula:

$$n = \frac{N}{1 + N(e)^2}$$

n: is the research sample size; e is the estimation error (5% = 0.05); N is the number of students participating in pre-clinical studies (N= 450). The sample size according to this study is 211 students.

- Sampling technique: Select stratified random sample

+ Step 1: The researcher divided nursing students at Bach Mai Medical College into classes

+ Step 2: In each class, the researcher makes a list of students

+ Step 3: In each class, the researcher randomly selected 40 nursing students to participate in the study. Students' personal information will be completely confidential. Students participating in the study will evaluate each instructor's teaching performance in the pre-clinical module.

2.5. Gathering techniques and instruments

2.5.1. Gathering techniques

The information collection technique is direct interview using a set of questions. After students have completed the pre-clinical module, the researcher gathers selected students in each class, explaining the research objectives, methods and students' rights when participating in the research. The researcher showed photos and reintroduced information from the instructors who

participated in teaching the pre-clinical module. After that, students who agree to participate in the study will evaluate the teaching activities of the instructors teaching the pre-clinical module by completing the questionnaire independently and seriously under the supervision of the instructors. management lecturer.

2.5.2. Research instruments

a. Students's instruments

Part 1: Demographic information of research subjects such as age, gender, geography...

Part 2: A set of questions about students' feedback on teaching activities integrating pre-clinical practice of instructors was built based on a set of questions by author Mahvash Salsali and his colleagues conducting research on Evaluate the impact of teaching activities in nursing education [7]. At the same time, the research questions refer to the Ministry of Education and Training's guidance on evaluating teaching activities including 7 elements: (1) Teaching content and methods; (2) Teaching materials; (3) Responsibility and enthusiasm of instructors; (4) Ability to stimulate creativity and critical thinking; (5) Fairness in student assessment; (6) Ability to organize and monitor students' learning process and [7] Pedagogical style [8]. The question set includes 26 questions on contents such as organization and classroom management skills (5 questions); Teaching methods (9 sentences); Caring about students (4 sentences); Testing and evaluation methods (4 sentences); General assessment of the lecturer (4 sentences). The statements are designed on a Likert scale from 1 to 5 from "Strongly disagree" to "Completely agree" to measure students' feedback on the lecturer's teaching activities. The questionnaire was piloted on 30 students to test reliability with a Cronbach alpha coefficient > 0.8 and Prior to piloting, the questionnaire was sent to experts for evaluation to determine its validity.

b. Lectures's instrumens

General information about the instructors regarding gender, age, marital status, educational status, teaching experience and frequency of participation in training on pre-clinical integrated teaching.

2.6. Data colection and data analysis

Analyze data using SPSS 20.0 software

Descriptive statistics including: mean, standard deviation, median, interquartile range of quantitative variables, as well as frequencies and percentages of qualitative variables were calculated. T-test and ANOVA test are used to find out factors related to instructors' teaching activities. Value $\alpha = 0.05$ is used to determine the statistical significance threshold.

2.7. Ethical Considerations

The research was approved by the Research Ethical Committee at Bach Mai hospital in Hanoi, Vietnam. Students and instructors are given a clear explanation of the research objectives, their voluntary participation in the research, and have the right to refuse to participate in the research without explanation. Choosing whether or not to participate in research is not

related to the student's learning or the lecturer's work history.

The research process is conducted independently. Information after being collected is encrypted with a series of numbers (ID) and stored securely at the research location and the information used for research purposes.

3. RESULTS

3.1. General characteristics of students participating in research

Of the 211 students participating in the study, the majority of study participants were female. 57.4% of students rated the pre-clinical module as difficult, 21.7% of students rated the pre-clinical module as very difficult. To evaluate the level of pressure when studying the pre-clinical module, 48.5% of students felt pressure when studying the pre-clinical module, 13.9% of students felt very pressured when studying the pre-clinical module.

3.2. Student feedback on integrated preclinical teaching activities

3.2.1. Student feedback on instructors' classroom organization skills

Table 1. Student feedback on instructors' classroom organization skills

No	Criteria	Degree evaluation				
		Very pleased (%)	Satisfied (%)	Medium (%)	Less satisfied (%)	Unsatisfied (%)
1	Instructors come to class on time	45.4	50.1	4.3	0.1	0.1
2	Instructors carry out teaching schedules according to regulations	44.9	50.4	4.6	0.1	0
3	Instructors allocate class time appropriately	44.3	50.5	5.0	0.1	0
4	Instructors organize students to participate in group activities to solve learning tasks	44.2	50.7	5.0	0.1	0
5	Instructors monitor and evaluate students' classroom learning activities	43.9	50.7	5.3	0	0

No	Criteria	Degree evaluation				
		Very pleased (%)	Satisfied (%)	Medium (%)	Less satisfied (%)	Unsatisfied (%)
1	Instructors come to class on time	45.4	50.1	4.3	0.1	0.1
2	Instructors carry out teaching schedules according to regulations	44.9	50.4	4.6	0.1	0
3	Instructors allocate class time appropriately	44.3	50.5	5.0	0.1	0
4	Instructors organize students to participate in group activities to solve learning tasks	44.2	50.7	5.0	0.1	0
Mean \pm SD		4.39 \pm 0.56				

Comment: Most students are satisfied with criteria related to instructors' classroom organization skills with a rate of over 90%.

3.2.2. Student feedback on instructors' teaching methods

Table 2. Student feedback on instructors' teaching methods

No	Criteria	Degree evaluation (%)				
		Very pleased	Satisfied	Medium	Less satisfied	Unsatisfied
1	The instructor has a clear and easy-to-understand method of communication	43.2	51.9	4.8	0.1	0
2	Instructors have extensive professional knowledge	43.3	51.4	5.2	0.1	0
3	The pace of the lecture is appropriate to the students' awareness	42.5	51.9	5.4	0.1	0
4	Instructors have proficient practical skills	43.7	51.1	5.1	0	0
5	Instructors use teaching aids effectively.	43.3	51.2	5.4	0.1	0
6	The instructor raises issues for students to think and debate	42.4	51.9	5.7	0	0
7	Instructors guide students in effective self-study methods.	42.3	51.7	6.0	0	0
8	Instructors relate the problems in the lesson to practice.	43.1	51.0	5.8	0	0
9	Professional questions are answered satisfactorily by the Instructor.	43.0	51.2	5.6	0.1	0
Mean \pm SD		4.37 \pm 0.56				

Comment: The average satisfaction score of students about the instructor’s teaching method is 4.37 ± 0.56 . In particular, the percentage of very satisfied students accounts for the highest percentage in the criterion “instructors have

proficient practical skills” (43.7%), followed by the criterion “instructors have deep professional knowledge”: widely and instructors use teaching aids effectively (accounting for 43.3%).

3.2.3. Student feedback on the lecturer’s attention during the teaching process

Table 3. Students’ feedback on the lecturer’s attention during the teaching process

No	Criteria	Degree evaluation				
		Very pleased	Satisfied	Medium	Less satisfied	Unsatisfied
1	Instructors create a friendly learning environment.	43.3	51.0	5.6	0.2	0
2	Instructors are very approachable and willing to share experiences with students	43.2	50.9	5.8	0.1	0
3	Instructors are ready to advise and help students study	43.6	50.9	5.3	0.2	0
4	Instructors care about moral education and students’ sense of discipline	42.6	51.6	5.6	0.1	0
	Mean \pm SD	4.37 \pm 0.57				

Comment: The average score of student satisfaction with the instructor’s attention during the teaching process is 4.37 ± 0.57 . In particular,

the criterion of instructors creating a friendly learning environment was very satisfied by 43.3% of students and 51.1% of students were satisfied.

3.2.4. Student feedback on instructors’ assessment and testing methods

Table 4. Student feedback on instructors’ assessment and testing methods

No	Criteria	Degree evaluation				
		Very pleased	Satisfied	Medium	Less satisfied	Unsatisfied
1	Student learning outcomes are assessed in many different forms	41.3	52.6	6.0	0	0.1
2	Instructors analyze and correct students’ errors when testing	42.6	51.8	5.5	0.0	0.1
3	Student learning outcomes are assessed accurately and fairly.	42.0	52.0	5.8	0.1	0.1
	Mean \pm SD	4.31 \pm 0.58				

Comment: The average score on the lecturer's assessment method is 4.31 ± 0.58 . Students rated all criteria as satisfactory at over 90%.

3.2.5. Students' general assessment of teaching activities instructors.

Table 5. Students' general assessment of teachers' teaching activities

No	Criteria	Degree evaluation				
		Very pleased	Satisfied	Medium	Less satisfied	Unsatisfied
1	Instrutors teach enthusiastically and responsibly	43.4	51.4	5.2	0	0
2	Students understand the issues conveyed in class.	41.7	52.3	5.8	0.2	0
3	Students practice techniques under the guidance of instructors.	41.4	52.6	5.6	0.3	0
4	Through the instrutor's teaching activities, students appreciate the value of the module.	42.6	51.6	5.6	0.1	0
Mean \pm SD		4.36 \pm 0.57				

Comment: The average score of the overall assessment of teaching activities of instrutors in the Pre-clinical module is 4.36 ± 0.57 . Among them, the highest percentage of students rated the lecturer's teaching as enthusiastic and responsible

with 43.4% of students being very satisfied and 51.4% of students being satisfied. In particular, through the teaching activities of the lecturer, 42.6% of students are very satisfied and 51.6% of students are satisfied with the value of the module.

3.3. Factors related to instructors' integrated pre-clinical teaching activities

Table 6. Some factors related to instructors' integrated pre-clinical teaching activities

Variable	Index	%	Student feedback on teaching activities (Mean \pm SD)	p
Sex	Male	25	4.41 \pm 0.52	0.004
	Female	75	4.35 \pm 0.56	
Academic level	Bachelor	8.3	4.36 \pm 0.55	0.4
	Masters	91.7	4.38 \pm 0.55	
Instructor's age	30 – 40	66.7	4.41 \pm 0.54	0.003
	40 – 50	25	4.35 \pm 0.55	
	50 – 60	8.3	4.30 \pm 0.55	
Teaching experience	< 5 years	8.3	4.37 \pm 0.53	0.148
	5 – 10 years	75	4.38 \pm 0.55	
	>10 years	16.7	4.36 \pm 0.55	
Frequency of participating in training on pre-clinical integrated teaching methods	Very often	8.3	4.39 \pm 0.53	0.164
	Frequent	75	4.38 \pm 0.55	
	Medium	16.7	4.37 \pm 0.54	
	Rarely/never	0		

Comment: Among the total instructors participating in teaching pre-clinical modules, female instructors account for a higher proportion. Male instructors' average scores of teaching activities were rated higher by students than female instructors ($p < 0.05$).

Most instructors have a master's degree in nursing, there are no instructors with a doctoral degree and only 8.3% of instructors have a bachelor's degree. Instructors with a master's degree will have higher feedback scores on teaching activities than those with a bachelor's degree. However, the difference is not statistically significant.

The highest proportion are instructors aged 30 - 40 years old (66.7%). Instructors aged 30 - 40 were rated by students as having higher average scores on integrated pre-clinical teaching activities than instructors aged 40 - 50 and over 50 years old ($p < 0.05$).

Regarding the teaching experience of instructors, 75% of instructors have teaching experience from 5 to 10 years, 16.7% of instructors have teaching experience of over 10 years and only 8.3% of instructors have teaching experience < 5 years. year. Instructors with 5 - 10 years of teaching experience will have the highest average score evaluating teaching activities. However, the difference is not statistically significant

75% of instructors regularly participate in training on integrated pre-clinical teaching methods. Instructors who are very often trained in pre-clinical integrated teaching methods have higher average scores evaluating teaching activities.

4. DISCUSSION

4.1. Student feedback on integrated preclinical teaching activities

Classroom organization skills are a basic skill of

instructors in general and instructors teaching pre-clinical modules in particular. In the pre-clinical integrated teaching method, students will discuss, have their questions answered and be taught about technical knowledge. Then, students analyze the clinical situation and practice according to instructions. Thus, reasonable distribution of students' theory and practice time is an important factor in determining the success of the lecture. 95.3% of students are satisfied with the class time distribution of instructors teaching pre-clinical modules. Our research results are higher than the research results of author Le Thi Huong Chi and her colleagues. Research on student evaluations of instructors' teaching activities in 2014 showed that 74.2% of students agreed about Reasonable time distribution between theory and practice [9].

To improve students' initiative in learning and their ability to self-study and search for information, in the pre-clinical integrated teaching method, instructors will raise issues for students to think and debate. discussion and instructors will answer professional questions for students[10]. At the same time, instructors will guide students on effective self-study methods. These criteria are highly appreciated by students during the process of studying the pre-clinical module with a student satisfaction rate of 94.3% respectively; 94.2% and 94%. The research results in this study are higher than the research by author Tran Thanh Hai, who studied the quality of instructors at Polytechnic University in 2014, showing that only 35.79% of students strongly agree and 16.7% of students agree. agree with the criteria of the lecturer's teaching method to stimulate students' thinking ability [10]. The reason for the difference may be that when updating the training program according to the new curriculum and changing the "student-centered" teaching method, the

school thoroughly informed each lecturer about the importance of independent thinking of learners in learning, focusing on raising problems, stimulating students' interest in searching for knowledge.

The characteristics of the teaching time of the pre-clinical module are conducted in the 2nd semester of the first year - the time when students are also approaching and adapting to the way of education at school, different from general education. Therefore, instructors need to always be ready to advise and help students study while creating a friendly learning environment. Students highly appreciated this activity of instructors with 94.5% and 94.3% of students satisfied, respectively. Our research results are similar to the results of author Le Thi Huong Chi on evaluating the teaching activities of instructors at the University of Labor and Social Affairs with the average score of the criterion of instructors' help and support. students' problems related to learning is 4.32 [9].

During the teaching process of the pre-clinical module, assessment activities are conducted at the end of the hour to evaluate the knowledge and skills of students during the lesson. 93.9% of students are satisfied with instructors' flexible application of forms to evaluate students. 94.4% of students are satisfied with the analysis and correction of errors at the end of the test. The average score on evaluation by instructors is 4.31 ± 0.58 . Our research results on evaluating instructors' learning outcomes are higher than author Tran Thanh Hai's research with an average score of 4.15. [10]

4.2 Some factors related to instructors' integrated pre-clinical teaching activities

According to our research results, male instructors have a higher average satisfaction score with teaching activities of pre-clinical modules (4.41 ± 0.52) than female instructors (4.35 ± 0.56).

The difference is statistically significant with $p = 0.004$. Our research results are similar to some previous authors who have shown that female instructors have lower teaching effectiveness scores than male instructors [11],[12]. Male instructors are often very independent, less influenced by emotions, and have a decisive and clear teaching style, while female instructors are highly emotionally expressive and always tend to care. Student [13]. Previous studies have shown that, with modules heavily related to technology, female instructors' assessment scores on teaching effectiveness will be the lowest; While in business-related courses or courses that use soft skills, female instructors' teaching effectiveness ratings will be highest [14]. The characteristic of the pre-clinical module is to conduct technical procedures, although the technical operations require a certain amount of dexterity as well as the need to apply a flexible communication skill, but perhaps clarity, male instructors will definitely be rated higher by students than female instructors.

The results of this study show that young instructors receive higher ratings from students about the teaching activities of the pre-clinical module. Older instructors with extensive life experience will tend to be careful and calm when solving problems, have extensive professional knowledge and value the solid transmission of knowledge, but it will be difficult. adapt to change as well as have difficulty absorbing science and technology, teaching using traditional methods and rarely wanting to change their methods. While young instructors will be enthusiastic, dynamic, willing to find new methods to apply to teaching and like to introduce new ideas, however, they will lack thoroughness and knowledge when looking at and solving problems. Expertise will be limited[15]. At the same time, older instructors will be evaluated on the criteria of extensive professional knowledge, but the criteria of classroom management or encouraging students

will have lower evaluation scores [16]. The pre-clinical module applies active teaching methods to replace traditional teaching methods. This is a new method that combines many operations and activities in class as well as applying many information technologies in the teaching process. Therefore, it is possible that young instructors will be more adaptable than older instructors.

5. CONCLUSION

This study has shown that the majority of students responded that they were satisfied with the faculty's integrated preclinical teaching

activities. Gender and age are factors that influence instructors' integrated pre-clinical teaching activities. The results of the study are the premise for conducting qualitative research and more in-depth research to clearly identify factors affecting instructors' integrated pre-clinical teaching activities as well as difficulties students encounter during their studies. It is necessary to maintain regular student feedback to promptly grasp the thoughts and aspirations as well as this is an opportunity for instructors to adjust and improve the quality of lectures

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GENOMIC CHARACTERISTICS OF SARS-COV-2 INFECTION IN THE COVID-19 PATIENTS TREATED AT THE NATIONAL HOSPITAL FOR TROPICAL DISEASES IN THE PERIOD OF 2021-2022

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ABSTRACT

Objectives: To describe some genomic characteristics, variations and genetic relationships of SARS-CoV-2 in COVID-19 patients treated at the Central Tropical Diseases Hospital in the period of 2021-2022.

Material and Methods: 300 patients diagnosed with SARS-CoV-2 infection by realtime RT-PCR testing at the Central Hospital of Tropical Diseases from January 2021 to April 2022. Samples are positive for the SARS-CoV-2 which are collected and stored for genomic sequencing testing. Cross-sectional descriptive study with 300 SARS-CoV-2 positive samples sequenced with the entire genome using the MiSeq system (illumina). Genome sequences of SARS-CoV-2 strains were analyzed using Bioedit 7.1 and Mega 10.1 software. Variants of SARS-CoV-2 strains were identified based on the Pango database (<https://cov-lineages.org/>).

Results: The findings showed that the 300 SARS-CoV-2 strains in the study were classified into three variant groups including Alpha (54 strains), Delta (121 strains) and Omicron (121 strains). In the Alpha group, we only see the B.1.1.7 lineage of 20I branch (Alpha, V1), Delta variant strains belonging to 3 branches: 21A, 21I and 21J and 2 lineages including B.1.617.2 and AY .57, Omicron variant strains all belong to 21L branch but there are four lineages including BA.2, BA.2.3, BA.2.3.2, BA.2.17. Genome sequence analysis of SARS-CoV-2 variants shows that the groups recording the number of mutations are Alpha with 32 mutations throughout the entire genome, Delta with 29 mutations, Omicron with 59 mutations. They are mainly substitution mutations, followed by deletion mutations, and the gene with the highest rate of mutation is the S gene.

Conclusions: SARS-CoV-2 strains in Vietnam have a variety of variations (Alpha, Delta, Omicron) as well as many mutations, of which the highest mutation rate is in the S gene. Mutations have some differences with SARS-CoV-2 strains causing disease in other regions of the world

Keywords: COVID-19; SARS-CoV-2; Genome sequencing; Genomic characteristics; Central Tropical Diseases Hospital

1. INTRODUCTION

SARS-CoV-2 is an emerging virus belonging to the family of coronaviruses that causes severe acute respiratory syndrome (COVID-19). After being infected with SARS-CoV-2, COVID-19 patients have very different clinical symptoms: some have no symptoms, some have only mild symptoms like the common cold, and some have more severe symptoms of pneumonia or acute respiratory distress syndrome, septic shock, multi-organ failure and failure to survive, especially in the elderly, with underlying diseases, and people with degraded weak immune systems [1], [2]. However, disease manifestations vary in regions and countries around the world.

SARS-CoV-2 is a virus with a single-positive RNA genome, about 25-32 kilobases in size, this is the virus with the largest genome among RNA viruses. RNA viruses have a higher mutation rate than DNA viruses [3], the nucleotide substitution rate of RNA viruses is estimated to be about six orders of magnitude greater than that of their respective cellular hosts. These characteristics of RNA viruses may be the cause of the diversity in symptoms and clinical progression in the COVID-19 patients at different times. There have been statistical reports of new variants with the hypothesis of increased infectivity, increased severity of the disease, increased proportion of patients requiring hospitalization for medical care, reduced antibody response as well as such as disease prevention vaccines, causing difficulties in the process of epidemic control as well as vaccine production. In Vietnam, there have been initial reports on genomic sequencing of SARS-CoV-2, but data are still sporadic [3].

Determining the nucleotide sequence variation of SARS-CoV-2 that causes disease in COVID-19 patients is very meaningful, helping to properly

assess the situation to have preventive measures, diagnosis, prognosis and more effective treatment. Therefore, we carried out the topic titled "Genomic Characteristics of Sars-Cov-2 Infection in the Covid-19 Patients Treated at the National Hospital of Tropical Diseases in the period of 2021-2022" with the goal:

Describe Genomic Characteristics of Sars-Cov-2 Infection in the Covid-19 Patients Treated at the National Hospital of Tropical Diseases in the period of 2021-2022.

2. RESEARCH SUBJECTS AND METHODS

Research subjects: 300 patients who are diagnosed with SARS-CoV-2 infection by realtime RT-PCR testing at the National Hospital for Tropical Disease from January 2021 to April 2022. The samples positive for SARS-CoV-2 are collected and stored for genomic sequencing testing.

Research methods: With a cross-sectional research design, we selected 300 COVID-19 patients who met the criteria for selection into the study, collecting information on: age, gender, Realtime RT- PCR, genome sequencing results and analysis of gene mutations.

