ABSTRACTS
(ORAL PRESENTATION)

Abstracts *(Oral Presentation)*

Diagnostic Accuracy of Three Screening Questionnaires for Predicting Moderate to Severe Obstructive Sleep Apnea in Patients with Morbid Obesity

Narongkorn Saiphoklang[1,2], Natapan Chinnalai[2], Ailada Chinnalai[2]

Abstract

Background: Obstructive sleep apnea (OSA) is a common disease among subjects with morbid obesity. Sleep questionnaires are practical tools to screen OSA prior to undergoing a diagnostic polysomnography (PSG).

Objectives: To evaluate the accuracy of Epworth sleepiness scale (ESS), STOP-BANG, and Berlin Questionnaire (BQ) for detecting moderate to severe OSA in patients with morbid obesity.

Methods: A cross-sectional study was conducted between October 2020 and December 2021 in Thammasat University Hospital, Thailand. Adult subjects with morbid obesity suspected of OSA were included. Morbid obesity was defined as body mass index (BMI) ≥ 40 kg/m^2 or BMI ≥ 35 kg/m^2 and obesity-related health conditions. ESS, STOP-BANG and BQ were performed in each patient before undertaking PSG. OSA severity was classified by apnea-hypopnea index (AHI): mild (AHI 5.0-14.9), moderate (AHI 15.0-30.0), and severe (AHI>30.0).

Results: A total of 205 subjects (40.5% male) were included. Mean age was 43.2 ± 14.3 years. BMI was 40.9 ± 5.3 kg/m^2. Comorbidities included hypertension (68.3%), dyslipidemia (39.0%) and diabetes (27.8%). AHI was 59.4 ± 39.2 per hour. No OSA was 2.4%. Mild, moderate and severe OSA were 9.8%, 14.6% and 73.2, respectively. The best cutoff values of ESS, STOP-BANG and BQ for detecting moderate to severe OSA were 6.5, 4.5 and 1.5, with sensitivity levels of 61.7%, 67.2% and 88.9%, respectively, and specificity levels of 52.0%, 36.0% and 36.0%, respectively. Area under the ROC curve values of ESS, STOP-BANG and BQ were 0.595, 0.696 and 0.669, respectively with all statistical significances.

Conclusion: BQ has the highest sensitivity whereas ESS has the highest specificity for predicting moderate to severe OSA in patients with morbid obesity. These questionnaires might be applied as predictive tools with optimal cut-point levels for screening OSA in morbid obesity.

Keywords: Berlin Questionnaire, Epworth Sleepiness Scale, obesity, obstructive sleep apnea, STOP-BANG

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Abstracts *(Oral Presentation)*

Prevalence and Associating Factors of Long COVID in Pediatric Patients During the Delta and The Omicron Variants

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Abstract

Introduction: The number of pediatric COVID-19 infections is increasing; however, the data on long COVID conditions in children is still limited.

Objective: Our study aimed to find the prevalence of long COVID in children during the Delta and Omicron waves, as well as associated factors.

Methods: A single-center prospective cohort study was conducted. We included 802 RT-PCR-confirmed COVID-19 pediatric patients in the Delta and Omicron periods. Long COVID was defined as having symptoms for ≥3 months after infection. Parents and/or patients were interviewed by phone. Multivariable logistic regression was performed to find associated factors with long COVID.

Results: The overall prevalence of long COVID was 30.2%. The Delta period had more prevalence than the Omicron (36.3% vs. 23.9%). Common symptoms for patients 0-3 years old were loss of appetite, rhinorrhea and nasal congestion. Conversely, patients 3-18 years old had hair loss, dyspnea on exertion, rhinorrhea and nasal congestion. However, there was no significant negative impact on daily life. Most symptoms improved after a 6-month follow-up. Factors associated with long COVID-19 conditions were infection during the Omicron period (adjusted OR 0.54; 95% CI 0.39-0.74, $P < 0.001$), fever (adjusted OR 1.49, 95% CI 1.01-2.20, $P = 0.04$) and rhinorrhea (adjusted OR 1.47, 95% CI 1.06-2.02, $P = 0.02$).

Conclusions: Infection during the Omicron wave has a lower prevalence of long COVID. The prognosis is often favorable and most symptoms gradually become less. However, pediatricians may schedule appointments to surveil long COVID in children with fever or rhinorrhea as an initial symptom.

Keywords: long COVID, SARS-CoV-2, COVID-19, Delta variant, Omicron variant

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Abstracts *(Oral Presentation)*

Safety Profiles of Three Major Types of COVID-19 Vaccine Among Two Cohorts of People Living with HIV

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Abstract

Background: Data on adverse effects (AEs) of COVID-19 vaccines among people living with human immunodeficiency virus (PLHIV) are currently limited.