Data analysis method:

Genome sequences of SARS-CoV-2 strains were analyzed using Bioedit 7.1 and Mega 10.1 software. Variants of SARS-CoV-2 strains were identified based on the Pango database (<https://cov-lineages.org/>). To find common and specific mutations for the strains in the study, reference strains collected from 5 continents as well as the original SARS-CoV-2 strain that caused the disease in Wuhan (GenBank code: NC_045512.2) were used to analyze Tables 1a, 1b, 1c).

The collected data are encrypted and put into the computer using Excel software.

Table 1a. GISAID codes for reference Alpha strains
(reference)

Nation	GISAID code
China	11799982
Vietnam	2479931
India	3398797
Algeria	12644861
South Africa	9702396
United Kingdom	11059113
Denmark	13354458
USA	13688884
Canada	5417938
Australia	9285767
New Zealand	4819971

Table 1b. GISAID codes for reference Delta strains
(reference)

Nation	GISAID code
China	13008954
Vietnam	12252512
India	10067925
Algeria	13578938
South Africa	13392375
United Kingdom	13362199
Denmark	13649083
USA	13689334
Canada	13560291
Australia	10260041
New Zealand	8681211

Table 1c. GISAID codes for reference Omicron strains
(reference)

Nation	GISAID code
China	13499642
Vietnam	13358806
India	13697133
Algeria	12043100
South Africa	13698670
United Kingdom	13694828
Denmark	13696448
USA	13708965
Canada	13671049
Australia	13274113
New Zealand	13439027

3. RESULT

Genomic characteristics and variants of SARS-CoV-2

1. Some characteristics of patients in the study: Patients are distributed in many different ages, from 18 - 70 years old. The

number of patients tends to decrease as age increases. Of which 45% are men, 55% are women. The male/female ratio is 0.83/1.

2. Gene sequencing results

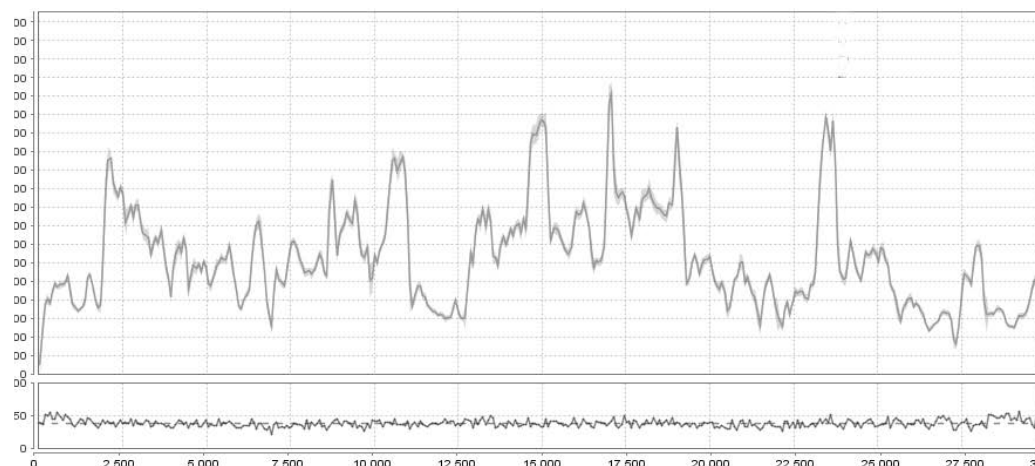


Figure 1. Gene sequencing results of SARS-CoV-2 strains

The sequencing results of 300 SARS-CoV-2 strains obtained in the study were of very good quality with an average reproducibility of about 4,000 times (4,000X), of which the lowest was about 700X and the highest was about 7,800. X. In particular, the S gene region (coding for Spike

protein) from nucleotide position 21563 to 25384 on the SARS-CoV-2 genome has a repeat reading of about 2,500X, which can detect small mutations and other gene regions like ORF1a, b, 3, 4, 5, 6, 7, 8 also have a relatively high level of repetitive readings (Figure 1).

1. Result of variation distribution

Table 2. Distribution of SARS-CoV-2 variants of 300 research samples

Variant	Branch	Lineage	Number of strains	Total (%)
Alpha	20I (Alpha, V1)	B.1.1.7	54	54
Delta	21I (Delta)	AY.57	116	121
	21A (Delta)	B.1.617.2	2	
	21J (Delta)	B.1.617.2	3	
Omicron	21L (Omicron)	BA.2	24	121
	21L (Omicron)	BA.2.3	41	
	21L (Omicron)	BA.2.3.2	48	
	21L (Omicron)	BA.2.17	8	
Others	20B	B.1.1	4	4
Total			300	300

The results of nucleotide sequence analysis of 300 samples in the study showed that there are 3 main variants: Alpha, Delta and Omicron, of which: Alpha variant has 54 strains belonging to 20I branch and lineage B.1.1.7; The Delta variant has 121 strains, including 116 strains belonging to branch 21I (lineage AY.57), 2 strains belonging to branch 21A (lineage B.1.617.2) and 3 strains belonging to branch (21J (lineage B.1.617.2); Omicron variant There are 121 strains, of which 24 strains belong to branch 21L (lineage BA.2), 41 strains belong to branch 21L (lineage BA.2.3), 48 strains belong to branch 21L (lineage BA.2.3.2) and 8 strains belong to branch 21L (lineage BA.2.17); There are also 4 strains belonging to 20B branch lineage B.1.1 (Table 2).

2. Rate of mutation of 3 groups of variants

Table 3. Distribution of mutation numbers of SARS-CoV-2 variants

Gen	Number of mutations of variants		
	Alpha	Delta	Omicron
E	1	1	2
M	1	1	2
N	4	3	6
ORF1a	7	5	12
ORF1b	1	3	4
ORF3a	0	1	2
ORF6	0	0	1
ORF7a	1	1	0
ORF7b	0	0	0
ORF8	4	2	0
ORF9b	0	1	4
S	13	11	26

Genome sequence analysis of SARS-CoV-2 variants showed that the Alpha group recorded a total of 32 mutations throughout the genome, including 6 deletion mutations and 26 substitution mutations. Mutations appear in most genes except for orf3a, orf6, orf7b, orf9b, of which mutations in gene S carry the most with 10 points. The Delta group has 29 mutations, including 5 deletion mutations and 24 substitution mutations. No mutations

appeared in the orf6 and orf7b genes. The most mutations were still recorded in the S gene with 11 points, followed by orf1a with 5 points. The Omicron group carries the most mutations with 59 mutations, including 10 deletion mutations and 49 substitution mutations. The S gene recorded up to 26 mutations, followed by the orf1a gene with 12 mutations, the orf7a, orf7b and orf8 genes had no mutations (Table 3).

3. Mutation characteristics of three groups of variants

Table 4. Comparison of mutations between Alpha, Delta, Omicron strains in Vietnam

Gen	Mutation location	Alpha	Delta		Omicron			
		B.1.1.7	B.1.617.2	AY.57	BA.2	BA.2.3	BA.2.3.2	BA.2.17
E	L21F	-						
	S55F			-				
	T9I				-	-	-	-
	S55F				-	-	-	-
M	E12D	-						
	I48M		-	-				
	Q19E						-	
	A63T				-	-	-	-
N	D3L	-						
	R203K/M	-	-	-	-	-	-	-
	F204R	-			-	-	-	-
	S235F	-						
	D63G		-	-				
	D377Y		-	-				
	P13L				-	-	-	-

Gen	Mutation location	Alpha	Delta		Omicron			
		B.1.1.7	B.1.617.2	AY.57	BA.2	BA.2.3	BA.2.3.2	BA.2.17
orf1a	E444A	-						
	T1001I	-						
	A1708D	-						
	T2230T	-						
	M2259I	-						
	P380S				-			
	P1640L			-	-			
	A3209V				-			
	V3718A				-			
	T3750I				-			
	S135R					-	-	-
	T842I					-	-	-
	G1307S					-	-	-
	A2909V						-	-
	L3027F					-	-	-
	T3090I					-	-	-
	L3201F					-	-	-
	T3255I					-	-	-
L3395H					-	-	-	
orf1b	P218L	-						
	P314L	-	-	-	-	-	-	-
	G662S		-	-				
	P1000L			-				
	R1315C				-	-	-	-
	I1566V					-	-	-
	T2163I					-	-	-
orf3a	S26L		-	-				
	L140F					-	-	
	T223I				-	-	-	-
orf6	D61L				-	-	-	
orf7a	T39I	-	-	-				
	V82A							
orf7b								

Gen	Mutation location	Alpha	Delta		Omicron			
		B.1.1.7	B.1.617.2	AY.57	BA.2	BA.2.3	BA.2.3.2	BA.2.17
orf8	Q27*	-						
	R52I	-						
	K68*	-						
	Y73C	-						
orf9b	T60A		-	-				
	P10S				-	-	-	-
S	N501Y	-			-	-	-	-
	A570D	-						
	D614G	-	-	-	-	-	-	-
	P681H	-	-	-	-	-	-	-
	T716I	-						
	S982A	-						
	D1118H	-						
	T19R		-	-				
	A222V			-				
	L452R		-	-				
	T478K		-	-				
	D950N		-	-				
	G142D		-	-	-	-	-	-
	V213G				-	-	-	-
	G339D				-	-	-	-
	S375F				-	-	-	-
	T376A				-	-	-	-
	R408S				-	-	-	-
	K417N				-	-	-	-
	N440K				-	-	-	-
	S477N				-	-	-	-
	T478K				-	-	-	-
	E484A				-	-	-	-
	Q493R				-	-	-	-
	Q498R				-	-	-	-
	Y505H				-	-	-	-
H655Y				-	-	-	-	
N764K				-	-	-	-	
D796K)				-	-	-	-	
Q954H				-	-	-	-	

Comparing mutations between SARS-CoV-2 Alpha, Delta and Omicron strains in Vietnam recorded: Mutations G28881A/T (R203K/M) in the N gene, C14408T (P314L) in the ORF1b gene, A23403G (D614G), C23604A (P681H) belongs to the S gene appearing in all strains.

The mutations C26305T (L21F) on the E, G26558T (E12D) region on the M, G28280C (D3L) gene on the gene, A1596C (E444A), C3267T (T1001i), C5388A (A1708D), T6954C (T2230T) G7042T (M2259I) on ORF1a gene, C14120T (P218L) on ORF1b gene, C27972T (Q27*), G28048T (R52I), A28095T (K68*), A28111G (Y73C) on ORF8 gene, C23271A (A570D), C23709T (T716I), T24506G (S982A), G24914C (D1118H) only appears on the Alpha strain B.1.1.7. The B.1.1 alpha strain did not appear to have characteristic mutations in the research samples.

Mutations C26408T (S55F) on E gene, A26666G (I48M) on M gene, A28461G (D63G) G29402T (D377Y) on N gene, C1403T (P380S), C5184T (P1640L), C9891T (A3209V), T11418C, (V371) 8A), C11514T (T3750I) on ORF1a gene, G15451A (G662S), C16466T (P1000L) on ORF1b gene, C25469T (S26L) on ORF3a gene, C27509T (T39I) on ORF7a gene, A28461G (T60A) on ORF9b and C21 genes 618G (T19R), C22227T (A222V), T22917G (L452R), C22995A (T478K), G24410A (D950N), G21987A (G142D) belong to the S .region only appearing in Delta strains

Mutations C26270T (T9I), C26408T (S55F) belong to gene E, G26709A (A63T) belong to gene M, C28311T (P13L) belong to gene N, T670G (S135R), C2790T, (T842I), G4184A (G1307S), C8991T (A2909V), C9344T (L3027F), C9534T (T3090I), C9866T (L3201F), C10029T (T3255I), C10449A (L3395H) on ORF1a gene, C17410T (R1315C), A18163G (I1566V), C19955 T (T2163I) on the ORF1b gene, C26060T (T223I) on ORF3a gene, T27384C (D61L) on ORF6 gene, C28311T (P10S) on ORF9b gene T22200G (V213G), G22578A (G339D),

C22686T (S375F), A22688G (T376A), A22786C (R408S), G22813T (K417N), T22882G (N440K), G22992A (S477N), C22995A (T478K), A23013C (E484A), A23040G (Q493R), A23055G (Q498R), T23075C (Y505H), C23525T (H655Y), C23854A (N 764K), G23948T (D796K) belonging to the S region appears only in the Omicron strain.

Among the 3 groups of strains of 300 research samples, the Omicron strain has the largest number of mutations with an average of 43.25 mutations in each virus strain, accounting for 52.1% of the total 83 monitored mutations. Then, it is the Delta strain with an average number of mutations of 20.5 mutations in each virus strain, accounting for 24.7% of the total 83 monitored mutations. Finally, it is the Alpha strain with an average number of mutations of 15 mutations per virus lineage, accounting for 18.1% of the total 83 monitored mutations (Table 4).

4. DISCUSSION

From the research results, we see that between the three groups of variants Alpha, Delta and Omicron in this study, there are quite large differences in the number and types of mutations across the entire genome. However, it is still noted that they have some common mutations in some genes such as N (mutation G2881A/T - (R203K/M), gene ORF1b (mutation C14408T - P314L) and gene S (mutation A23403G - D614G and C23604A - P681H). In addition to the common mutations between the three variant groups, we also noted common mutations between the two variant groups, such as between the Alpha and Delta variants that share common mutations such as C27509T - T39I (ORF7a gene), between the Alpha and Omicron variant groups there is the mutation G28882A - F204R (N gene) and between the Delta variant group and Omicron there is A23063T - N501Y, G21987A - G142D (S gene). Compared to the mutations published on the Pango Lineage

system, we found that the data in our study have certain differences, especially the mutations in the S gene of all three variant groups. In addition to the specific mutations for each type, variants, our research also recorded many mutations that only appear in SARS-CoV-2 strains circulating in Vietnam, this is also a transmission characteristic with a fast life cycle of the virus and has been recorded in many different studies.

Research by Shenghui Weng et al. [4] on the mutation level of three variant groups in China found that the Omicron group carries up to 50 points of mutations, including 43 substitution mutations and 6 deletion mutations and an insertion mutation, the mutations mainly appear in the S gene. Meanwhile, the Alpha group, Beta group, Gamma group, Delta group have 22, 18, 23 and 29 mutations, respectively. Research by Shuchen Feng et al. [5] on the genomic sequence variation of SARS-CoV-2 in epidemics in the US noted that three groups of variants were found, including the Alpha group (branch 20I, lineage B.1.1.7), Delta group (branch 21J, lineage AY) and Omicron group (branch 21K, lineages BA.1, BA.1.15 and BA.1.1). Furthermore, the author also noted that the Omicron variant group has more mutations than the Delta variant group (Omicron has 57.4 mutations compared to 44.8 mutations of the Delta variant). Research by Marios Nikolaidis et al. [6] comparing the gene sequences of SARS-CoV-2 variants on the NCBI gene data bank found that the total number of mutations of the Alpha variant group is 42, Beta (43), Gamma (49), Delta (58), Lamda (40), Omicron (59) with a total of 253 detected mutations in the genome. In which mutations appear in the gene coding for Spike protein in the Alpha, Beta, Gamma, Delta, Lamda, Omicron variants, there are 9, 12, 14, 11, 13 and 36 mutations respectively. Meanwhile, Chakraborty et al. [7] study on genomic sequence variation of pathogenic

variant groups on different continents shows that variants circulating in Asia have the highest frequency of mutations (Omicron-69, Delta-52, Alpha-45) compared to the remaining continents (Africa: Omicron-64, Delta-44, Alpha-45); Europe: Omicron-60, Delta-34, Alpha-43); North America: Omicron-56, Delta-37, Alpha-45); South America: Omicron-61, Delta-44, Alpha-48); Oceania: Omicron-65, Delta-47, Alpha-38), the Omicron variant is still recorded as the group carrying the most mutations.

Through analysis of genetic changes of SARS-CoV-2 strains causing epidemics in Vietnam as well as other SARS-CoV-2 strains causing previous epidemics in Vietnam as well as in countries around the world, we see that These SARS-CoV-2 strains have great genetic variability with a variety of different mutation variants and the proportion of strains carrying mutations is also relatively different between mutation sites. The complex genetic variation of SARS-CoV-2 is one of the main causes leading to the COVID-19 outbreak in Vietnam as well as countries around the world with a large number of infected people as well as a high conversion rate of severe complications and many deaths.

5. CONCLUSION

SARS-CoV-2 strains in Vietnam have a variety of variations (Alpha, Delta, Omicron) as well as many mutations, of which the highest mutation rate is in the S gene. These mutations have a number of differences with SARS-CoV-2 strains causing disease in other regions of the world.

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COMPLIANCE WITH THE AIDET COMMUNICATION MODEL AND PATIENT SATISFACTION WITH THE NURSING STUDENT'S COMMUNICATION AT BACH MAI MEDICAL COLLEGE IN 2022

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ABSTRACT

Objectives: Survey the patients' satisfaction with nursing students' communication following the AIDET model.

Material and Methods: a descriptive cross-sectional study was conducted on 107 patients in internal units with nursing students, a questionnaire based on patients' satisfaction according to AIDET criteria.

Results: the percentage of students who perform the AIDET mode regularly was 72% and very often was 86%. The percentage of students doing steps AIDET model regularly and very often was 86%; 79.4%; 73.8%; 72%; 75.7%; 81.3%; 72.9% and 83.2% respectively. The proportion of good, very well, quite well nursing students' communication was 39.3%; 36.4% and 7.5% respectively. Regarding the specific contents of communication skills was good, very good and excellent ranging from 88.9% to 94%.

Keywords: AIDET communication model, patient satisfaction, nursing students.

1. INTRODUCTION

Communication used to exchange information, establish social relationships [1]. In health facilities, communication between nurses and patients is an increasingly concerning issue and it is one of the criteria for evaluating patient satisfaction [2]. Good communication brings clear sources of information, increasing safety for patients contributing to reducing questions and litigation and avoiding unnecessary medical mistake.

Many studies in the world and Vietnam show that most health workers such as nurses have good communication with patients [3], [4], [5].

However, besides the positive points, there are also limitations. Many models and methods have been applied to improve communication effectiveness. The AIDET (acknowledge, introduce, duration, explanation and thank you) is a simple, easy-to-implement communication model, fully content that patients want to know in the process of care and treatment. Therefore, the application of this model is necessary.

In the world, the medical center in Texas has applied the AIDET model well. Measuring the patient's satisfaction has shown that 80% of patients are satisfied and will introduce this

facility to others [6]. In Vietnam, the AIDET model has been applied in health facilities in recent years. Research by Ngoc Thanh at Ho Chi Minh Dental Hospital in 2019 shows that five AIDET content processes are all evaluated with an average of over four points and the percentage of patient satisfaction reaches over 90%; 97.4% of patients are satisfied with the communication of nurses [5]. However, the research and evaluation of the effectiveness of the AIDET communication model in medical facilities is still very limited. Experimental research on the effectiveness of the communication training program between nurses and patients according to the AIDET model of the 2017 Cho Ray Hospital shown that the AIDET application made patients more satisfied [7]. Therefore, the implementation of AIDET in medical practice is necessary.

At Bach Mai Medical College, educational programs on communication skills for students in clinical practice are receiving more attention. AIDET communication practice training has also been conducted since 2020. However, there has been no research on the compliance of students who practice communication according to the AIDET process with patients and the patients' satisfaction with student communication. Thus, we conducted this study to survey compliance with the AIDET communication model in the clinical practice of nursing students of Bach Mai Medical College in 2022 and survey the patient satisfaction of these students.

2. MATERIALS AND METHODS

2.1. Study population

Patients treatment in the Internal units of Bach Mai Hospital where nursing students at Bach Mai Medical College participate.

Inclusion criteria:

- Patients \geq 18 ages with good contact

- Hospitalized time \geq 3 days

- Patients agreed to participate in the study after being explained the purpose and process of the study.

Exclusion criteria:

- Patients did not agree to participate in the study or were not able to answer questions cognitively.

2.2. Methods

This is a descriptive cross-sectional study

Convenient sampling with 107 patients.

Study timeline: from July 2022 to July 2023.

Study setting: Internal units at Bach Mai Hospital where nursing students participate.

2.3. Instruments

- Demographic characteristics: Includes 05 characteristics about the patient's demographic characteristics and treatment department (gender, age, religion, ethnicity, treatment department)

- Frequency of students' communication activities: Includes 8 elements of communication activities, which are based on the criteria of the AIDET model (according to the guidance of the Studer group). Rating on a Likert scale includes: never, rarely, sometimes, often, and very often, corresponding to a score from 01 to 05 points. The maximum score for each item is 05 points.

- Survey patient satisfaction with nursing communication according to the AIDET model (based on the patient satisfaction survey according to AIDET criteria from the research in Cho Ray). Evaluation on a 5-level Likert scale: Excellent (5 points), very good (4 points), good (3 points), fair (2 points), poor (1 point). The highest score for each item is 05 points, and the lowest score is 01 point.

2.4. Statistical analysis

The information obtained from the study was processed according to the biomedical statistical algorithm on SPSS software 20.0. The results are expressed in percentage (%) for the categorical variables.

2.5. Ethics approval

We strictly followed the Bach Mai Hospital Ethics Council; human rights and privacy were protected and confidential and voluntary participation. The study was conducted under participants' permission and agreement.

3. RESULTS

3.1. Compliance with the AIDET communication model in the clinical practice of nursing students at Bach Mai Medical College

Table 1. Adherence to the AIDET communication model in clinical practice by nursing students

NO	CONTENT	Never, rarely	Sometime	Often, very often
1	The student greet patient	2 (1,9%)	13 (12,1%)	92 (86,0%)
2	The student acknowledge the using the patient's name	4 (3,7%)	18 (16,8%)	85 (79,4%)
3	The student introduce himself/herseft name	4 (3,7%)	24 (22,4%)	79 (73,8%)
4	The student explain his/her role as a nursing student	7 (6,5%)	23 (21,5%)	77 (72,0%)
5	The student offer an estimated duration of time	8 (7,5%)	18 (16,8%)	81 (75,7%)
6	The student explain some of the steps (diagnostic test, mediaction)	2 (1,9%)	18 (16,8%)	87 (81,3%)
7	The student explain that additional provider	8 (7,5%)	21 (19,6%)	78 (72,9%)
8	The student thank patient	2 (1,9%)	16 (15,0%)	89 (83,2%)

The proportion of students who regularly, very often greet patients was 86.0%. The proportion of students who regularly and very often using patient names was 79.4%; never or rarely using patient information was 3.7%. The proportion of students who often and very often introduce their names was 73.8%; never or rarely introducing names was 3.7%. The proportion of students who frequently,

very frequently explained their role as nursing student was 72%. The proportion of students who regularly and offer an estimated duration of time was 75.7%. The percentage of students who often, very explain some of the steps was 81.3%. The proportion of students who often, very explain that additional provider was 72.9%. The percentage of students who often, very often thank patients was 83.2%.

3.2. Patient satisfaction with nursing students' communication

Table 2. Assessing communication skills of nursing students

Content	Poor	Fair	Good	Good	Excellent
Greeted me in a way that made me feel comfortable	0	7 (6,5%)	46 (43,0%)	33 (30,8%)	21 (19,6%)
Treated me with respect	0	4 (3,7%)	45 (42,1%)	36 (33,6%)	22 (20,6%)
Showed interest in my idea about my health	1 (0,9%)	6 (5,6%)	50 (46,7%)	26 (24,3%)	24 (22,4%)
Understood my main health concern	3 (2,8%)	8 (7,5%)	51 (47,7%)	20 (18,7%)	25 (23,4%)
Paid attention to me	2 (1,9%)	5 (4,7%)	44 (41,1%)	35 (32,7%)	21 (19,6%)
Let me talk without interruptions	1 (0,9%)	3 (2,8%)	42 (39,3%)	38 (35,5%)	23 (21,5%)
Gave me as much information as I wanted	1 (0,9%)	6 (5,6%)	48 (44,9%)	24 (22,4%)	28 (26,2%)
Talked in terms I could understand	0	6 (5,6%)	42 (39,3%)	31 (29,0%)	28 (26,2%)
Checked to be sure I understood everything	1 (0,9%)	4 (3,7%)	43 (40,2%)	35 (32,7%)	24 (22,4%)
Encouraged me to ask question	1 (0,9%)	10 (9,3%)	40 (37,4%)	34 (31,8%)	22 (20,6%)
Involved me in decisions as much as I wanted	0	7 (6,5%)	45 (42,1%)	32 (29,9%)	23 (21,5%)
Discussed next steps, including any follow-up plan	2 (1,9%)	8 (7,5%)	42 (39,3%)	32 (29,9%)	23 (21,5%)
Showed care and concern	0	5 (4,7%)	42 (39,3%)	34 (31,8%)	26 (24,3%)
Spent the right amount of time with me	1 (0,9%)	8 (7,5%)	41 (38,3%)	33 (30,8%)	24 (22,4%)

In table 3.2, the percentage of patients who rated students' greeting skills as good and very good was 43.0% and 30.8%; Respect for patients was 42.1% and 33.6%. The proportion of students concern patients' health as good and very good was 46.7% and 24.3%; understanding patients' main health concerns was 47.7% and 18.7%; paid attention to patients was 41.1% and 32.7%. The proportion of patients talk without interrupting good and very good was 39.3% and 35.5%;

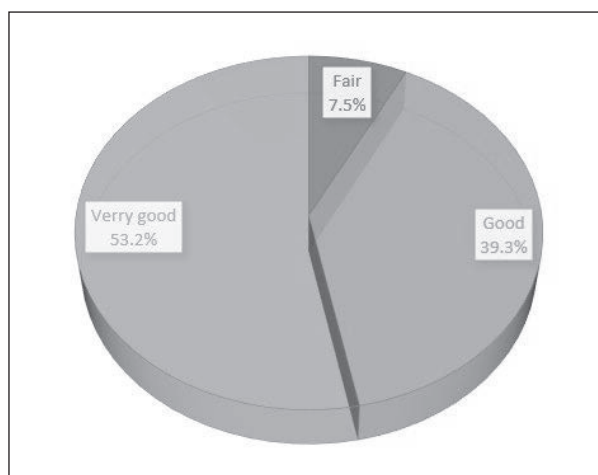
providing enough information the patient wants was 44.9% and 22.4%; Talked in terms patients could understand was 39.3% and 29%. The proportion of patients who assess good and very good skills in encouraging patients to ask questions was 37.4% and 31.8%; patients participating in the decision they want was 42.1% and 29.9%; showing concern and care for patients were 39.3% and 31.8%; Spending appropriate time on patient was 38.3% and 30.8%.

Table 3. Patients satisfaction with nursing students' communication

Content	Yes	No
Satisfied and recommend Bach Mai Medical College	105 (98,1%)	2 (1,9%)
Satisfied and recommend Bach Mai hospital	104 (97,2%)	3 (2,8%)

Comments: 98.1% of patients are satisfied and recommend Bach Mai Medical College to relatives and friends. There was 97.2% of patients are satisfied and recommend Bach Mai Hospital to relatives and friends.

3.4. Patients' overall assessment of student's communication skills



The proportion of students communicating Fair, good, and very good was 39.3%, 7.5%, and 53.2% respectively.

4. DISCUSSION

4.1. Compliance with the AIDET communication model in the clinical practice of nursing students at Bach Mai Medical College

The content of AIDET includes A (Acknowledge): Establishing a relationship - confirming the patient by name, I (Introduction): Self-

introduction, D (Duration): Time information, E (Explanation): Explanation of procedures Technique/ implementation process, T (Thanks): Thank you [8], [9].

4.1.1. Criterion A (Acknowledge) - Establishing a relationship

Greeting was the first step when performing a procedure/technique or asking/observing/examining a patient. Greeting with a polite, cheerful, and appropriate attitude helps nurses and nursing students create a good first impression, helping patients feel secure and comfortable when receiving medical service. In our study, the proportion of students who regularly and very often greet patients was 86.0%. There are 1.9% of students who never or rarely greet patients. This rate in our study was higher than in Tran Thi Thanh Truc's research before training which was 21.9% and equivalent to the research results after training which was 87.6% [10].

In addition, to introducing themselves, students need to use the patient's name. The proportion of students who regularly and very often use patient names was 79.4%; never or rarely using patient information was 3.7%. Using the patient's name helps to identify the patient. This is an important step before performing any procedure or technique to avoid errors and mistakes to ensure patient safety. This percentage of students establishing relationships with patients in our study was lower than in Tran Le Yen's study was 83.8% [11]; research by Nguyen Thi Thanh Truc, this rate reached 93.8% [10]. This result partly shows that nurses with many years of work experience can be more aware of the role of identifying people. diseases to compare and avoid errors.

4.1.2. Criterion I (Introduction) - Introduction

In communication, introducing yourself by name makes communication easier and friendlier, increasing patient satisfaction and belief in

nurses, medical staff, and medical facilities [1], [9]. Our research shows that students who regularly and very often introduce their names when communicating was 73.8%; never or rarely introducing names when communicating was 3.7%. The percentage of students self-introducing themselves to patients in our study was higher than in Tran Le Yen's study was 59.4% of students self-introducing themselves. Our research was conducted on 2nd-year college students who have just been trained in the AIDET model, practicing the adult health care module in the internal department so it may be higher than the Tran Le Yen's study which are final-year students who had trained the AIDET model of the second year [11].

The proportion of students who frequently, very frequently explained their role as nursing students was 72%. This result shows that nursing students are more confident in communication and more attentive in introducing their names and roles as nursing students.

4.1.3. Criterion D (Duration) – Notice of time

Time information includes technical process implementation time and waiting time. The proportion of students who regularly and very often estimated duration of time was 75.7%. This rate was lower than in Tran Thi Thanh Truc's study was 84.4% [10]. This difference may be because the subjects in these two studies are not the similar. The participants in our study were second-year students who had just entered clinical practice. Students lack experience and are not aware of the time it takes to perform the technical procedure or the waiting time that may arise when performing the procedure. In Tran Thi Thanh Truc's study which majority of nurses working time more than 5 years was 87.5%. They are more experienced and can be more confident and proactive when communicating with patients.

4.1.4. Criterion E (Explanation) - Explanation

Explaining to the patient is very important, including explaining the procedure, the care process, the meaning of the procedure, possible complications, how to solve complications and explaining the patient's questions. Our research shows that the rate of students who often, very often explain some steps when customers have questions was 81.3%. The proportion of students who often, very often explain some support services to evaluate patients was 72.9%. This rate was lower than in Nguyen Thi Thanh Truc's study was 78.1% [10]. Explaining to patients so students need to accumulate more knowledge and experience. In addition, nurses who have more experience will be more confident when explaining to patients.

4.1.5 Criterion T (Thanks) – Thank you

In our study, the percentage of students who often, very often thanked patients was 83.2%, that higher than the study of Tran Thi Thanh Truc and the research of Nguyen Thi Anh Nhung and Tran Le Yen [10], [11], [12]. Thus, the proportion of nurses thanking patients was quite good. This shows that the awareness and attitude of nurses and nursing students have improved, showing respect for patients and thanking patients for trusting the services at the medical facility.

Thus, in our study, the percentage of students who perform the steps of the AIDET model regularly and very often was quite high from 72% to 86%. This rate in our study was not similar to Tran Thi Thanh Truc's study [10]. The differences may be due to different methods and subjects. Our research was conducted on 2nd year nursing students, Tran Thi Thanh Truc's research was conducted on nurses at the district hospital. Besides, our research only stopped at assessing how often students perform steps and did not assess the effectiveness of training programs according to the AIDET model. Our results also show that AIDET training has had a positive impact on nursing students.

4.2. Patient satisfaction with nursing communication

4.2.1. Patient satisfaction with nursing students' communication

In our study, patients evaluated the communication skills of nursing students based on 5 levels on the Likert scale from poor to excellent, on many criteria such as greeting the patient to make them feel comfortable, being respectful and respectful, respecting the patient, showing interest in the patient's opinion, understand the patient's main health concerns, show attention to the patient.

Most patients assess nurses, and nursing students' communication as good, very good and excellent [12], [13]. The percentage of students whose greeting skills as good and very good was 43.0% and 30.8%; Respect for patients was 42.1% and 33.6%. The proportion of patients who rated good and very good on the skill of not interrupting the patient when speaking was 39.3% and 35.5%; providing enough information the patient wants was 44.9% and 22.4%; Using terms patients could understand was 39.3% and 29%. Regarding speaking and listening skills, our study had results equivalent to Le Thi Ha Trang's study with satisfaction rates with greetings, introducing names, and using appropriate language when communicating with patients; Showing attentiveness when listening and not interrupting the patient when communicating are all achieved and receive patient satisfaction of 97% or more [14]. Thus, speaking and listening skills are increasingly emphasized by nurses as well as nursing students, who pay attention to and show respect for patients when communicating through attentive listening and not interrupting. However, nurses need to pay more attention to introducing their names and professional titles.

The proportion of patients who rated their skills as good and very good in showing

concern for their health was 46.7% and 24.3%; understanding patients' main health concerns was 47.7% and 18.7%. The proportion of patients who rated good and very good skills in encouraging patients to ask questions was 37.4% and 31.8%; patients participating in the decision they want was 42.1% and 29.9%; showing concern and care for patients were 39.3% and 31.8%; Spending appropriate time on patients was 38.3% and 30.8%. It lower in Le Thi Ha Trang's research with skills in providing information, and instructions and providing concise, accurate information that is easy to understand, answering patients' questions reaching the standard of 97.1% [14]. Skills such as explaining to the patient and providing enough information and the patient's want and discussed next steps, including any follow-up plan. Because the second-year students who practice the adult health care module in internal medicine lack experience and need more time to hone their knowledge and practice.

4.2.2. Patient satisfaction with nursing students' communication

Regarding patients' overall assessment of the communication skills of nursing students at Bach Mai Medical College. Our study shows that the proportion of patients assessed very good, good and fair was 36.4%; 39.3% and 7.5% respectively. Our study show that the percentage of patients who feel satisfied with the communication with nursing students at Bach Mai Medical College and will recommend this school's students to relatives and friends was 98.1% and 97.2% of patients feel satisfied with the communication of nursing students at Bach Mai Medical College and will recommend family and friends to come for examination at Bach Mai Hospital. This percentage in our research was equivalent to the research of other authors such as Nguyen Van Hieu, Nguyen Hai Ninh, Phong Ngoc Thanh [3], [4], [5].

5. CONCLUSION

Surveying compliance with the AIDET communication model and patient satisfaction with communication of nursing students at Bach Mai Medical College in 2022, the results are:

- Communication practices of nursing students at Bach Mai Medical College in 2022 according to AIDET model criteria

The percentage of students who regularly and very often communicate according to the AIDET model ranges from 72% to 86%. The proportion of performing the step-by-step frequently and very frequently was 86%; 79.4%; 73.8%; 72%; 75.7%; 81.3%; 72.9% and 83.2% respectively.

- Patient satisfaction with communication of nursing students at Bach Mai Medical College according to the AIDET model.

The percentage of nursing student communication was high including good, very good and fair was 39.3% 36.4% and 7.5% respectively.

- Regarding the specific content of communication skills, the rate of PATIENT rating good, very good and excellent ranges from 88.9% to 94%.

6. RECOMMENDATION

The AIDET model program needs to be detail developed to ensure effectiveness. Besides, it was necessary to integrate AIDET in pre-clinical teaching. At the same time, more guidance, inspection and supervision at clinical units. Strengthen communication activities on communication practices in medical facilities.

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EFFECTIVENESS OF COMBINATION OF MODERN TEACHING METHODS IN NURSING TRAINING AT THAI BINH MEDICAL COLLEGE

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ABSTRACT

Objectives: To describe the effectiveness of teaching methods applied to nursing students at Thai Binh Medical College.

Material and Methods: The study was conducted on 327 nursing students and 88 lecturers participating in teaching modules in the nursing training program.

Results: The results show that students trained with modern teaching methods have higher final scores for subjects in the study than those trained with traditional methods, the difference ranges from (0, 7 to 0.98 points). The percentage of students achieving good grades is also higher, the difference ranges from 11.9% to 29.3% in the surveyed subjects. . Modern teaching methods also help improve learning efficiency in both groups of students with high (20-25 points) and low (15 - <20) initial admission threshold scores.

Conclusions: The level of positivity and interest in learning of students participating in learning using modern methods is higher than that of traditional teaching methods, and students' learning efficiency is also better. Lecturers also evaluated the new teaching method to promote learners' positivity and initiative in the learning process.

Keywords: *modern teaching methods, innovative teaching methods, active learning, nursing training.*

I. INTRODUCTION

Nursing is an occupational title in medicine that refers to people who provide direct care to patients. The direct object of nursing is human health and emotions. Therefore, nursing training is something that requires extreme care and precision. Nurses who graduate must have perfect knowledge and skills, and especially

have good communication skills, a sympathetic attitude and love for patients wholeheartedly.

Currently, there are over 300 nursing college training establishments nationwide, with an enrollment of thousands of students/year. This shows that the ability of schools throughout the country to provide a large number of nursing human resources is very large. However, nursing

training to ensure quality and meet domestic, regional and international needs is not uniform across units.

In recent years, Thai Binh Medical College has continuously implemented training innovations to improve the quality of training in all professions - especially nursing to meet the requirements of the integration process. Training innovation in the school is carried out synchronously, including: innovating training programs, innovating teaching methods, innovating evaluation methods, innovating methods of managing students' affairs. The content of this report focuses on the implementation of innovative teaching methods in nursing training at Thai Binh Medical College.

II. MATERIAL AND METHODS

1. Subject

The study was conducted on 327 nursing students and 88 lecturers directly involved in teaching nursing at Thai Binh Medical College.

2. Method

2.1. Research design: Experimental study

2.2. Sample selection method:

- Select a convenient sample, taking all nursing college students of Course 13(C13) and Course 12 (C12).

- The total number of students participating in the study is 327 students:

Nursing College C13: 152 students, including 114 female students (75%) and 38 male students (25%); The number of students aged 18-24 is 148 students (accounting for 97.3%) and the number of students aged 25-35 is 4 students (accounting for 4%); The number of students with course entrance scores from 15 - <20 points is 67 students (44.1%) and the number of students with admission scores from 20 -25 points is 85 students (55.9%).

Nursing college C12: 175 students including 140 female students (80%) and 35 male students (20%); The number of students aged 18-24 is 169 students (accounting for 96.5%) and the number of students aged 25-35 is 6 students (accounting for 3.5%); The number of students with course admission scores from 15 - <20 points is 72 students (41.1%) and the admission score from 20 -25 points is 103 students (58.9%).

Through analyzing the data, the research team found that there were no differences in the general characteristics of the two groups of study subjects (P value >0.05).

- Lecturers participating in the study are lecturers who teach theory and pre-clinical practice for nursing students at Thai Binh Medical College (42 lecturers) and visiting lecturers who teach clinical practice for students at hospitals (46 lecturers).