Objectives: To determine safety profiles of three major types of COVID-19 vaccine among PLHIV.

Methods: A cohort study was conducted among PLHIV receiving care at two clinics during COVID-19 epidemics in Thailand (2021-2022). Data were collected using the online survey system.

Results: Of the 398 vaccinated PLHIV, 153 received two doses and 245 received three doses of COVID-19 vaccines. Inactivated and viral vector were the common vaccine types received by the PLHIV as the first and second doses while mRNA vaccine was commonly used as a booster dose. For the first and second vaccine doses, the most common AEs were fever (15% and 11%) and injection site pain (11% and 11%). For a booster dose, viral vector vaccine significantly caused more injection site pain and headache than the other two types. The majority of all AEs of the first, second and booster doses spontaneously recovered without treatment (55%, 59% and 59%). By multivariable analysis, receipt of viral vector or mRNA vaccine and age less than 40 years were independently associated with any AEs of the primary series vaccines, while having AEs from the previous dose and female sex were factors associated with any AEs of a booster vaccine.

Conclusions: The three types of COVID-19 vaccines were generally safe among PLHIV. PLHIV who were elderly, female or had AEs from the previous vaccine dose should be closely monitored for AE development.

Keywords: Adverse effects; COVID-19; Vaccine; People living with HIV

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Abstracts *(Oral Presentation)*

The Accuracy of An Upright Chest X-ray as A Diagnostic Screening Tool for The Acromioclavicular Joint Dislocation

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Abstract

Background: A chest radiograph (CXR), either supine or upright, is the standard investigation tool in primary assessment of blunt thoracic and abdominal trauma. Patients with thoracic injury frequently have associated shoulder girdle injuries such as scapular fracture, clavicular fracture, or acromioclavicular joint (ACJ) injury. The Zanca view of both shoulders is the standard radiograph for ACJ dislocation to assess the vertical displacement of the distal clavicle by measuring the coracoclavicular distance (CCD), compared to the unaffected contralateral side.

Hypothesis/Purpose: To determine accuracy of CCD measurement of upright CXR, comparison to the standard Zanca view in the diagnosis ACJ dislocation.

Study design: Matched case-control study; Level of evidence, 3.

Methods: CXRs from 70 patients with history of ACJ dislocation at Thammasat University Hospital from 2010-2021 were collected, and were 1:1 age-and gender-matched with the 70 CXRs of control group. Totally 140 cases were randomized and measured regarding CCD difference by two independent doctors (musculoskeletal radiologist and orthopaedic sports medicine). Accuracy was defined, comparing to the standard Zanca radiograph. Inter-and intra-observer agreement were measured.

Results: There were 55 male and 15 female patients with an average age of 46 in both cases and controls. In the disease group, the percentage of CCD difference, compared to the unaffected side (ΔCCD) was 130.25 ± 88.42 and 152.6 ± 106.56 (mean difference 22.44 with 95% CI [2.4, 42.48], *p-value* = 0.029) in upright CXR and Zanca view, respectively. Totally 140 CXRs, Zanca as the gold standard, the upright CXRs with definition of abnormal CCD difference of >25%, revealed 95.71% sensitivity, 85.71% specificity, 6.7 of the positive likelihood ratio (+LLR), 0.05 of the negative likelihood ratio (-LLR). The accuracy was 90.71%. The intra-observer reliability was 94.29% agreement and 0.94 of weighted kappa coefficient (95%CI = 0.89-0.98). The inter-observer reliability was 95.7% agreement and 0.95 with weighted kappa coefficient (95%CI = 0.92-0.99).

Conclusions: Upright CXR can be used as a diagnostic screening tool for ACJ dislocation in patients with more than 25% superior displacement as compared to the Zanca radiographs. The CCD measurement in upright CXR has almost perfect agreement of inter- and intra-observer reliability.

Keywords: acromioclavicular dislocation; coracoclavicular distance; upright chest X-rays; Zanca view; accuracy

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Abstracts *(Oral Presentation)*

A Flight-testing Study for Drone Delivery of Automated External Defibrillators in Simulating Out-of-Hospital Cardiac Arrest in Suburban Areas of Thailand

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Abstract

Background: Immediate access to an automated external defibrillator (AED) and early defibrillation are vital to survival from out-of-hospital cardiac arrests (OHCAs). The use of drones for delivering AEDs in the event of OHCAs have been proposed as a feasible alternative to traditional EMS. However, there is limited data on flight testing of such drone deliveries in suburban areas.

Objectives: This study aims to evaluate the flight capabilities and accuracy of drones delivering AEDs to OHCAs.

Methods: The study took place at the Thammasat University, Pattaya campus, Thailand. Ninety test flights were performed on DJI M-600 with three different payloads: no load, 2 kg AED and 4 kg AED. The testing evaluated the speed and accuracy of difference points of landing by using drone and mobile phone GPS location. Flight distance, drone response time, drone overall speed, wind speed, battery usage and landing distance error to target location were recorded. Multivariable regression analysis was used to determine the association of different factors with drone overall speed.