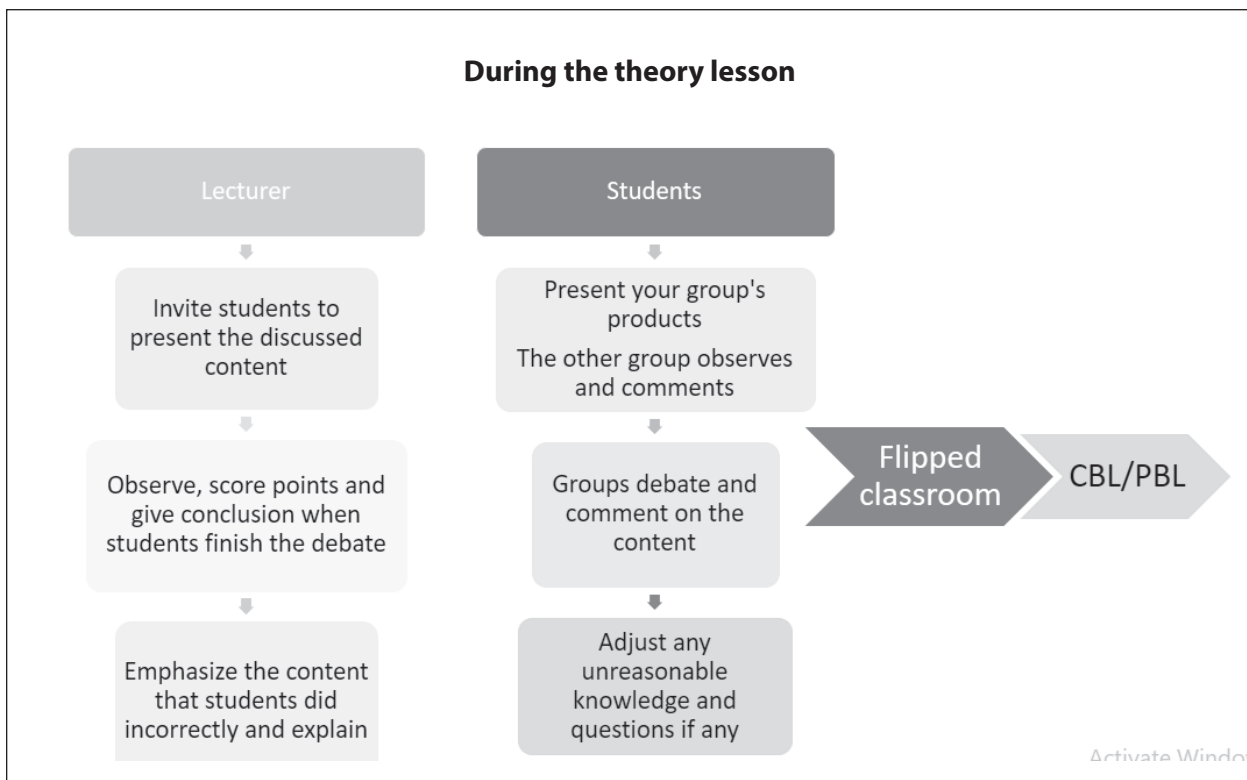
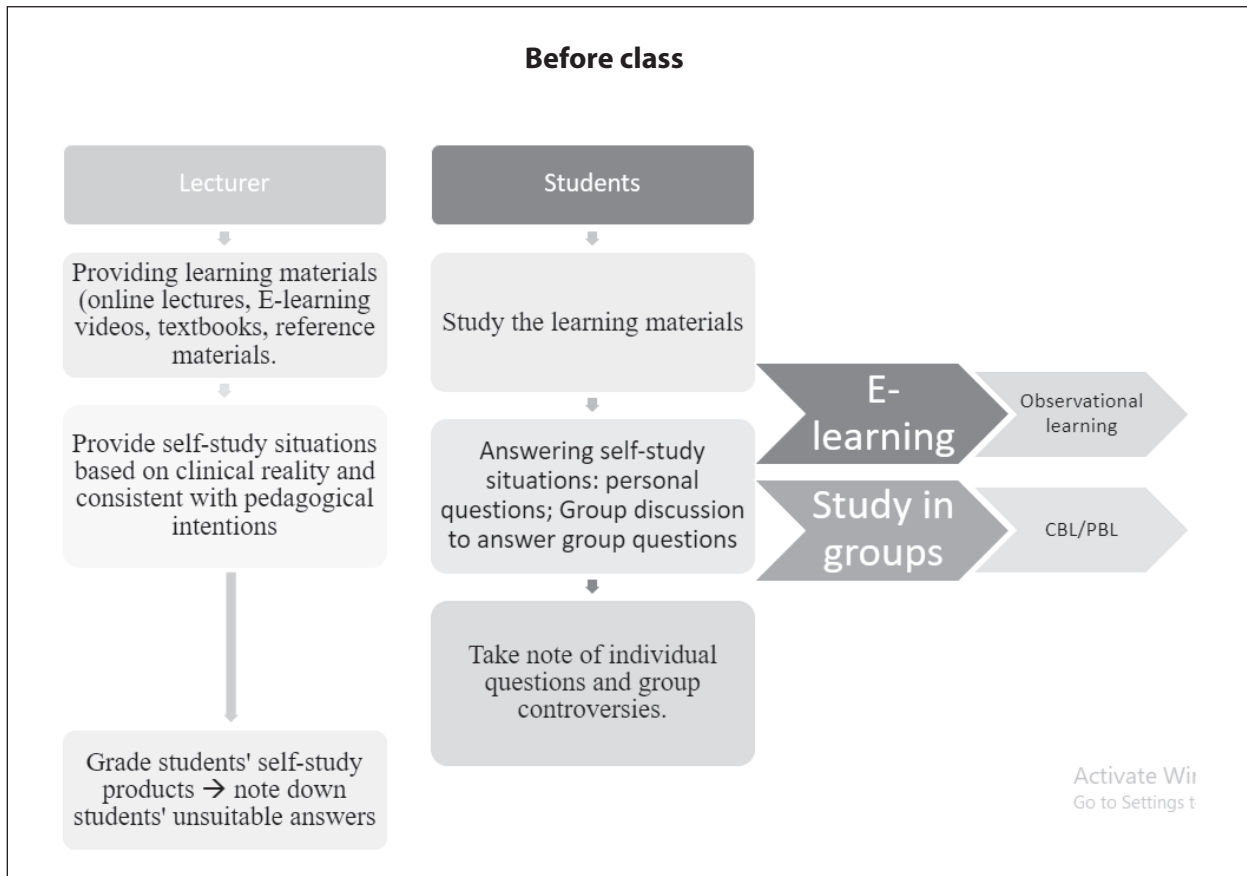
2.3. Research period: From July 2022 to March 2023

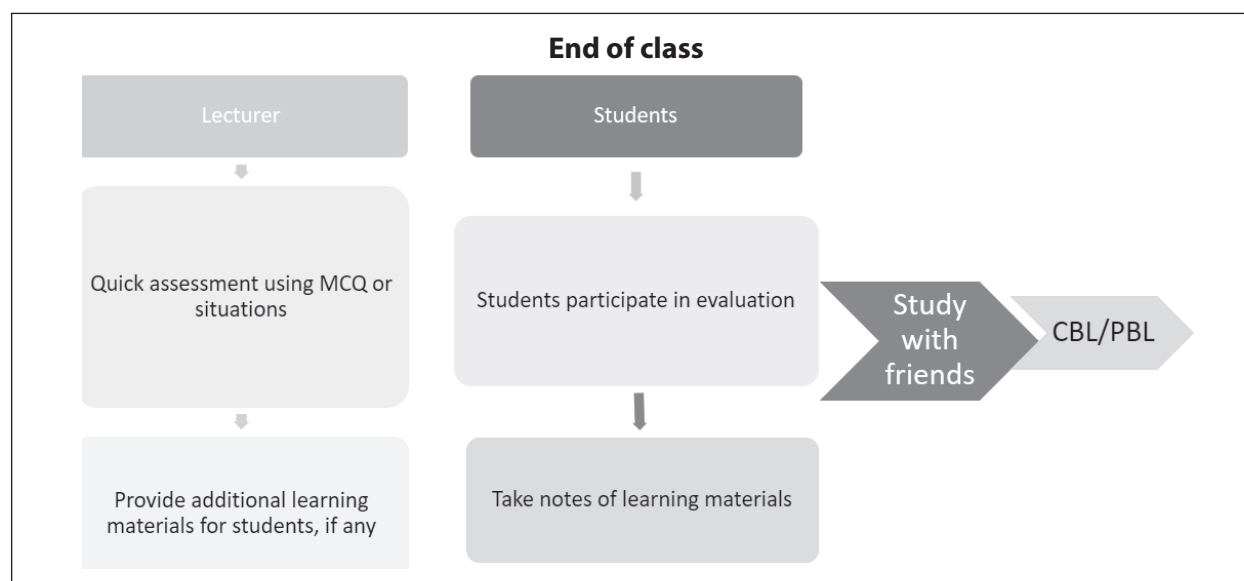
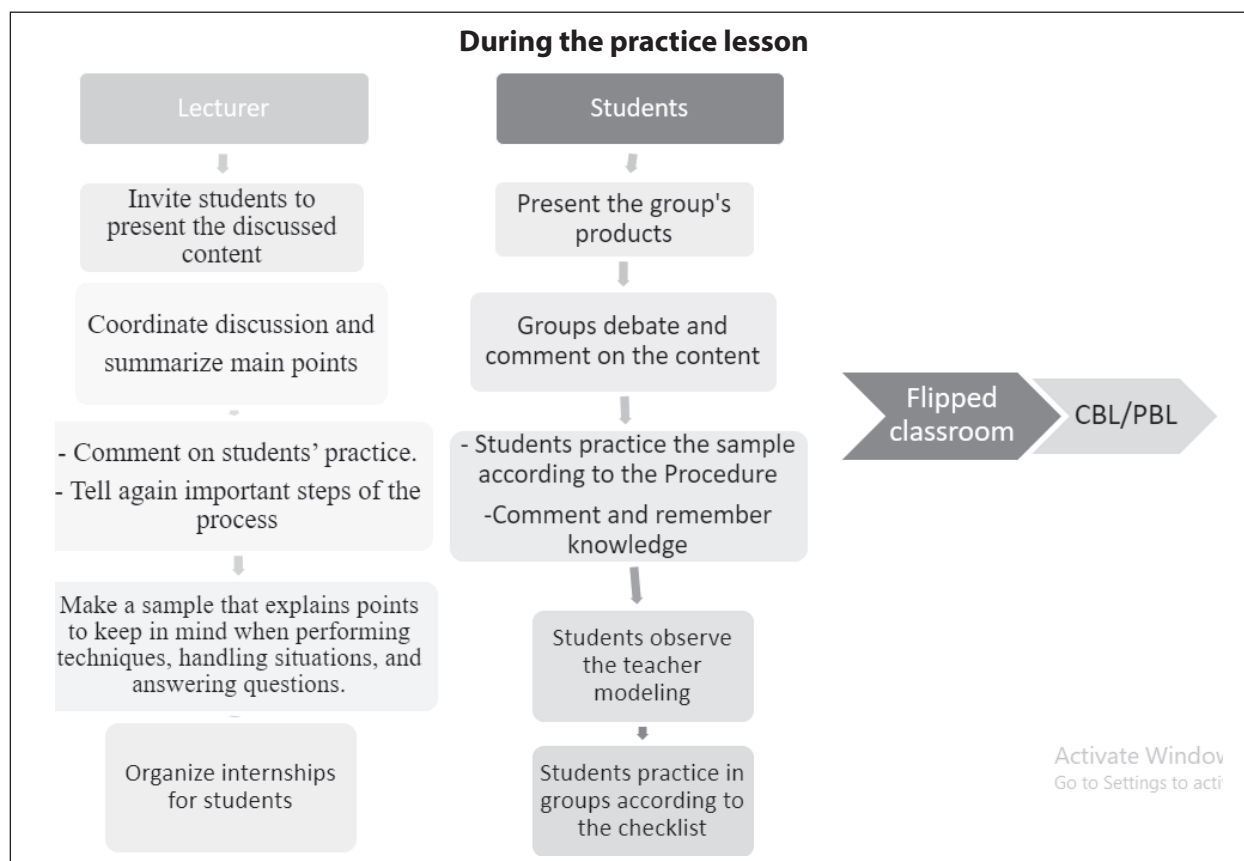
2.4. Research content

- Two groups of students are applied two different teaching methods in the learning process.

+ Nursing students Course 12 apply traditional teaching methods: Teachers are responsible for conveying knowledge and information to students through lectures, textbooks and exercises. Students sit, listen and take notes on the knowledge given by the teacher, and do theoretical and practical exercises according to the teacher's requests and instructions.

+ Nursing students Course 13 apply modern combination teaching methods such as: E-learning lectures; Clinical Case-Based Learning (CBL); Group learning; Flipped classroom; Observational learning; Simulation-based learning (PBL). The methods are flexibly applied in preparation before class, teaching during class sessions, and at the end of class.





+ Tools to support the implementation of modern teaching methods

E-learning online learning system for nursing training: 27 subjects are built online, there are over 500 video lectures, self-study case studies,

100% of subject textbooks and quality testing are provided on the online system. Students who do not study for enough time on the online system or do not fully answer the self-study requirements before coming to class will not be

able to participate in the live class session. The system notifies teachers of students eligible to participate in live classes. The system is built with interfaces for easy operations on computers, phones, and tablets.

Self-study situations: There are 358 official teaching situations built into the E-learning self-study system for students to prepare before coming to class. There are more than 500 clinical situations used during direct classroom teaching, practice, assessment, and student evaluation. The situations used in training are all real clinical situations in actual treatment and are approved and evaluated by the Faculty-level professional council before being put into use. Every year, the school updates and innovates at least 30% of teaching and evaluation situations to ensure the requirements of the training program.

Simulation practice room: Arranged like a hospital room. Students receive the case, prepare their own tools (3-4 techniques for 1 case), perform the technique (lecturers and students monitor via Mini CEX on the computer and give direct feedback). Use hospital management software system to manage patients.

Mini-CEX quick assessment tool : evaluates students' clinical skills : Patient's history taking skills; Physical examination skills; Humane qualities/professionalism; Clinical inference/argumentation; Consulting skills ; Organization/performance; Overall clinical competency . Each skill is evaluated at 3 levels: not meeting expectations, meeting expectations and exceeding expectations, each level has 3 evaluation levels .

- Evaluate the learning scores of two student courses (12 and 13): Randomly select 03 subjects in the nursing training program of C12 and C13 that satisfy the criteria: First year curriculum: 01 subject; 2nd year: 01 subject; 3rd year: 01 subject.

Particularly for the 3rd year training program, 01 clinical subject will be randomly selected from the clinical subjects of the training program. The learning outcomes of the subjects are analyzed and commented.

- Survey the opinions of lecturers and students about two teaching methods.

2.4. Methods of collecting and processing data

Students learning results: collected from points saved in the Management and Training Department.

Students and lecturers survey data : synthesize survey questionnaires on the E-Learning system.

Data are entered and processed using SPSS software, calculating average values, percentages, comparing averages, comparing ratios between 2 groups, using statistical tests to verify the results.

2.5. Research ethics

The research was conducted for scientific purposes, with the consent of the school Board of Directors. Lecturers and students were invited to participate in the research. Students' profile information, students learning outcomes, and survey results of students and lecturers were collected honestly and scientifically. Used for research purposes only.

III. RESULTS AND DISCUSSION

1. Student learning outcomes

The two target groups C13 and C12 share the same nursing training framework program of 97 credits and 39 subjects. The research team randomly selected the names of 03 subjects in the nursing training program of C12 and C13 (one subject is a clinical subject). The results of the selected subjects are:

+ First year (Subject 1): Subject "Basic Nursing

1" - Final exam format: Practice exam at the school's simulation practice room

+ Second year (Subject 2): Subject "Caring for patients with specialized internal medicine" - Format of final exam: Test

+ Third year (Subject 3): Subject "Clinical health

care for adults 3" - Final exam format: Marking clinical practice exam.

The learning outcomes of the subjects are statistically calculated from the Management and Training Department's software, the specific results are as follows

Table 1. Statistics of student learning outcomes

No	Content	Subject 1		Subject 2 _		Subject 3 _		P value
		C12	C13	C12	C13	C12	C13	
1	Average study mark	7.02	8.0	6.97	7.67	7.32	8.05	P _{value} <0.05
2	% Excellent	22.2	34.1	12.2	38.2	57.7	84.4	P _{value} <0.05
3	% Good	32.7	54.2	53.1	39.6	38.3	11.1	P _{value} <0.05
4	% Average	45.1	11.7	27.3	20.9	4.0	2.6	P _{value} <0.05
5	% Did not pass the exam the first time	0	0	7.4	1,3	0	0	P _{value} <0.05
6	Study again	0	0	0	0	0	0	
7	Study to improve scores	0	0	0	0	0	0	

The average academic scores of C13 students (8.0, 7.67, 8.05) are higher than C12 students (7.02, 6.97, 7.32); The percentage of students achieving excellent scores in all three subjects in C13 students (34.1%; 38.2%; and 84.4 %) is also higher than that of C12 students (22.2%; 12.2% and 57.7%).

The retake rate of C13students (1.3%) and C12

(7.4%) in the three research subjects is low, only appearing in subject number 2 (2nd year). In the 3 subjects studied, there was no record of re-studying or improving students' scores.

The research team also conducted a survey on the learning outcomes of two groups of students with different admission threshold scores in the C13 and C12. The following results:

Table 2. Academic results of two groups of students with different entrance scores for course C13

Course 13		% Excellent mark			% Good mark			% Average mark		
		Subject 1	Subject 2	Subject 3	Subject 1	Subject 2	Subject 3	Subject 1	Subject 2	Subject 3
Admission score	15 - <20	16.4	17.1	42.7	25.0	19.8	5.9	6.6	11.7	1,3
	20 - 25	17.7	21.1	41.7	28.8	19.8	5.2	5.1	9.2	1,3
P value		>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

Table 3 . Academic results of two groups of students with different entrance scores for course C13

C12 course		% Excellent mark			% Good mark			% Average mark		
		Subject 2	Subject 3	Subject 1	Subject 2	Subject 3	Subject 1	Subject 2	Subject 3	Subject 1
Admission score	15-<20	7.9	8.0	42.8	16.0	26.2	18.8	28.6	18.3	3.4
	20 - 25	14.3	4.2	14.9	16.7	26.9	19.5	16.5	9.1	0.6
P value		<0.05	<0.05	<0.05	>0.05	>0.05	>0.05	<0.05	<0.05	<0.05

The results of table 3 and 4 show that in the C13 nursing course, there is no difference in the rate of excellent mark, good mark, or average mark between two groups with high or low entrance scores. This shows that modern teaching methods are a suitable choice for both groups of students. For the C12 course, there is a difference in the rate of excellent and average scores in the two groups of subjects mentioned above. The group with an entrance score of 20-25 points has a higher rate of excellent mark and lower rate of average mark at the end of the course exams than the group with admission scores (15 - <20). This also allows a preliminary conclusion that the traditional teaching method is suitable for the group of students who have had a good cumulative learning process from high school.

From the above results, it can be seen that applying modern teaching methods has brought

better learning results for nursing students. This result is also similar to the studies of the author group Jie Gong (2021)[1] and the group of authors Xue – Tao Fu (2022) [2]. Especially for the subject Clinical Adult Health Care 3 (3rd year), the average score of the entire C13 course is 8.05 and the rate of excellent scores is over 84%. Clinical subjects are subjects that require students to integrate professional knowledge, practical skills, communication skills, and handle real -life situations. Achieving a high score in this module represents the cumulative results of previous prerequisite modules, reflecting the teaching quality of the subject “Adult Health Care 3” and related modules.

2. Results of a survey of lecturers and students on the application of modern teaching methods compared to traditional teaching methods

2.1. Student assessment results

Survey content		Level 1	Level 2	Level 3	Level 4	Level 5	P
The teaching method being applied brings excitement to students	C12	5.7	17.1	36.9	27.7	12.6	P _{value} <0.05
	C13	19.7	47.7	24	6.5	1.9	
The teaching method being applied supports students in the self-study process	C12	5.1	5.7	48.0	22.9	18.3	P _{value} <0.05
	C13	26.3	41.0	23.0	7.8	1.9	
The knowledge and skills learned are effective for students when applied in clinical practice	C12	7.5	18.8	50.4	20.5	2.8	P _{value} <0.05
	C13	25.1	51.3	10.5	10.5	2.6	

Level 1: Completely agree. Level 2: Agree. Level 3: Confused. Level 4: Disagree. Level 5: Completely disagree

Survey results on the level of excitement of C12 and C13 students in the teaching methods being applied show that: for C13 students, 67.4% of students are interested in the teaching methods being applied; 8.4% are not interested while the corresponding rates in C12 are 23.4% and 40.3%.

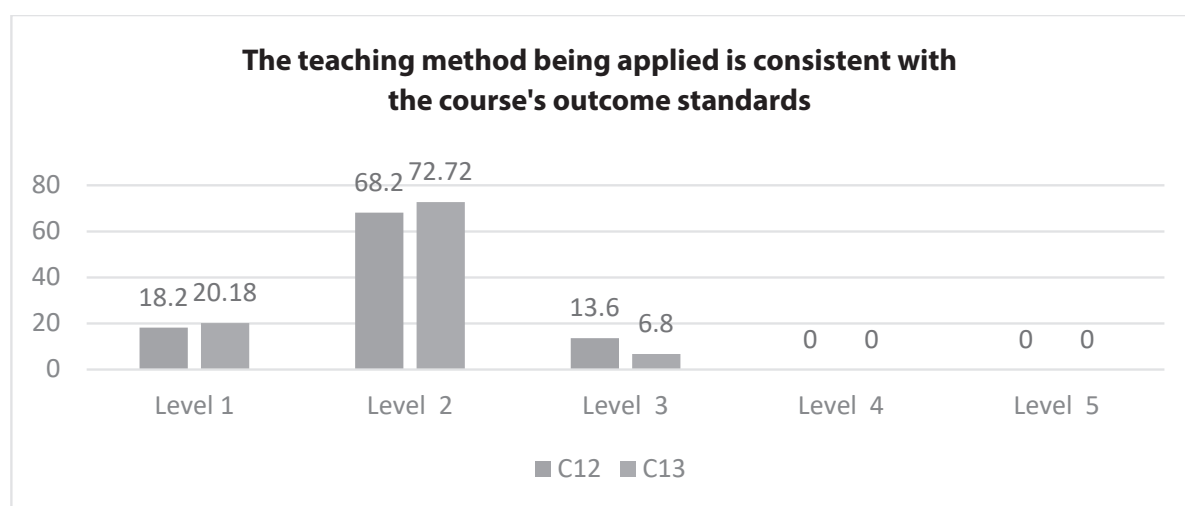
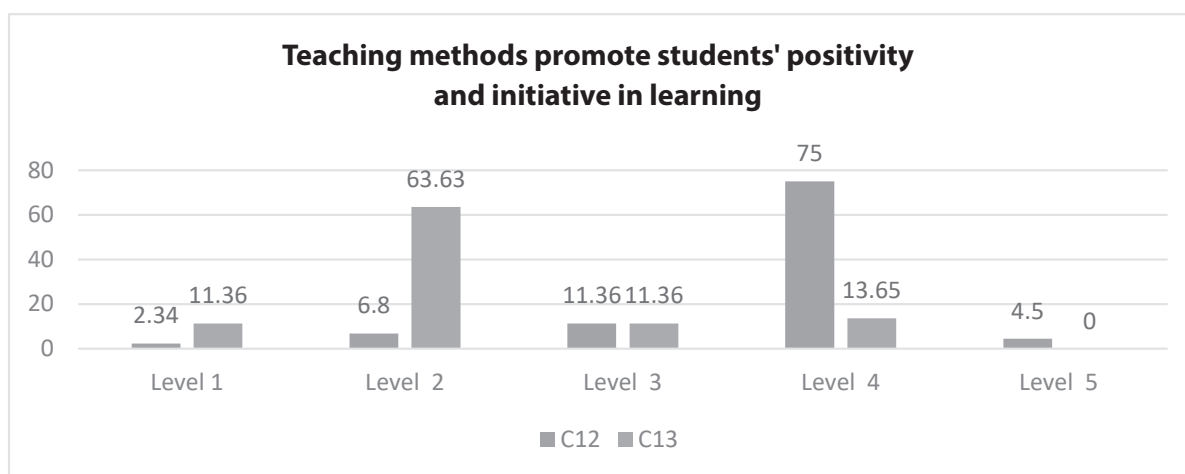
Innovating teaching methods has helped students participate actively in the learning process; Students have a pretty good sense of preparation, self-study at home as well as participating in lesson creation in class sessions. The agreement rate in C13 is 67.3% and disagreement is 9.7%, while the corresponding

figures in C12 are 10.8% and 41.2%.

Evaluation of the effectiveness of teaching methods to help students gain appropriate knowledge and skills to apply in clinical practice shows: 76.4% of students agree and 13.1% students disagree in C13; This rate in C12 is 26.3% and 23.3%, respectively.

This survey result is also similar to the research of author Tran Huy Quang (2020) - Foreign Trade University on evaluating the effectiveness of applying modern teaching methods in o training [3].

2.2. Instructor's assessment results



Level 1: Completely agree. Level 2: Agree. Level 3: Confused. Level 4: Disagree. Level 5: Completely disagree

- Survey results show that 18.2% of lecturers completely agree; 68.2% agree that the training method meets the output standards of the C12 course, while this figure for the C13 course is 20.48 and 72.72%, respectively. This survey result shows that, no matter what teaching method is applied, students are provided with sufficient content to ensure they achieve the course's output standards.

- The majority of lecturers participating in the survey (74.99%) agreed that combining modern teaching methods helps promote students' positivity and initiative in learning rather than teaching using traditional teaching methods. This survey result is also similar to the Andrea et al (2021) [4].

3. CONCLUSION

Applying modern teaching methods in specialized nursing training has brought positive results, contributing to improving the training

quality of Thai Binh Medical College. The final score of the subjects in the research of the training course using modern teaching methods (C13) is higher than the training course using traditional teaching methods (C12), the difference ranges from (0.7 to 0, 98 points). The rate of students achieving good scores in C13 is higher than in C12, the difference ranges from 11.9% to 29.3% in the surveyed subjects. Modern teaching methods also help improve learning efficiency in both groups of students with high (20-25 points) and low (15 - <20) initial admission threshold scores. The level of positivity and interest in learning of students participating in learning using modern methods is higher than that of traditional teaching methods, and students' learning efficiency is also better. Lecturers also evaluated the new teaching method to promote learners' positivity and initiative in the learning process.

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THE CURRENT SITUATION OF DEPRESSION, ANXIETY, STRESS, AND ASSOCIATED FACTORS AMONG MEDICAL LABORATORY TECHNOLOGY STUDENTS OF BACH MAI MEDICAL COLLEGE IN 2022

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1. INTRODUCTION

Depression, anxiety, and stress are psychological disorders that are easy to encounter, especially for studentage. This is a period of many physiological and psychological changes such

as personality, emotions, intelligence and changes in the living environment and learning environment, so it is very vulnerable. These problems can negatively affect students' social functions such as learning, communication, and career orientation.

ABSTRACT

Objectives: Describe the prevalence of depression, anxiety and stress among medical technology students, and analysis of some associated factors to depression, anxiety and stress among medical laboratory technology students of Bach Mai Medical College in 2022.

Material and Methods: A cross-sectional descriptive study was conducted on medical technology students of Bach Mai medical college in 2022.

Results: The rate of depression, anxiety, and stress is 34%; 52%; 48%;4% of students have 1 of 3 disorders, 48% have 2 to 3 disorders, of which 66% of students have 2 of 3 disorders, 34% of students have all 3 disorders simultaneously. Potential risk factors for depression, anxiety and stress include: students having problems with the police; not participating in activities organized by the school; lack of financial support for 1 month; dissatisfied with the major; orientation of not working in the right profession after graduation; ending a close relationship (friendship); there are a lot of pressure in studying; have disagreements with parents.

Conclusions: This study found concerningly high rates of depression, anxiety, and stress among medical laboratory technology students at Bach Mai Medical College, indicating a need for targeted mental health interventions.

Keywords: depression, anxiety, stress, students, medical technology students

Another study in Malaysia in 2013 on students in government college found that about 23.7% of students suffered from moderate and severe stress; 63% of students showed signs of moderate, severe and very severe anxiety; 39.2% of students showed signs of moderate, severe and very severe depression.

Bach Mai Medical College is a medical college with a unique organizational structure belonging to Bach Mai Hospital, with a favorable practice environment for students to develop professional skills. Besides the advantages, it will also create pressure for students to always try to learn, always strive to meet academic requirements.

This study was conducted to provide general information about mental health issues in Bach Mai Medical College students, with the hope of being representative of College students in Hanoi. The study also provides evidence that is a premise and a basis for making specific plans for the health care of college students.

Objectives of the study:

- Survey on the prevalence of depression, anxiety and stress among medical technology students in courses of Bach Mai Medical College in 2022.
- Analysis of some associated factors to depression, anxiety and stress among medical technology students of Bach Mai Medical College in 2022.

2. RESEARCH SUBJECTS AND METHODS

2.1. Location and time of participating in the study

- Location: Bach Mai Medical College
- Research period: 2022-2023

2.2. Research subjects

2.2.1. Criteria for selecting research subjects:

- Medical technology students are studying at Bach Mai Medical College including: first year,

second year and third year students. (Course 6, course 7, course 8).

- Students have confirmed their consent to participate in the research.

2.2.2. Exclusion criteria for research subjects:

- Students refuse to participate in research.
- Students are not present during the time of collecting research data such as: absent from school, sick leave, etc.
- Students participate voluntarily but do not cooperate in the research process.

2.3. Research design: Cross-sectional descriptive study.

2.4. Choose sample and sample size

Apply the formula to calculate sample size for 1 proportion:

$$n = \frac{Z_{1-\alpha/2}^2 \cdot p(1-p)}{d^2}$$

In which: n is the research sample size; $Z_{1-\alpha}$ = 1.96 with 95% confidence; P = 0.423: Anxiety rate of public health students at the University of Public Health. The calculated sample size is 375 students. The actual sample size collected is 100.

2.5. Research variables and indicators

- Dependent variables are depression, anxiety, and stress variables
- Independent variables are corassociated measurement variables

2.6. Tools and techniques for collecting information

2.6.1. Research tools

Use a set of designed questions about personal characteristics, family factors, friend factors, school, and society and the DASS-21 scale includes 21 questions for students to self-assess. Questions associated to depression, anxiety and stress.

2.6.2. Information gathering techniques:

The data collection process have performed from creating a questionnaire form. Then, a pilot survey was conducted with 10 students to check the logic and appropriateness of the questionnaire before officially collecting research data. Investigation time is outside of students' class hours to avoid affecting their learning. The investigator explained the study and the self-completed questionnaire after receiving consent from the study participants. Instructions for answering the set of questions directly and submitting.

Data after cleaning are analyzed and processed using medical statistical algorithms on SPSS 25.0 software. Variables are described according to basic statistical tests to describe numbers and proportions (%). Analyze associated factors to signs of depression, anxiety, and stress using Chi-square test and logistic regression.

2.7. Research ethics

The study was approved by the Research Protocol Council of Bach Mai Hospital before conducting the research.

The study was allowed by the board of rectors of Bach Mai Medical College and the consent of students participating in the study.

Research subjects were clearly explained about the purpose of the research and confirmed in the "research participation agreement" before answering questions.

All research information is completely confidential. The information collected is only for study and research and not for any other purpose.

3. RESEARCH RESULTS

3.1. Characteristics of research subjects

The study shows that women make up the majority with 64%, mainly Kinh ethnic group (90%) and no religion (90%). The number of first year, second year and third year students accounts for 50%, 29% and 21% respectively. Family finances are mostly average (79%), with 12% of students having economic difficulties. Families with 1-2 children account for 69%, families with 3 or more children account for 31%. Parents' marital status is mainly living together 88%. Parents have a high education level, mainly high school.

3.2. Signs of depression, anxiety, stress

3.2.1. Rates of depression, anxiety, and stress in students

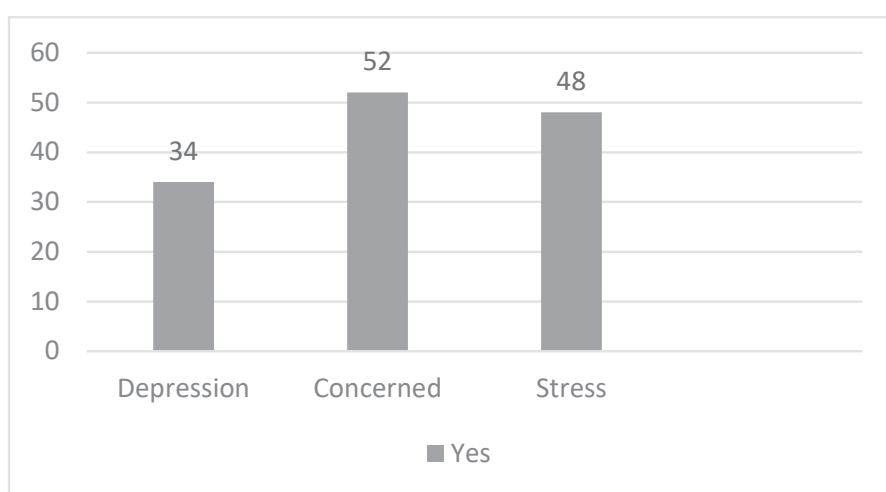


Figure 1. Percentage of students showing signs of depression, anxiety and stress

Comment: Using the DASS-21 scale to evaluate the results study shows that the rate of students with anxiety is the highest at 52%, the rate of

students with stress is the second highest at 48%, and the rate of students suffering from depression is the lowest at 34%.

Table 1. Rates of depression, anxiety, and stress by course

	Depression		Concerned		Stress	
	(n=100)	(%)	(n=100)	(%)	(n=100)	(%)
The third year (N= 21)	8	8	11	11	10	10
Second year (N= 29)	12	12	15	15	15	15
First year (N=50)	14	14	26	26	23	23
Total	34	34	52	52	48	48

Comment: Table 3.1 shows that the rate of depression in first-year students is the highest, accounting for 14%. The rates of depression in second- and third-year students were 12% and 8%, respectively.

The rate of anxiety in first-year students is the highest, accounting for 24%. The prevalence of anxiety in second- and third-year students was 15% and 11%, respectively.

The rate of stress in first-year students is the highest, accounting for 23%. The rate of stress in second-year and third-year students is 15% and 10%, respectively.

3.2.2. Levels of depression, anxiety, and stress in students

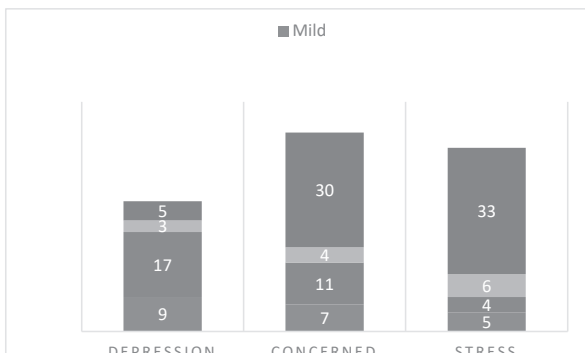


Chart 3.2. Rates of depression, anxiety and stress levels of students

Comment: Chart 3.2 shows.

The rate of moderate depression is the highest at 17%, the rate of mild depression is the second highest at 9%, and the rate of severe and very severe depression is 3% and 5%, respectively.

The rate of very severe anxiety is the highest, accounting for 30%. The rates of mild, moderate, and severe anxiety were 7%, 11%, and 4%, respectively.

The rate of very severe stress is the highest, accounting for 33%. The rates of mild, moderate and severe stress are 5%, 4% and 6%.

3.2.3. Combination disorder of depression, anxiety, and stress in students

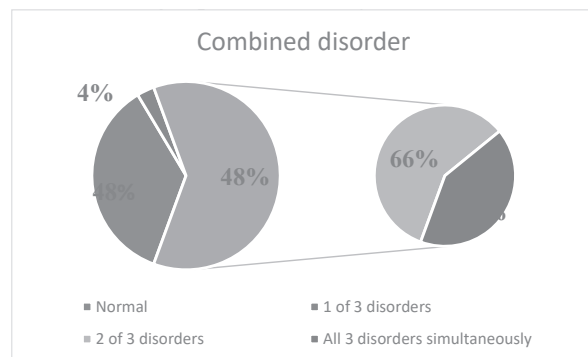


Chart 3.6. Rate of combined disorders of depression, anxiety, and stress among students

Comment: Using the DASS-21 scale to evaluate the research results showed that among the research students, 4% of students suffered from 1 of 3 disorders (depression, anxiety, stress);

66% of students have 2 of 3 disorders and 34% of students have all 3 disorders simultaneously, 48% of students have 2 to 3 disorders, 48% of students are normal.

3.3. Analyze factors associated to depression, anxiety, and stress of research subjects

Table 2. Factors associated to depression, anxiety, and stress in students

Student characteristics		Depression OR(95%CI)	Concerned OR(95%CI)	Stress OR(95%CI)
Satisfied with the field of study	Have	1	1	1
	Are not	10.04 (2.57-39.25)	4.02 (1.05-15.44)	4.86 (1.26-18.66)
Future career orientation	Do the right job	1	1	1
	Do another job	4.77 (1.32-17.23)	2 (0.56-7.13)	2.4 (0.67-8.56)
Participate in activities organized by the school	Have	1	1	1
	Are not	2.78 (1.15-6.68)	3.44 (1.39-8.52)	3.55 (1.45-8.68)
Lack of financial support for more than 1 month	Are not	1	1	1
	Have	8.33 (3.03-25)	6.67 (2.13-20.16)	6.25 (2.08-20.03)
There are problems with the police	Are not	1	1	1
	Have	5.56 (1.56-20)	6.25 (0.7-50.02)	7.14 (0.85-50.13)
End of a close relationship (friendship)	Are not	1	1	1
	Have	3.45 (1.23-6.67)	1.79 (1.23-25)	8.33 (2.22-33.33)
Feeling a lot of pressure in studying	Are not	1	1	1
	Have	5.26 (2.08-14.29)	5.88 (2.50-14.29)	5.88 (2.56-14.29)
Disagreement with parents	Are not	1	1	1
	Have	5.56 (1.56-20)	14.29 (1.75-34.23)	16.67 (2.13-36.18)

Comment: Students who are dissatisfied with their major are 10.04 times more likely to suffer from depression, anxiety and stress (95%CI:2.57-39.25); 4.02 times (95%CI: 1.05-15.44) 4.86 times (95%CI: 1.26-18.66) more than students who are satisfied with their major

Students who intend to pursue another career after graduation are 4.77 times more likely to suffer from depression (95%CI:1.32-17.23) compared to students working in the right profession after graduation

Students who do not participate in activities organized by the collage are 2.78 times more likely to suffer from depression, anxiety and stress (95%CI: 1.15-6.68); 3.44 times (95%CI: 1.39-8.52); 3.55 times (95%CI: 1.45-8.68) compared to students who participate in activities organized by the collage.

Students who end a close relationship (friendship) are 3.45 times more likely to have depression (95%CI: 1.23-6.67), 1.79 times more likely to have anxiety (95%CI: 1.23-6.67) : 1.23-25), 8.33 times more stressed (95%CI: 2.22-33.33) than students who did not end a close relationship (friendship).

Student who lack of financial support for more than 1 month are 8.33 times more likely to suffer from depression (95%CI: 3.03-25), anxiety 6.67 times (95%CI: 2.13-20.16), stress 6.25 times (95%CI: 2.08-20.03) compared to students who did not lack of financial support for more than 1 month.

Students who have had problems with the police within a month are at increased risk of depression 5.56 times (95%CI: 1.56-20) times higher than students with no problems with the police.

Student feel a lot of pressure in studying have 5.26 times the risk of stress (95%CI: 2.08-14.29), 5.88 times the risk of anxiety (95%CI: 2.50-14.29) and have 5.88 times more stress (95%CI: 2.56-14.29) than students who do not feel a lot of pressure in studying.

Student who disagree with their parents are 5.56 times the risk of depression (95%CI: 1.56-20), 14.29 times the risk of anxiety (95%CI: 1.75-34.23) and 16.67 times more stressed (95%CI: 2.13-36.18) than students who do not disagree with their parents.

4. DISCUSSION

1.1. Survey the rates of depression, anxiety, and stress among students between courses.

The rate of students with mild or more depression is 34%. In Tukey, research by Nuran Bayram and

colleagues in 2008 was conducted on 1617 students with the DASS scale [1], showed that 27.1% of students suffered from moderate to very severe depression [1]. In Malaysia, in 2014, research by Fuad and colleagues conducted on 227 medical students showed that 24.4% of students suffered from depression [2]. In Pakistan, Tabassum Alvi's 2010 study on 279 medical students used the BDI scale and showed that 35.1% of students showed depression [3]. Thus, when learning about student depression, although many different scales are used, the rate of depression in students is consistent with studies around the world.

The rate of students suffering from anxiety is the highest at 52%. The results of our study are higher than those of Blanco et al., rAnxiety disorders are one of the most common mental health problems among students with about 11.9% of students having anxiety disorders [4]. However, this result is similar to the study of Tabassum Alvi and colleagues (2010) with the rate of students suffering from anxiety being 47.7% [3]. The difference may be because our study used the DASS 21 scale while the study of Tabassum Alvi and colleagues (2010) used the BAI scale [3].

The rate of stressed students is 48%, similar to research results around the world. In Canada, the rate of students having to deal with stress-associated problems in the past 12 months is up to 45%.6. In Malaysia, research by Maher D. Fuad Fuad and colleagues (2014) showed that 16.9% of medical students were stressed [2]. In Ethiopia, research by Leta Melaku and colleagues (2015) conducted on 329 medical students at Jimma University with the GHO-12 scale and obtained results that 52.4% of students were stressed [7].

The rate of combined depression, anxiety and stress disorders, results showed that 48% of students were normal; 4% of students have 1 of

3 disorders (depression, anxiety, stress); Of the 48% of students with 2 to 3 disorders, 66% of students have 2 of the 3 disorders. In particular, research has shown that 34% of students have all three disorders simultaneously. Anxiety, depression and stress are associated psychological disorders that can interact with each other. Anxiety can arise suddenly, as in panic, or gradually over minutes, hours, or even days. Anxiety can last from a few seconds to many years; Longer durations are characteristic of anxiety disorders. Anxiety ranges from vague feelings to actual panic. The ability to tolerate a certain level of anxiety varies from person to person.

1.2. Factors associated with depression, anxiety, and stress in students

Satisfied with the major: Our study shows that dissatisfaction with your major increases the risk of depression by up to 10.04 times (95%CI: 2.57-39.25), increasing the risk of anxiety by 4.02 times (95%CI: 1.05-15.44) and increased the risk of stress by 4.86 times (95%CI: 1.26-18.66), the relationship is statistically significant. Our research results are similar to the results of a number of studies in the world and in Vietnam. Research by Nuram Bayram and colleagues in 2008 showed a close relationship between stress, anxiety and depression with students' satisfaction with their major. In this study, medical students who do not feel satisfied with their major are often at higher risk of stress, anxiety and depression than the group who feel satisfied and interested in their major ($p < 0, 05$) [1]. In Vietnam, research by Le Thanh Trung (2017) has shown that students who are dissatisfied with their major are 2.2 times more likely to suffer from signs of depression, anxiety, and stress ($p < 0.001$, 95%CI: 1.4-3.4); 1.8 times ($p < 0.05$, 95% CI: 1.2-2.8) and 2.6 times ($p < 0.001$, 95 %CI: 1.7-4) compared to students who are satisfied with majors [8].

Future career orientation: From whether they are satisfied with their major or not, students will have future career directions. After graduating, students can plan to pursue the nursing profession they have chosen, or they can also pursue other careers. Our research shows that students with a future orientation to another career are 4.77 times more likely to suffer from depression (95%CI: 1.32-1.23) than students with a career orientation. right career in the future, however the relationship is statistically significant. Our research results correlate with the research of Nguyen Thu Hang and colleagues (2019), surveying anxiety disorders in 500 fourth-year students at Nam Dinh nursing university. Research has shown that work after graduation is the leading factor influencing anxiety in final-year students. In addition, the study also showed that 22.3% of students plan to have another career when they graduate [9]. The difference may be because our research subjects included students from first to third year, while in Nguyen Thu Hang's research, the research subjects were final year students.

Participate in activities organized by the school: Extracurricular activities, as a natural and essential part of university life, are activities enjoyed by many students. The following activities can be classified as extracurricular activities: joining clubs and attending arts, sports, and music activities. Carrying out hobby activities helps students reduce stress, and extracurricular activities are also an opportunity for students to exchange and share with friends, limiting signs of anxiety and depression. in students. Many studies around the world have shown the positive impact of extracurricular activities organized by schools on student psychology, reducing the risk of depression, anxiety, and stress as research by Yusoff and colleagues (two thousand and thirteen)ten, Maher D. Fuad Fuad et al (2014)2. Our research

shows that not participating in extracurricular activities organized by the school increases the risk of depression, anxiety, and stress by 2.78 times (95%CI: 1.15-6, respectively). 68); 3.44 times (95%CI: 1.39-8.52); 3.55(95%CI: 1.45-8.68), the relationship is statistically significant.

Ending a close relationship (friendship): In the study, 18% of students experienced the end of a close relationship such as a friendship. These students are 3.45 times more likely to suffer from depression; anxiety is 1.79 times higher; Stress is 8.33 times higher than not ending a close relationship (friendship), the result is statistically significant. Thus, the situation of ending a close relationship such as a friendship increases the risk of depression, anxiety and stress.

Lack of financial support for more than 1 month: The rate of students lacking financial support for more than 1 month is 24%. Research results indicate that these students are at increased risk of depression 8.33 times (95%CI: 3.03-25), anxiety 6.67 times higher (95%CI: 2.13-20.16), stress 6.25 times higher (95%CI: 2, 08-20.03). Compared to students who do not lack financial aid. The results are statistically significant. Thus, a situation of lacking financial support for 1 month only increases the risk of depression, anxiety and stress.

Having problems with the police: Research results showed that 7% of students had problems with the police. These students are 5.56 times more likely to have depression(95%CI: 1.01-33.33)Compared to other students, the relationship is statistically significant with $p > 0.05$. Thus, problematic situations with the police have a statistically significant relationship with students' risk of depression.

Feeling a lot of pressure in studying: study 51% of students feel a lot of pressure in studying. Research also shows that feeling a lot of pressure while studying increases the risk of depression by

5.26 times.(95%CI: 1.49- 5.69); increased risk of anxiety to 5.88; increases the risk of stress by 5.88 times, the relationship is statistically significant. Our research results are similar to a number of domestic and international studies. Vu Dung's research on nursing students has shown the risk of high levels of stress in the group of students under pressure to study. Exercise at medium and high levels is 3 times higher than the low pressure group ($p < 0.05$) [11]. Nuran Bayram's 2008 study on 1617 students in Turkey showed that the group of students who were satisfied with their academic results had lower depression scores than the group of students who were dissatisfied.twelfth. Research by Tabassum Alvi and colleagues on 279 medical students at Wah Medical University, Pakistan in 2008 showed that dissatisfaction with testing criteria, overload with exam schedules, and testing are closely associated factors. closely associated to depression and anxiety in students [3]. Thus, the factor of feeling a lot of pressure while studying increases the risk of depression, anxiety and stress.

Disagreement with parents: Our research showed that in the past year, 13% of students had disagreements with their parents. These students are 5.56 times more likely to have depression, 14.29 times more likely to have anxiety, and 16.67 times more likely to be stressed than students who do not disagree with their parents. Statistical significance. This result is similar to the results of domestic and foreign research. Research by Le Thanh Trung (2017) [8] showed that the risk of depression in students who frequently have conflicts with their families is 3.7 times higher than in students who do not often have conflicts with their families ($p < 0.05$). Students who do not often share are 1.7 times more likely to show depression than those who regularly share with their families ($p < 0.05$).8. Research by Lu Chen (2013) showed that students with poor relationships with their parents are 1.4

times more likely to be depressed than those with good relationships with their parents [13]. This similarity shows that the relationship with family plays a very important role in determining depression in students. Frequent conflicts and lack of sharing will reduce parents' care and concern for students, negatively affecting the students' own mental health.

5. CONCLUSION

1. Current status of the incidence of depression, anxiety and stress in student courses

- The rate of students suffering from depression, anxiety, and stress is 34% respectively; 52%; 48%.
- The rate of depression, anxiety, and stress in first-year students is the highest, accounting for 14%, 26%, 23%,
- There are 4% of students suffering from 1 of 3 disorders (depression, anxiety, stress); 66% of students have 2 out of 3 disorders in 48% had 2-3 disorders; 34% of students have all 3 disorders simultaneously, while 48% have 2-3 disorders.

2. Some factors associated to depression, anxiety and stress of children in the park

Potential risk factors for depression, anxiety and stress include: students having problems

with the police; not participating in activities organized by the school; lack of financial support for 1 month; dissatisfied with the major; orientation of not working in the right profession after graduation; ending a close relationship (friendship); there is a lot of pressure in studying; have disagreements with parents.

6. RECOMMENDATIONS

Student affairs promote ideological, political, and vocational education to help students have the right stance, thoughts, and actions when participating in professional activities and in social relations.

Coordinate with families to promote management, support students in studying, training themselves, gaining experience and developing soft skills to prepare for after graduation.

It is necessary to pay attention to health care and school health, especially mental health for students such as propagating how to detect depression, anxiety, and stress early for timely treatment.

Strengthen Youth Union, Student Union and extracurricular activities to help students reduce stress during the study process.

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PRE-OPERATIVE ANXIETY AND PERCEPTIONS OF ILLNESS UNCERTAINTY AMONG PARENTS OF CHILD WITH OPERATION AT THE CENTER OF EAR, NOSE, THROAT AND COCHLEAR IMPLANTATION, HANOI MEDICAL UNIVERSITY HOSPITAL

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ABSTRACT

Introduction: Surgery is a medical procedure which has several risks and complications. Consequently, it makes parents of in-patient children undergoing surgery experience a high level of illness uncertainty (IU) demonstrated as a source of anxiety. Anxiety affected both family and the treatment process.

Objectives: This study was conducted to explore the level of anxiety and uncertainty among parents of children undergoing surgery and identified associated factors.

Material and Methods: 50 parents of children undergoing surgery at the Center of ENT and Cochlear Implantation were invited to complete research questionnaire (100% response rate) from September 15th to October 19th, 2021. The level of anxiety was measured using the State and Trait Anxiety Inventory (STAI), the perception of illness uncertainty was measured by Parental Perception of Uncertainty in Illness Scale (PPUS).

Results: The mean scores of State anxiety was 43.56 ± 6.5 and Trait anxiety was 45 ± 7.513 . Of all parents, 44% had state anxiety and 56% had Trait anxiety. PPUS showed the mean score was 85.9 ± 16.26 . Parent living in rural areas (OR=7.2, CI: 1.88 – 27.52) high uncertainty in illness ($r=0.345$, $p=0.014$) were significantly associated with parental anxiety.

Conclusion: Levels of preoperative parental anxiety and uncertainty were moderate. Parental anxiety was significantly associated with age of parents, residence and parents' uncertainty.

Keywords: Anxiety, Parents, Children, Surgery, ENT.

1. INTRODUCTION

Surgery is one kind of medical procedure which has several risks and complications [1]. It makes parents of in-patient children undergoing surgery always experience a high level of illness uncertainty (IU) which was demonstrated as a source of anxiety if it was last persistent [2]. Anxiety is an emotion characterized by feelings of tension, worried thoughts and physiologic changes including increased blood pressure, sweating, trembling, dizziness or a rapid heartbeat [3].

Anxiety is the biggest barrier for young parents to believe in the effectiveness of surgery, making parents confused in the process of decision-making, particularly consenting to surgery. On the other hand, parents' anxiety can transfer to their children and causes bad response to treatment and lengthens the hospitalization [4]. In addition, the presence of anxiety in parents causes difficulty in caring as it reduces their ability to function normally and causes negative effects in coping with the new or stressful situation [5].

Anxiety appeared in every corner of human life, especially in families having hospitalized children. Netsanet (2020) using the STAI- score to measure anxiety among 176 parents of children who undergo surgical operations, and the results showed a high prevalence (74.2%) of parental anxiety [6]. Similarly, Georgios Kamlourogrou et al (2019) claimed 79.8% of parents of children waiting for pediatric surgical consultation were classified as being anxious [7]. In Vietnam, these percentages were at the high level, 85.3% in father and 52.1% in mother (Nguyen Thi Dau et al, 2020) [8]. Whether high proportion and obstacles of preoperative anxiety in parents, there was not any study in ENT and Cochlear Implantation Center.

The preoperative period always makes parents

anxious and leads to serious effects that reduce the effectiveness of treatment. However, these problems could be improved if we accurately assess parents' knowledge and anxiety levels that help health care workers to assist parents in managing anxiety and improving the quality of comprehensive care for children and their families. In spite of the impacts of anxiety in individuals, there has been little research in Vietnam to assess the anxiety prevalence among parents and its relation with other factors, particularly uncertainty in illness. Many experts mentioned the contribution of IU to anxiety, however, that this evidence was not conclusive. In order to fill these gaps, this study was conducted with following objectives:

1. Describe the level of Anxiety and Perceptions of illness uncertainty among parents of child with ENT operation at Center of ENT and Cochlear implantation
2. Explore factors affected to parents' Anxiety of pre- operative child with ENT operation at Center of ENT and Cochlear implantation

2. METHODS

2.1. Subjects

The participants in this study were (1) parents of children under 16 years old who was preparing for operation at Center of ENT and Cochlear Implantation in Hanoi Medical University Hospital in collective time, (2) having the ability to understand and answer questions posed by researchers and (3) no signs of mental and cognitive impairment that affect the completion of the questionnaire. Parents of children being in Emergency status were excluded from the study.

2.2. Study setting

This cross-sectional study was conducted in Hanoi Medical University Hospital from September 15th to October 19th, 2021

2.3. Sampling and sample size

The sample size selected for this survey was based on a single population proportion formula. The proportion of preoperative parental anxiety in different levels as Netsanet's research (2020) was 72%, with 95% of confidence intervals, and 5% margin of error⁶. Since, the sample size for this study was calculated as:

$$n = z_{1-\alpha/2}^2 \times \frac{p(1-p)}{\Delta^2}$$

When: n: Sample size

$z_{1-\alpha/2}$: Statistics for a level of confidence (z= 1.96 for 95% confidence interval)

p: Proportion of preoperative parental anxiety (p= 0.72)

Δ : Standard error (= 0.13)

Therefore:

$$n = 1.96^2 \times \frac{0.72(1-0.72)}{0.13^2} \approx 46$$

Considering 10% of non-response rate the total number of participants was 50. All consecutive parents of children undergoing surgical operation were include until the calculated sample size reached

2.4. Research instrument, Data collection and data analysis

Data was collected by face-to-face interviews using self-administered questionnaires. The questionnaires were divided into 2 sections for medical staff and participants. Data was collected using a self-evaluation questionnaire including 2 parts. Part A was used to assemble data from parents and composed by 3 sections: Demographic, Parents' anxiety and Parents' perception of illness uncertainty. Demographic section collected data about general information (age, gender, level of education, occupation, ethnicity, health,...). Parents' anxiety was measured using the Y-form of The State - Trait

Anxiety Inventory (STAI) in the Vietnamese version. This instrument consists of 40 items divided into 2 subscales: Stated anxiety and Trait anxiety. The State anxiety assesses anxiety at the presence of interviewing. It includes 20 items rated on a 4- point Likert scale from "not at all" to "very so much". The Trait anxiety evaluates personal characteristic using 4-point Likert scale classifinding from "Almost Never" to "Almost Always". The range of possible scores for each subscales vary from 20 to 80. The higher scores, the greater anxiety. Parents' perception of IU was assessed using 31- item Parents' Perception Uncertainty in Illness Scale - PPUS (Mishel, 1983). The total score ranges from 31 to 155 respond to 5- point Likert scale (1-strongly disagree to 5-strongly agree), with higher values reflecting increased perceived illness uncertainty. The PPUS has demonstrated high reliability with the Cronbach's alpha from 0.81 to 0.93. Part B was used to ask medical staff to assess physical status, past and current medical conditions of the children undergoing anesthesia. Data were collected on children's age, gender, nutrition status, number of previous hospital admission and operation, diagnosis, plan of anesthesia and the undergoing surgical procedure.

Data were entered and analised by SPSS-20. Several descriptive statistics (frequency, percentage, means, standard deviation score..) and correlational analysis (Chi-square test and Spearman's Rho test) were conducted. The significant level was set at $p < 0.05$.

2.5. Ethical considerations

Study was conducted following the code of ethics among human study. Study has been approved and supported by the Director Board of Hanoi Medical University Hospital. Data was only collected when parents signed in the informed consent after they were clear about the purpose and content of the study, and the

right to withdraw from an interview at any time. The information is only used for research purposes without any others.

3. RESULTS

Table 1. Demographic characteristics of parents in the Center of ENT and Cochlear implant (N=50)

Variable	n(%)	Variable	n(%)
Relation with the children		Age group	
Mothers	38 (76)	≤ 35 years	24 (48)
Fathers	12 (24)	>35 years	25 (48)
Ethnic group		Religion	
Kinh	48 (96)	No	48 (96)
Non-Kinh	2 (4)	Yes (catholic)	2 (4)
Marital status		Education level	
Married	48 (96)	College and bellow	30 (60)
Divorced	2 (4)	Bachelor and above	20 (40)
Residence		Occupation	
Urban	24 (48)	Officer	17 (34)
Rural	26 (52)	Other	33 (66)
Living with children		Total child in family	
Yes	47 (94)	≤ 2	16 (32)
No	3 (6)	> 2	34 (68)
		Family income	
		< 5 millions/month	13 (26)
		5 – 10 millions/ month	19 (38)
		> 10 millions/month	18 (36)

Comment: Most of them were mothers (76%). The average age of the parents was 38.86 (SD: 8.12), and the majority of them were in the group > 35 years old (52%). The parents' ethnicity was primarily Kinh (96%) and had no religion (96%). More than half of parents lived in rural areas (52%). The majority of parents were in college and below (60%); 34% of them

3.1. Demographic characteristics

Fifty family caregivers were invited to participate in this study, with the response rate of 100%.

worked as officers, 36% had an income over 10 millions/month. The majority of the parents were married (96%), lived with their child (94%) and had more than 3 children (68%)

The average age of children undergoing surgert was 8.36 (SD = 3.55). Table 2 summaries characteristics of children

Table 2. Physical status, medical condition of the children undergoing surgery (N=50)

Variable	n(%)	Variable	n(%)
BMI		Age group	
< 18.5	26 (52)	≤ 5 years	8 (16)
18.5 – 25	20 (40)	5 – 10 years	26 (52)
> 25	4 (8)	>10	16 (32)
Gender		Previous hospital admission	
Male	39 (78)	0	38 (76)
Female	11 (22)	≥ 1 time	12 (24)
Medical diagnosis		Plane Surgical procedure	
Acquire disease	36 (72)	Ear surgery	14 (28)
Congenital disease	14 (28)	Sinus surgery	2 (4)
		Head and neck surgery	3 (6)
		Pharynx and Larynx surgery	31 (62)

Comment: Majority child was in the group of 5-10 years old (52%). More than three-fourth of them were male (78%). More than half of children (52%) were underweight with BMI <18,5. 32 children (64%) never admitted to hospital. The number of children who had acquired disease was more than 2.5 times of those who had congenital disease. Pharynx and Larynx surgery was the highest surgery in children at the Center of ENT and Cochlear Implantation (62%).

3.2. Physical status, past and current medical conditions of the children

Table 3. Physical status, past and current medical condition of the children undergoing surgery (N=50)

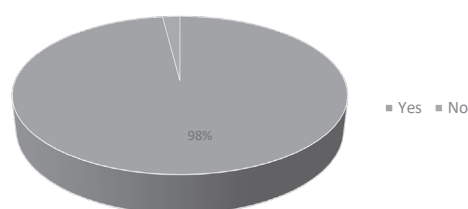


Figure 1. Parents was explained about the state of the children (N=50)

Comment: At time of interview, one parent was not explained about the state of their children

3.3. Parental anxiety

The mean State-Anxiety score by S-STAI among the family caregivers was 43.56 (range 28–60, SD= 12.74) and by Trai-Anxiety was 45.0± 7.51, with the range between 21 and 61.

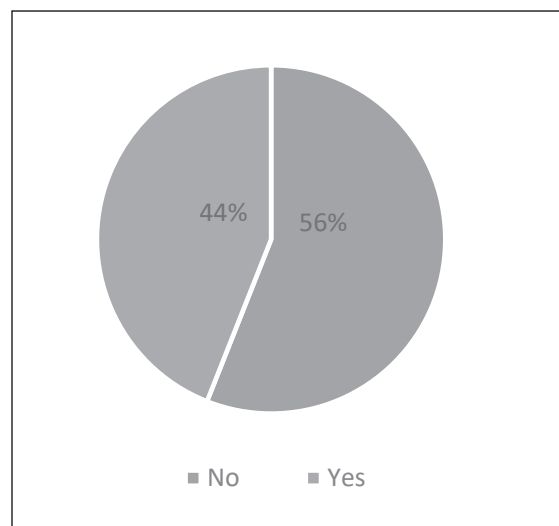


Figure 2. State anxiety proportion

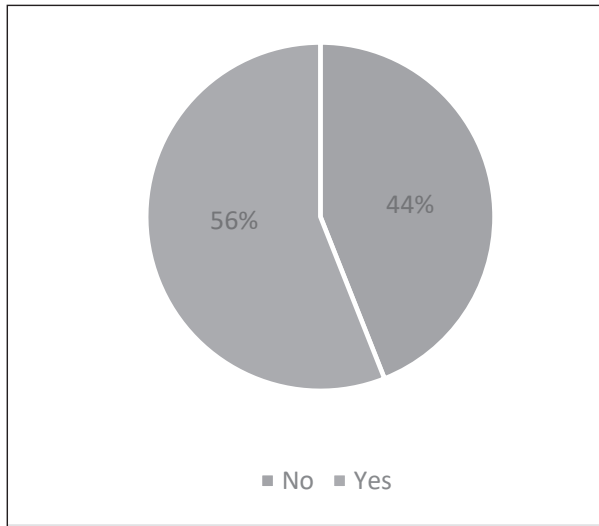


Figure 3. Trait anxiety proportion

Comment: The proportion of State Anxiety was low (44%), and that of Trait Anxiety was 56% (Figure 2, Figure 3).

1.4. Illness uncertainty level

The score of uncertainty in illness ranged from 56 to 99 with the mean was 85.6 ± 16.26 , which was classified as moderate level. The classification of uncertainty in illness was shown in table 3.

Table 3. Level of illness uncertainty in parents (N=50)

Level	N	%
Low	2	4.0
Moderate	33	66.0
High	15	30.0

The proportion of parents who experienced uncertainty in illness from high to low level, Moderate (66%), and low (4%).

3.5. Explore Factors related to the parental pre- operative anxiety

Table 4. Parental anxiety and Parent’s characteristics (N=50)

Demographic characteristics		Have State anxiety		Have Trait anxiety	
		Yes n(%)	p*/OR	Yes n(%)	p*
Relation/ Parents	Mother (N=38)	15 (39.5)	0.251	20 (52.6)	0.393
	Father (N=12)	7 (58.3)		8 (66.7)	
Age group	≤ 35 (N=24)	14 (58.3)	OR=2.45 0.75 – 8.03	15 (62.5)	0.374
	> 35 (N=26)	8 (30.6)		13 (50)	
Ethnics	Kinh (N=48)	20 (41.7)		26 (54.2)	
	Non-Kinh (N=2)	2 (100)		2 (100)	
Religion	Yes (N=2)	1 (50)	1.0	0 (0)	-
	No (N=48)	21 (43.8)		28 (58.3)	

Residence	Urban (N=24)	6 (25)	OR=7.2 1.88 – 27.52	11 (45.8)	0.164
	Rural (N=26)	16 (61.5)		17 (65.4)	
Education level	College and below (N=30)	15 (50)	0.295	17 (56.6)	0.907
	Bachelor and above (N=20)	7 (35)		11 (55)	
Parent occupation	Officer (N=17)	8 (47.1)	0.754	12 (70.6)	0.136
	Others (N=33)	14 (42.4)		16 (48.5)	
Average income	<5 millions/ month (N=13)	6 (46.2)	0.974	7 (53.8)	0.86
	5- 10 millions/ month (N=19)	8 (42.1)		10 (52.6)	
	>10 millions/ month (N=18)	8 (44.4)		11 (61.1)	
Marital status of parents	Married (N=48)	20 (41.7)	-	26 (54.2)	-
	Divorced (N=2)	2 (100)		2 (100)	
Living with children	Yes (N=47)	20 (42.6)	0.576	26 (55.3)	1.0
	No (N=3)	2 (66.7)		2 (66.7)	
Number of children	≤ 2 (N=16)	6 (37.5)	0.525	10 (62.5)	0.525
	> 2 (N=34)	16 (47.1)		18 (52.9)	

* Chi-square test/ Fisher exact test

Comment: Parent living in rural show risk of State anxiety is 7.2 time higher compare with those living in Urban. Other variables did not show significant correlation with State and Trait anxiety

Table 5. Parental anxiety with child's characteristics (N=50)

		Have State anxiety		Have Trait anxiety	
		Yes n(%)	p*	Yes n(%)	p*/ OR
Congenital diseases	Yes (N=8)	5 (62.5)	0.250	4 (50)	0.709
	No (N=42)	17 (66.7)		24 (57.1)	
Previous hospital admission	0 (N=32)	15 (46.9)	0.585	21 (65.6)	OR=3.0 0.91 – 9.92
	≥ 1 (N=18)	7 (38.9)		7 (38.9)	
Previous surgery	0 (N=38)	17 (44.7)	0.852	23 (60.5)	0.251
	≥ 1 (N=12)	5 (41.7)		5 (41.7)	
BMI	Normal (N=20)	7 (35)	0.295	10 (50)	0.485
	Abnormal (N=30)	15 (50)		18 (60)	
Medical diagnosis	Acquire disease (N=36)	22 (61.1)	0.243	19 (52.8)	0.462
	Congenital disease (N=14)	6 (42.9)		9 (64.3)	
Plane of the undergoing surgical procedure	Throat surgery (N=31)	11 (35.5)	0.121	17 (54.8)	0.833
	Other (ear, sinus, Head-neck) (N=19)	11 (57.9)		11 (57.9)	

* Chi-square test/ Fisher exact test

Child's characteristics did not show significant correlation with State and Trait anxiety

Table 6. Spearman's rank correlation coefficient between the illness uncertainty and anxiety (N=50)

	Have State anxiety		Have Trait anxiety	
	Correlation coefficient	p-value	Correlation coefficient	p-value
Illness Uncertainty	0.06	0.68	0.345	0.014**

** $p < 0.05$

Parent's Illness Uncertainty score showed significant correlation with Trait Anxiety.

4. DISCUSSION

The sample consisted of 50 parents (76% mothers) with the mean age of 36.86 (SD=8.12), 96% of them were married. Among 50 children, the mean age was 8.36 ± 3.55 with the majority falling in the age group of 5-10 (52%), The sproportion of male was more than 3 time female (78% compared to 22%).

STAI was used as an instrument that measures parents' anxiety in both anxiety (situational) and trait (baseline) anxiety. The overall level of state anxiety in parents was moderate with the mean S-STAI was 43.56 ± 12.74 , trait anxiety was high with the mean score was 45 ± 7.51 . Of these parents, 44% were classified as high anxiety; while that of Trait-Anxiety was 56%. It is the same as in 10 parents, there are 4 people experiencing high anxiety; 5 people will be of high trait anxiety. These findings were not consistent with those of previous literature reviews that show high levels of anxiety. Netsanet (2020) showed the prevalence of parents who had a total S-STAI score bigger than 43 was 74.2% [6]. The lower percentage of parental anxiety in this study can be resulted from the difference in subjects. He investigated the parents of all children undergoing surgery, while I just paid attention to parents whose children were in the ENT and Cochlear department. Similarly, Nguyen Thi Dau and et al (2020) claimed a higher percentage of parental anxiety (83%) in her study on 112 parents of children with systemic lupus erythematosus [8]. This disease is not totally cured, so that children would live with it all their lifetime [9]. As a result, their parents experienced high levels of anxiety.

Parental uncertainty was measured using PPUS (Mishel, 1983). It demonstrated high reliability and preferred by many researchers as it's high reliability with consistency alpha coefficient of

0.91. In my study, The results of PPUS analysis indicated that parents were in moderate levels of uncertainty with the mean score was 85.9 +/- 16.25 and the range from 56 to 99. Of all parents, more than half reported moderate uncertainty (66%) that was the same with Kai-Wai (2018 [10]. Although knowledge now can be taught easily by the development of the Internet, it was difficult for them to find high quality information, so they stayed in high levels of uncertainty.

Younger parents had more anxiety than the older one. This finding was observed in an other study (Aikaterini, 2018) [11]. The reason for this was that olders had more experiences which keptd them calm, while the younger was commonly troubled and confusse in next plan.

Consistent with that of Netsanet (2020) and Ezgi Erkilic (2017) parents living in rural areas experienced higher anxiety [12]. It was explained by the unfamiliar environment, far away from home, so that they were passive in caring for the children.

On the aspects of family characteristics, Laura (2017) suggested that parents divorced had a higher level of anxiety than other one [13]. Interestingly, in my study, although divorced parents absolutely experienced anxiety, it was not significant. That was due to a small population including 2 unmarried parents. That made it difficult to calculate the differences.

Illness uncertainty had a direct relationship with parents' anxiety (Mitchell, Marion L and Courtney, Mary D (2004)[14]. Whereas, surprisingly, my study showed that parental perception was not significantly correlated with anxiety, but was correlated with trait anxiety with $r= 0.345$, $p= 0.014$. This results may stem from the small population as the affected of COVID 19.

5. CONCLUSIONS

The level of preoperative anxiety and uncertainty in illness was moderate. The percentage of parents who experienced State anxiety was 44%, Trait anxiety was 56%. Parental anxiety was significantly associated with residence and parents' uncertainty. No correlation between parental anxiety and relation with the children, education level, parents' occupation, income, living with children, number of children,

characteristics of the children, children's physical status, past and current medical conditions.

RECOMMENDATION

Medical staff, partially nurses should consider parents' anxiety during preoperative period as spend more time explaining about disease for the family caregivers, particularly parents living in rural areas.

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THE STATUS OF EQUIPMENT, HUMAN RESOURCES, AND PROFESSIONAL CAPABILITIES IN COVID-19 DIAGNOSIS AND TREATMENT AT THE COVID-19 INTENSIVE CARE CENTER UNDER BACH MAI HOSPITAL AND ITS SATELLITE HOSPITALS

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ABSTRACT

Objectives: This study aims to describe the current status of equipment, human resources, and professional capabilities in COVID-19 diagnosis and treatment at the COVID-19 Intensive Care Center under Bach Mai Hospital and its satellite hospitals.

Methods: This observational study was conducted from August to September 2021. Data on beds, equipment, staffing, and patient metrics were collected from CIC and 10 assigned satellite hospitals at baseline (August 23) and endline (September 30).

Results: At baseline, satellite hospitals had limited isolation beds, ventilators, and oxygen supplies. Two field hospitals had the greatest capacity expansion, increasing from 0 to 4,500+ regular beds and 982+ ICU beds. Physician staffing ranged from 10-267 per hospital, with only 1-13 being critical care specialists. Nurse staffing varied from 35-173 total, with 1-14 critical care nurses per hospital. By endline, some hospitals had enhanced oxygen systems and outlets. However, specialized staff and equipment remained insufficient. Field hospitals admitted patients early but had no ventilated patients. Average length of stay ranged from 4-17 days between hospitals. Key lessons including, immediately establishing surge ICU capacity based on projected demand, deploying staff flexibly, addressing resource disparities between hospitals, and investing in specialized training. This can enhance pandemic preparedness and intensive care delivery during outbreaks.

Conclusions: Rapid expansion of beds and workforce absorbed the COVID-19 surge, but critical shortages persisted. Variable patient outcomes and lengths of stay indicated room for quality improvement. Further research should evaluate the long-term impacts of these efforts.

Keywords: COVID-19, pandemic, preparedness, intensive care units, resource mobilization

1. INTRODUCTION

The COVID-19 pandemic has caused significant morbidity and mortality globally, with many patients developing severe illness requiring intensive care. In Vietnam, Ho Chi Minh City was an epicenter of the major outbreak that started in May 2021. By July 2021, the city was reporting thousands of new cases and hundreds of deaths daily, overwhelming the healthcare system.

To expand critical care capacity, on July 30, 2021 the Ministry of Health established the COVID-19 Intensive Care Center (CIC) under Bach Mai Hospital at Hospital No. 16 in District 7 of Ho Chi Minh City. The aim was to create a specialized center to treat the most severe COVID-19 patients requiring the highest level of care. In addition, CIC was also assigned to support 10 tier 2 hospitals in the treatment pyramid to assist and train to improve their professional capabilities in prevention, early diagnosis, treatment of COVID-19. The assigned satellite hospitals included: District 7 Hospital, District 8 Hospital, Can Gio Hospital, Nha Be Hospital, Hospital No. 1, Hospital No. 16, Tan Hung Hospital, Hospital of Medical Rehabilitation - Occupational Diseases, FV Hospital, Tam Duc Heart Hospital [1], [2], [3].

Initial rapid needs assessments conducted in August 2021 at the 10 assigned satellite hospitals supporting CIC identified key gaps in infrastructure, equipment, medications, and workforce training. Most lacked sufficient ICU beds, ventilators, oxygen delivery systems and supplies to manage the surge in critically ill patients. Clinician training in delivery of advanced organ support and optimized resource allocation was urgently needed.

Our study aimed to evaluate the current status of resources, infrastructure, and staff critical care competencies at CIC and the satellite hospitals one month after CIC establishment. The results

will help identify persisting needs and priority areas for continued support, to inform plans for enhancing intensive care capabilities both short-term during the pandemic and long-term for future outbreak preparedness. Understanding strengths and weaknesses can facilitate delivering high-quality care to the most severely affected COVID-19 patients in this region.

2. METHODS

2.1. Study design: Prospective cohort study.

2.2. Study settings

The research was conducted from September 2021 to September 2022. Specifically, data was collected from August 1, 2021 to November 1, 2021 at the COVID-19 Intensive Care Center under Bach Mai Hospital and 10 satellite hospitals in Ho Chi Minh City assigned to the COVID-19 Intensive Care Center under Bach Mai Hospital. The study duration was 12 months.

2.3. Participants

The study participants were the COVID-19 Intensive Care Center under Bach Mai Hospital and ten COVID-19 treatment satellite hospitals assigned by the Ministry of Health and Ho Chi Minh City Department of Health to the COVID-19 Intensive Care Center under Bach Mai Hospital.

2.3.1. Inclusion criteria

Hospital was invited to the study if they were: i) The COVID-19 Intensive Care Center under Bach Mai Hospital was established according to Decision No. 3628/QĐ-BYT dated July 30, 2021; or 10 satellite hospitals of the COVID-19 Intensive Care Center under Bach Mai Hospital according to Decision No. 3992/QĐ-BYT dated August 18, 2021 of the Ministry of Health on assigning upper-level hospitals to directly provide professional support in COVID-19 management and treatment in Ho Chi Minh City, No. 5899/SYT-NVY dated August 22, 2021 and No. 6380/

SYT-NVY dated September 5, 2021 of Ho Chi Minh City Department of Health on contact information between upper-level hospitals and lower-level hospitals in professional support [1], [2]; and iii) Invited hospitals agreed to participate in the study.

2.3.2. Exclusion criteria: Hospital information is insufficient for analysis and evaluation.

2.4. Sample size and sampling method

We used complete sampling. All qualified hospital parameters were included in the study. Convenience sampling was used.

2.5. Data collection

We aggregated the data, including equipment, human resources, and professional treatment activities using checklists and information forms designed before and 3 months after support was provided. Required addition information was also extracted from the hospitals by trained researchers using a predesigned study form.

2.6. Ethical considerations

The study was approved by the Scientific Council of Bach Mai Hospital and permitted for implementation by the Leaders of Bach Mai Hospital and the participating satellite hospitals.

3. RESULTS

Table 1. Total number of regular beds for COVID-19 treatment

No.	Hospital	Total number of regular beds for COVID-19 treatment		Total number of ICU beds for COVID-19 treatment	
		2020	2021	2020	2021
1	FV Hospital	0	61	1	5
2	Nha Be District Hospital	10	60	0	10
3	Tan Hung Hospital	0	18	0	2
4	District 7 Hospital	0	150	0	50
5	Hospital of Medical Rehabilitation - Occupational Diseases		91		111
6	District 8 Hospital	20	90	0	10
7	Tam Duc Heart Hospital	0	40	0	10
8	Shelter Hospital for COVID-19 Treatment No. 1		4500		180
9	Shelter Hospital for COVID-19 Treatment No. 16		982		18
10	Can Gio COVID-19 Treatment Hospital	600	600	20	20

Table 2. Current status of equipment related to COVID-19 treatment

Hospital	Number of non-invasive ventilators (including HFNC)		Number of invasive ventilators		Number of infusion pumps	
	23/8	30/9	23/8	30/9	23/8	30/9
FV Hospital	10	10	10	10	45	45
Nha Be District Hospital	0	5	0	0	3	3
Tan Hung Hospital	2	2	8	8	60	60
District 7 Hospital	18	19	6	11	20	20
District 8 Hospital	33	33	9	9	8	8
Tam Duc Heart Hospital	2	2	8	8	15	15
Shelter Hospital for COVID-19 Treatment No. 1	20	30	3	5	3	5
Shelter Hospital for COVID-19 Treatment No. 16	37	42	0	0	10	10
Can Gio COVID-19 Treatment Hospital	40	40	4	4	30	30

All hospitals collecting data are located in Ho Chi Minh City with the following general information: 04 provincial general hospitals and 06 district-level hospitals; Hospital ranking: 2 rank I hospitals, 4 rank II hospitals, 2 rank III hospitals and 2 unranked hospitals; Hospital type: 5 public hospitals, 3 private hospitals and 2 field hospitals.

The number of beds for COVID-19 treatment in both regular and ICU groups in 2021 was higher than in 2020, especially for the 2 shelter hospitals for COVID-19 treatment which increased sharply from 0 to 4,500 beds and 982 beds, respectively. (Table 1)

100% of units had oxygen cylinders at baseline (8/23/2022) and endline (9/30/2022). 6/10 units had a central oxygen system at baseline, however by endline 2 more units had been equipped with a central system, bringing the total units with central oxygen to 8/10, in which the shelter hospitals had the largest total oxygen tanks of 4,000 m³. The number of oxygen outlets in most units increased from 8/23 to 9/30/2021, especially the field hospital which increased from 0 to 900 outlets in just over 1 month. Overall, there was no difference in non-invasive ventilators and infusion pumps in all 10 units between baseline and endline. (Table 2)

Table 3. Total number of general physicians and critical care specialists for COVID-19 treatment

Hospital	Total of general physicians for COVID-19 treatment				Total critical care specialists for COVID-19 treatment	
	Postgraduate	Undergraduate	College	Mid-level, other	Postgraduate	Undergraduate
FV Hospital	27	3				9
Nha Be District Hospital	2	8	0	0	1	0
Tan Hung Hospital	14	10			2	5
District 7 Hospital	13	53		0	1	13
Hospital of Medical Rehabilitation - Occupational Diseases					1	
District 8 Hospital	1	28	0	0	0	0
Tam Duc Heart Hospital	24	56	58	105	4	6
Shelter Hospital for COVID-19 Treatment No. 1	9					10
Shelter Hospital for COVID-19 Treatment No. 16		24				1

Table 4. Total number of general and critical care nurses for COVID-19 treatment

Hospital	Total of general nurses for COVID-19 treatment				Total critical care nurses for COVID-19 treatment			
	Post-graduate	Under-graduate	College	Mid-level, other	Post-graduate	Under-graduate	College	Mid-level, other
FV Hospital		9	38	41		8	7	3
Nha Be District Hospital	1	0	12	8	0	1	8	0
Tan Hung Hospital	2	5		26		2		8
District 7 Hospital	1	13	33	13	0	5	12	2
Hospital of Medical Rehabilitation - Occupational Diseases	1							
District 8 Hospital	0	0	50	0	0	0	0	0
Tam Duc Heart Hospital	4	6	2	26		5	6	14
Shelter Hospital for COVID-19 Treatment No. 1		10	12		50			
Shelter Hospital for COVID-19 Treatment No. 16		1	60			0	0	

The staffing capacity for COVID-19 treatment varied across the different hospitals surveyed. Overall, the total number of physicians ranged from 10 to 267, with the majority having an undergraduate medical degree and only 1-2 per hospital having specialized postgraduate training (Tables 3). Very few physicians had mid-level qualifications. In terms of critical care specialists, there were only 1-13 per hospital, mostly with undergraduate degrees. For nursing staff, the total number ranged from 35 to 173, with the majority being undergraduate nurses and 41-50% in most hospitals being college-level. Only 0-9 nurses per hospital had postgraduate degrees. Regarding critical care nurses, there were 1-14 per hospital, predominantly with undergraduate training (Table 4).

In summary, while the total number of staff differed across hospitals, the majority had undergraduate-level qualifications and there was limited specialized critical care expertise, with only 1-14 critical care nurses and physicians per hospital. Expanding the specialized ICU workforce is an important consideration for augmenting COVID-19 treatment capabilities.

4. DISCUSSION

The Ministry of Health established the COVID-19 Intensive Care Center (CIC) under Bach Mai Hospital at Hospital No. 16 in District 7, Ho Chi Minh City on July 30, 2021 per Decision 3628/QĐ-BYT. CIC's main task was treating the most severe COVID-19 patients. Additionally, per Decisions 3992/QĐ-BYT and 5899/SYT-NVY in August 2021, CIC was assigned to support 10 tier 2 hospitals in improving their COVID-19 prevention and treatment capabilities. From the early days of providing professional support and training, Bach Mai Hospital proactively applied support plans for the frontline at District 7 Hospital. Bach Mai Hospital's team of experts

applied a range of professional techniques, provided advice on isolation, measures to isolate patients, patients' relatives, established safe buffer zones for infection prevention and control, trained and directly supported the implementation of specialized infection control, especially intensive care for severe COVID-19 patients at the grassroots level at District 7 Hospital with great results. From the pilot model with the motto of providing intensive care for severe COVID-19 patients as early as possible at District 7 Hospital, Bach Mai Hospital continued to scale up and apply this approach to other assigned satellite facilities.

Through the collected results, we found that the shelter hospitals for COVID-19 treatment were the units with the highest total number of regular beds for COVID-19 treatment and total ICU beds for COVID-19 treatment among the participating hospitals. This data accurately reflects the COVID-19 treatment situation at the peak of the COVID-19 pandemic in Ho Chi Minh City at that time. Right behind the Field and Treatment Hospitals, Nha Be District Hospital was the 2nd facility to admit COVID-19 patients earliest among the 9 participating hospitals. The number of physicians treating COVID-19 patients at Tam Duc Heart Hospital was recorded as the highest with 80 doctors, however the highest number of nurses participating in patient care was at FV Hospital with 106 nurses.

We evaluated at two points in time - at the beginning and end of support activities. The baseline on August 23, 2021, when CIC was assigned and began coordination and support activities with satellite hospitals. The endline, September 30, 2021, when the pandemic situation in Ho Chi Minh City quickly stabilized, the Center ended and summarized support activities. The equipment at the satellite hospitals on August 23 and September 30

differed, as some systems and equipment were supplemented to units to serve treatment and patient care activities such as: central oxygen system, oxygen outlets, especially the Field Treatment Hospital, increased from 0 to 900 outlets in just over 1 month. The number of non-invasive ventilators and infusion pumps did not differ between the two time points. At the 2 Field Treatment Hospitals, the number of patients on room air and nasal cannula oxygen both tended to decrease from baseline to endline, at these 2 hospitals there were no patients on non-invasive ventilation or mechanical ventilation. The average length of stay of COVID-19 patients differed between hospitals, highest at FV Hospital with 17 days, lowest at Tam Duc Heart Hospital with 4 days of treatment, and there was not a large difference between August 23 and September 30.

The creation of field hospitals and rapid expansion of ICU beds reflects efforts to quickly augment critical care surge capacity, a key lesson emphasized during COVID-19 for pandemic preparedness [4]. However, the lack of specialized staff, equipment shortages, and variable length of stay between hospitals indicates there were still gaps in meeting resource needs, similar to reports from other countries [5], [6]. Having only 1-13 critical care specialists per hospital in this study mirrors the global shortage of ICU clinicians relative to demand seen during COVID-19 peaks [5]. The rapid training and redeployment of non-ICU nurses also aligns with strategies used internationally to expand the workforce, though safe staffing ratios remained challenging [6]. The field hospitals had the most beds and admitted patients early in the outbreak, aligning with literature recommending dedicated “mega-ICUs”

for standardized pandemic care [5]. However, persistent disparities in resources between hospitals despite the coordination center highlights how centralized pandemic planning and response is essential but difficult to achieve [6]. Overall, this rapid mobilization of ICU beds and staff helped absorb the patient surge, yet critical shortages remained. The variable outcomes and lengths of stay indicate room for improving quality of care through greater investments in specialized staff, equipment, infrastructure, and more equitable resource distribution. Integrating these lessons can enhance Vietnam’s ICU pandemic preparedness.

5. CONCLUSION

In conclusion, this study describes the mobilization of resources by the COVID-19 Intensive Care Center under Bach Mai Hospital to support satellite hospitals during the pandemic peak in Ho Chi Minh City. The rapid expansion of beds, equipment, and workforce helped absorb the surge of severely ill COVID-19 patients and improve intensive care capabilities at participating hospitals.

However, persistent gaps were identified including shortages of critical care specialists, variability in resources between hospitals, and different patient outcomes and lengths of stay. This indicates a need for continued investments in specialized staff, infrastructure, and equitable distribution of resources to enhance pandemic preparedness. Central coordination to standardize care and distribute supplies is also essential.

The experiences of the Intensive Care Center and satellite hospitals provide valuable insights that can strengthen Vietnam’s capacity to respond to future outbreaks. Key lessons include acting urgently to establish surge ICU capacity,

deploying staff flexibly, investing in training, and addressing resource disparities between facilities. Adapting these strategies along with emerging best practices can optimize intensive care delivery during public health crises.

Further studies are warranted to evaluate the long-term impacts of these efforts on ICU

capacities and clinical outcomes. Additional data on patient trajectories and resource availability over time can help identify enduring needs and targets for quality improvement. This can ensure Vietnam is equipped to meet the challenges posed by COVID-19 and future infectious disease threats.

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LOWER MORTALITY RATE OF COVID-19 VACCINATED PATIENTS ADMITTED TO A LARGE INTENSIVE CARE CENTER DURING THE OUTBREAK CAUSED BY SARS-COV-2 DELTA VARIANT IN VIETNAM

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ABSTRACT

Introduction: Vaccinated critically ill COVID-19 patients, even with only the first dose, showed better outcomes than non-vaccinated individuals during the Delta variant-driven outbreak in Vietnam. In developing countries with limited supply, mass immunization using any accessible type of vaccine are an effective strategy to reduce mortality and burden on health systems.

Objectives: To determine the association between COVID-19 vaccination status and mortality among hospitalized positive patients required intensive care unit (ICU) during the Delta variant-driven wave of COVID-19 in Vietnam

Methods: We conducted a retrospective observation study among 504 critically ill COVID-19 cases enrolled to ICUs of ICC, BMH from August to September 2021. Kaplan-Meier survival analysis was used to compare 28-day in-hospital mortality between groups. Cox proportional hazards regression adjusted for gender, age, comorbidities, and vital signs at baseline were used to determine the association between vaccination status and mortality outcome among patients. The secondary outcome was the proportion of patients required endotracheal intubation and invasive ventilation, and length of ICU stays.

Results: Out of 504 critically ill COVID-19 patients, 117 (23.2%) were vaccinated with at least one dose. Vaccinated patients were younger (median 57 vs 61 years, $p < 0.001$) and had fewer comorbidities (36.5% vs 63.5%, $p < 0.001$) compared to unvaccinated patients. Vaccinated patients also required less respiratory support and had lower 28-day mortality (31.6% vs 58.4%, $p < 0.001$). In adjusted analysis, vaccination was associated with a 26% reduction in mortality risk (aHR 0.74, 95% CI 0.57-0.96, $p = 0.036$).

Conclusions: Partial COVID-19 vaccination was associated with significantly reduced risk of death among critically ill patients admitted to the ICU during the Delta variant surge in Vietnam. Rapidly achieving high first dose vaccine coverage, even with constraints on optimal vaccine supplies, appeared effective at decreasing COVID-19 mortality and healthcare burden. These real-world data support that vaccination with available options should be urgently prioritized globally to save lives during the pandemic.

Keywords: COVID-19, SARS-CoV-2, Delta variant, vaccines, severe and critical, non-pharmaceutical interventions, Asia, Vietnam

1. INTRODUCTION

Vaccination has proven to be the most critical strategy for controlling the COVID-19 pandemic. Multiple large-scale studies have demonstrated that the available COVID-19 vaccines are highly effective at preventing symptomatic disease and death from COVID-19 [1],[2]. Vietnam was initially praised for its aggressive and early lockdown and quarantine measures when the pandemic began in 2020 [3],[4]. These strict policies likely prevented widespread transmission early on. However, Vietnam's vaccination rate remained low due to global supply shortages. This left the population vulnerable when the Delta variant emerged as the dominant strain. In June 2021, Vietnam had recorded only 8,000 total COVID-19 cases since the start of the pandemic. Yet by September 2021, cases had soared to over 800,000 - a hundred-fold increase in just three months. Nearly 20,000 Vietnamese lives were lost during this devastating surge. The Delta variant's heightened transmissibility overwhelmed Vietnam's early pandemic success. This tragedy highlights the absolute necessity of widespread vaccination to control the COVID-19 pandemic, even when strict public health measures are in place. Achieving high vaccination rates must remain the key priority globally, along with continued research

into variant-proof vaccines and treatments. No country can declare victory over COVID-19 until there is sufficient immunization worldwide to stop the emergence of dangerous new variants.

In response to the rapidly rising COVID-19 death rate in Ho Chi Minh City (HCMC), Vietnam's epicenter, the Ministry of Health established three major intensive care centers (ICCs) in early August 2021 [1]. Additionally, the HCMC government launched a mass vaccination campaign for all residents over 18 years old, prioritizing available vaccine supplies for the city [2]. By the end of September, 100% of HCMC's adult population had received at least one vaccine dose, with over 5 million residents fully vaccinated [3]. While COVID-19 vaccines provide strong protection against death, immunity takes 10-14 days to develop after the first dose, with maximal protection occurring two weeks after the second dose [4]. This study aims to investigate the association between COVID-19 vaccination status and mortality risk among ICU patients hospitalized for COVID-19 during the Delta variant surge in Vietnam. As the Delta wave escalated in mid-2021, HCMC rapidly expanded critical care capacity and accelerated vaccination efforts. By evaluating ICU patient outcomes according to vaccination status, this study can provide real-world evidence

on vaccine effectiveness against Delta variant mortality. The results could verify the benefits of Vietnam's mass immunization campaign in its COVID epicenter. More broadly, the findings will contribute to understanding how vaccines protect vulnerable populations during periods of peak Delta transmission. Rapid vaccination rollout remains a key public health strategy against emergent, highly transmissible SARS-CoV-2 variants.

2. METHODS

2.1. Study design and settings

We conducted a retrospective observation study among 504 critically ill COVID-19 cases enrolled to ICUs of ICC, BMH from August to September 2021.

2.2. Study participants

All patients aged 18 years or older diagnosed with COVID-19 and admitted to the ICUs of ICC, BMH during August 1 to September 30, 2021 were included in the study. COVID-19 diagnosis was confirmed by positive result on real-time reverse transcription PCR (RT-PCR) assay of nasopharyngeal swabs. Patients were classified by COVID-19 vaccination status into two groups: unvaccinated (no previous COVID-19 vaccination) and vaccinated (received at least one dose of COVID-19 vaccine). Demographic data, comorbidities, clinical signs and symptoms, laboratory findings, treatments, and clinical outcomes were extracted from electronic medical records.

2.3. Data collection

A standardized data collection form was used to obtain relevant information from patient medical records, including demographics, vaccination status, vital signs at admission, comorbidities, treatments received, respiratory support, and patient outcomes. Data was collected retrospectively by trained study staff through review of electronic medical records. All data was anonymized by assigning a unique study ID prior to analysis.

2.4. Data analyze

Kaplan-Meier survival analysis was used to compare 28-day in-hospital mortality between groups. Cox proportional hazards regression adjusted for gender, age, comorbidities, and vital signs at baseline were used to determine the association between vaccination status and mortality outcome among patients. The secondary outcome was the proportion of patients required endotracheal intubation and invasive ventilation, and length of ICU stays.

2.5. Ethical considerations

The study protocol was reviewed and approved by the Institutional Review Board of Bach Mai Hospital prior to data collection. As this was a retrospective study using routine, anonymized patient data, the need for individual informed consent was waived. All patient data was kept confidential and deidentified during data analysis and reporting. The study followed standards outlined in the Declaration of Helsinki.

3. RESULTS

Table 1. Demographics, clinical courses, treatment, and outcomes of vaccinated COVID-19 patients at ICU Bach Mai Hospital at HCMC, 2021

	No vaccination or 1 dose ≤ 14 days (n=387)	1 dose > 14 days or 2 doses (n=117)	Total (N=504)	p-value
Gender, n (%)				
Male	165 (42.6%)	47 (40.2%)	212 (42.1%)	0.64
Female	222 (57.4%)	70 (59.8%)	292 (57.9%)	
Age, Median (IQR)	61 (52 - 72)	57 (43 - 64)	60 (51 - 69)	<0.001
Age group, n (%)				
<50	78 (20.2%)	42 (35.9%)	120 (23.8%)	0.001
50-59	98 (25.3%)	29 (24.8%)	127 (25.2%)	
60-69	102 (26.4%)	32 (27.4%)	134 (26.6%)	
70-79	62 (16%)	9 (7.7%)	71 (14.1%)	
>80	47 (12.1%)	5 (4.3%)	52 (10.3%)	
Comorbidities, n (%)				
No	127 (32.8%)	57 (48.7%)	184 (36.5%)	<0.001
1	112 (28.9%)	37 (31.6%)	149 (29.6%)	
≥2	148 (38.2%)	23 (19.7%)	171 (33.9%)	
Smoking, n (%)	42 (10.9%)	13 (11.1%)	55 (10.9%)	0.94
Overweight (BMI>25), n (%)	160 (41.3%)	39 (33.3%)	199 (39.5%)	0.12
Vital signs at admission, n (%)				
SpO ₂ <93% (on room air)	378 (97.7%)	83 (70.9%)	461 (91.5%)	<0.001
Respiration rate > 30	134 (34.6%)	25 (21.4%)	159 (31.6%)	0.007
PaO ₂ /FiO ₂ < 300	376 (97.2%)	106 (90.9%)	461 (91.5%)	0.09
Glasgow score <15	278 (71.8%)	97 (82.9%)	375 (74.4%)	0.02
MAP <70 or >109	325 (84.0%)	103 (88.0%)	428 (84.9%)	0.28

Treatment, n (%)				
Remdesivir	243 (62.8%)	87 (74.4%)	330 (65.5%)	0.02
Dexamethasone	351 (90.7%)	95 (81.2%)	446 (88.5%)	0.005
Methylprednisolone	61 (15.8%)	10 (8.6%)	71 (14.1%)	0.05
Oxygen therapy, n (%)				
Nasal cannula	154 (39.8%)	25 (21.4%)	179 (35.5%)	0.001
Simple face mask	80 (20.7%)	20 (17.1%)	100 (19.8%)	0.39
Reservoir face mask	121 (31.3%)	27 (23.1%)	148 (29.4%)	0.09
HFNC	200 (51.7%)	38 (32.5%)	238 (47.2%)	0.001
CPAP/BIPAP	18 (4.7%)	3 (2.6%)	21 (4.2%)	0.32
Invasive ventilation	240 (62%)	38 (32.5%)	278 (55.2%)	<0.001
28 day-outcomes, n (%)				
Alive and discharged	65 (16.8%)	47 (40.2%)	112 (22.2%)	<0.001
Alive, recovered and transferred	96 (24.8%)	33 (28.2%)	129 (25.6%)	
Death	226 (58.4%)	37 (31.6%)	263 (52.2%)	
Length of ICU stays, Median (IQR)	10 (6 - 10)	9 (7 - 9)	9 (6 - 9)	0.66

Out of 504 critically ill cases of COVID-19 at ICC of BMH, 47.2% have been vaccinated. Among them, only 20 (4%) individuals were fully vaccinated, and 97 received one dose for at least 14 days (19.2%). Among those vaccinated patients, 55.5% received vector vaccines, 29% received inactivated vaccines and 14.3% received mRNA vaccines. The median age was 60 years old with 14.1% and 10.3% were from 70-79 and ≥80 years old, respectively. The proportion of patients had comorbidity was 63.5%, and the most common underlying conditions were hypertension (50.4%), diabetes (25%) and other

cardiovascular diseases (19.6%). The low blood oxygen saturation and high respiratory rate at admission from non-vaccinated group was higher than vaccinated group, however, the PaO₂/FiO₂ ratio was not significantly different. The rate of required high-flow nasal cannula (HFNC), intubation and mechanical ventilation were also lower among vaccinated group. The overall 28-day in-hospital case fatality rate was 52.2%, and significantly higher in non-vaccinated group (58.4% vs. 31.6%; p<0.001) (Table 1). The median days of ICU hospitalized was 9 days (IQR = 6-9) with no difference between groups.

Table 2. Cox proportional hazard regression of mortality among COVID-19 patients at ICU Bach Mai Hospital at HCMC, 2021

	Univariate regression				Multivariate regression			
	HR	95% CI		p-value	aHR	95% CI		p-value
Gender (Female ref)	0.94	0.74	1.21	0.644	1.07	0.83	1.37	0.619
Age group (<50 ref)								
50-59	1.52	0.99	2.35	0.058	1.25	0.78	2.00	0.357
60-69	2.57	1.70	3.88	<0.001	2.35	1.48	3.73	<0.001
70-79	2.60	1.66	4.07	<0.001	1.90	1.16	3.10	0.01
>80	3.20	1.99	5.17	<0.001	2.22	1.31	3.76	0.003
Numbers of comorbidity (None. ref)								
1	1.31	0.95	1.80	0.095	1.02	0.73	1.43	0.913
≥2	1.68	1.25	2.28	0.001	1.23	0.88	1.71	0.227
SpO2 < 88%	2.70	2.12	3.45	<0.001	1.68	1.24	2.27	0.001
Respiratory rate >30	2.80	2.19	3.57	<0.001	1.55	1.14	2.09	0.005
Heart rate ≥70 or ≤110	1.34	0.99	1.82	0.06	0.97	0.69	1.36	0.842
MAP <70 or >109	1.81	1.35	2.44	<0.001	0.93	0.68	1.27	0.631
Glasgow <15	3.57	2.79	4.57	<0.001	2.08	1.52	2.86	<0.001
Overweight	1.20	0.94	1.53	0.149				
Remdesivir (Yes)	0.42	0.33	0.54	<0.001	0.59	0.45	0.76	<0.001
Dexamethasone (Yes)	0.51	0.35	0.74	<0.001	0.67	0.45	1.02	0.06
Methylprednisolone (Yes)	0.84	0.60	1.17	0.304				
Vaccinated 1 dose > 14 days or 2 doses	0.66	0.51	0.85	0.001	0.76	0.59	0.98	0.036

Using Kaplan-Meier survival estimation, we calculated the incidence of mortality rate among vaccinated group 21.5/100 patients-week, which was significantly lower than non-vaccinated group (38.0/100 patients-week; log-rank test: $p < 0.001$) (Figure 1). In multivariate Cox proportional hazard regression, vaccinated

group had lower hazard of death than non-vaccinated group (aHR=0.74; 95% CI=0.57-9.60) (Table 2). Other factor associated with death outcome including higher age and had worse vital signs at admission. No differences in mortality rate were found between type of vaccines injected among patients (Figure 2).

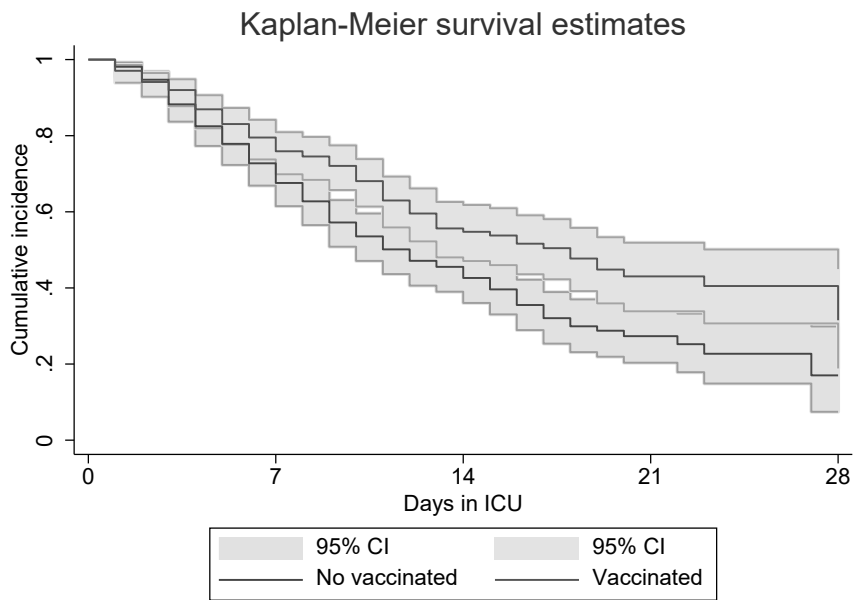


Figure 1. In-hospital mortality rate by unvaccinated and vaccinated patients at ICU Bach Mai Hospital at HCMC, 2021

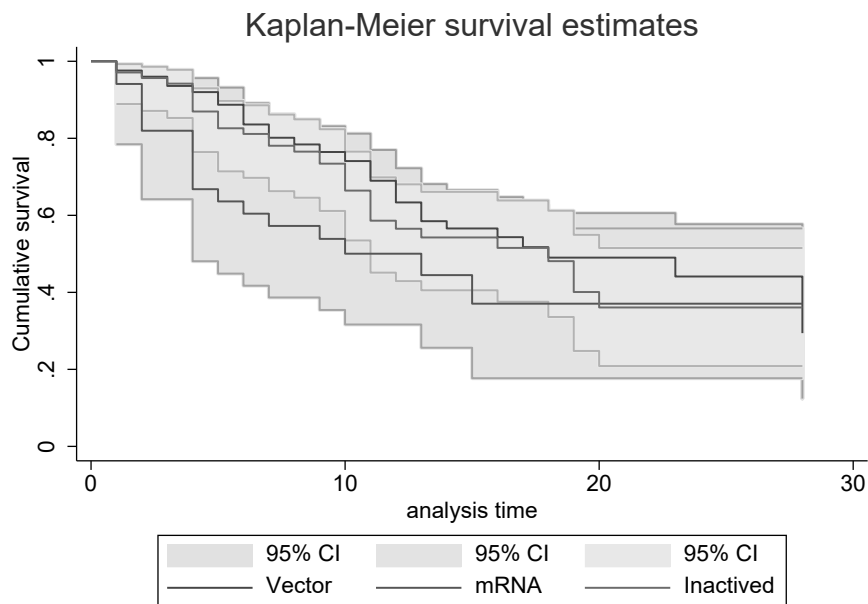


Figure 2. In-hospital mortality rate by type of vaccine at ICU Bach Mai Hospital at HCMC, 2021

4. DISCUSSION

Our study demonstrated that COVID-19 vaccination, even with just a single dose administered at least 14 days prior to symptom onset, was associated with reduced mortality among critically ill patients requiring ICU care during the Delta variant surge in Ho Chi Minh

City, Vietnam. This protective effect of partial vaccination aligns with findings from large studies in other nations including the United States, England, and Israel, which all reported decreased COVID-19 mortality rates among vaccinated individuals despite the widespread Delta variant transmission [1,2,6]. Our results

are particularly notable given Vietnam's limited critical care capacity and resources compared to these high-income nations [8,9]. Yet despite these constraints, the overall ICU mortality rate among our Vietnamese cohort was comparable to rates reported globally [7]. This suggests Vietnam's mass vaccination campaign, which achieved high first dose coverage just before the Delta wave, was a highly effective strategy for decreasing COVID-19 mortality and preventing healthcare system collapse even in the context of surging Delta variant transmission [10]. Our real-world evidence affirms that rapidly achieving widespread partial or full vaccination can save lives even when overall healthcare capacity is limited.

While vaccine supplies remain scarce in many developing countries, our results highlight the need for rapidly mobilizing and administering any available vaccines without hesitation. Recent evidence indicates mRNA vaccines confer optimal protection against COVID-19 [1,2]. However, delays from mRNA vaccine shortages could have proven even more disastrous in Vietnam during the Delta surge. Through apt risk communication messaging, the Ho Chi Minh City government achieved 100% first-dose coverage and 60% second-dose coverage among all adults in the city [11]. This rapid rollout, using mostly the available vector and inactivated vaccines, was essential for controlling the Delta outbreak in time. When supplies are constrained, implementing quick, mass vaccination with the available options is critical to curb mortality, reduce strain on hospitals, and save lives. Our findings suggest that in a crisis scenario like Delta, obtaining high coverage with partially effective vaccines fast is better than waiting for more efficacious ones.

To our knowledge, this is one of the first studies to assess real-world COVID-19 vaccine effectiveness against mortality during the Delta variant surge Vietnam. The key finding that

even partial vaccination provided a significant mortality reduction in critically ill ICU patients has important public health implications. This suggests that rapidly achieving high first dose coverage with available vaccines, even less efficacious ones, can save many lives during an outbreak driven by variants like Delta. Our single-center design and lack of full immunologic data are limitations. Follow up studies should continue investigating vaccine effectiveness across multiple care settings and assess immunogenicity. However, these real-world findings strongly suggest Vietnam's coordinated vaccination campaign, which achieved nearly complete first dose coverage right before the Delta peak, likely prevented thousands of potential deaths despite supply constraints. Other developing countries struggling with vaccine shortages can relate. Rapidly mobilizing and administering even partially protective vaccines to maximize coverage quickly appears an effective strategy to reduce mortality when facing highly transmissible new variants. However, adequate full vaccination coverage remains the goal. Vietnam's experience reinforces that timely vaccination rollout using all available supplies is a priority for saving lives and controlling the COVID-19 pandemic globally.

Our analysis had several limitations. First, the patients were only recruited from only one ICU in HCMC, that could not be represented data for all the critically ill COVID-19 patients during the outbreak. Secondly, given the fact that it is a shelter hospital, the facilities are not guaranteed to perform an accurate diagnosis of complications as well as underlying diseases of the patient. Lastly, as a result of the study's design, it was not possible to assess the antibodies responses to identify the vaccination failure cases and could not distinguished the effectiveness of vaccination from those with mild or moderate diseases that not required ICU treatment.

5. CONCLUSIONS

This study representative group of hospitalized patients required intensive care with high mortality rate in a large intensive center for COVID-19 in Vietnam. Partial vaccination with any type of vaccines showed better outcomes in severe and critical COVID-19 patients, that suggested the most effective method of

protecting such susceptible people indirectly is via mass vaccination. Despite this, the mortality rate is still considerable even with fully vaccinated patients. Additional prospective longitudinal studies are urgently needed to identify predictors of antibody responses among vaccinated individuals, as well as its association to the ICU outcomes in critical COVID-19 cases.

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INSTRUCTION FOR AUTHOR

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1. Halpern SD, Ubel PA, Caplan AL (2002). Solid-organ transplantation in HIV-infected patients. *N Engl J Med.* 347 (4): 284-7.
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