Results: This study completed 90 flights totalling 487.52 km, 14 hours of flight time and 88 successful deliveries. The median flight distance was 4.04 km (IQR 2.28-7.98). The drone's overall speed was negatively affected by payload weight, with a mean absolute difference of 0.83 m/s for 2 kg AED and 1.29 m/s for 4 kg AED compared to no load. The maximum distance coverage was around 4.35 km for the drone could fly to reach target within 8 minutes. Landing distance errors were mostly within one-meter range, successful delivery rates ranging from 96.67% to 100%.

Conclusions: Drone delivery of AEDs can be an effective alternative means of responding to OHCAs in suburban areas. The heavier payload weight resulted in slower speed, while mobile phone GPS location is accurate for landing purposes. Future studies should continue exploring the viability and safety of drone emergency response systems.

Keywords: drone delivery, AED, out-of-hospital cardiac arrest, early defibrillation, suburban area

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Abstracts *(Oral Presentation)*

Analgesic and Anti-inflammatory Effects of 1% Cannabidiol Gel

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Abstract

Background: Cannabidiol (CBD) is an active ingredient in cannabis plants. Moreover, CBD is widely used for analgesic and anti-inflammatory effects. However, CBD's pharmacological efficacy may decrease when used via the oral route, regarding the high first-pass metabolism with cytochrome P450. Consequently, this study evaluated the analgesic and anti-inflammatory effects of 1% CBD gel in animal models.

Objectives: The study aimed to investigate the analgesic and anti-inflammatory effects of 1% CBD use in animal models.

Methods: The formalin and writhing test were evaluated for analgesic effect. Carrageenan-induced edema was used for the anti-inflammatory effect of CBD in rats. Paw volume was measured at baseline and after injection at 1, 2, 3 and 4 h. At the end of the experiment, rats were sacrificed with isoflurane and confirmed with cardiac puncture. All tissues and blood samples were collected after being sacrificed with isoflurane by the veterinarian staff.

Results: The 1% of tropical CBD gel had significantly decreased times of paw licking, decreased writhing response, and degree of paw edema when compared to Placebo and Diclofenac (p<0.01 or less). Moreover, the 1% CBD gel reduced the degree of inflammation and inflammatory cell infiltration displayed by histopathological analysis (p<0.05).

Conclusions: The study demonstrated that the 1% CBD gel had the potential for analgesic and anti-inflammatory effects in an animal model. Further safety and efficacy investigations of 1% CBD gel use in large populations and clinical settings are required.

Keywords: Cannabidiol, Cannabidiol gel, Analgesic, Anti-inflammatory

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Abstracts *(Oral Presentation)*

Antinociceptive and Anti-inflammatory Activity of 1% Cannabidiol Cream

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Abstract

Background: Cannabidiol (CBD) is a non-psychoactive compound of products derived from the plant *Cannabis sativa.* CBD has therapeutic potential for analgesic and anti-inflammatory. The bioavailability of oral administration CBD has been reported to be poor because of the high first-pass metabolism with cytochrome P450. Transdermal delivery systems of CBD may decrease via cytochrome P450 and increase bioavailability. This study aimed to evaluate the antinociceptive and anti-inflammatory activities of 1% CBD cream in a rodent model.

Objectives: The study aimed to evaluate the antinociceptive and anti-inflammatory activities of 1% CBD cream in a rodent model.

Methods: We evaluated the antinociceptive and anti-inflammatory of 1% CBD cream. Antinociceptive activity was used for the formalin and writhing tests. The anti-inflammatory activity was used for carrageenan-induced edema.

Results: Formalin test, Area under the curve (AUC) values in all treatments were significantly decreased when compared with placebo cream ($P<0.0001$ and $P<0.0001$, respectively), which were the same results in both phases. The results of the acetic-induced writhing response test have demonstrated that diclofenac and CBD cream showed significantly reduced writhes, comparing with a placebo group. Carrageenan-induced edema showed that 1% CBD cream has significantly decrease paw volume from 1 to 4 h when compared to the placebo group.

Conclusions: The study demonstrated that 1% CBD cream has a benefit for analgesia and anti-inflammation. Even though the mechanism of the actions has not been completely understood but also, the topical of 1% CBD cream may also be a good candidate for analgesic and anti-inflammatory conditions.

Keywords: Cannabidiol, Cannabidiol cream, Antinociceptive, Anti-inflammation

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Abstracts *(Oral Presentation)*

The Impact of Metformin on The Osteogenic Differentiation of Mesenchymal Stromal Cells from Placenta.

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Abstract

Background: Metformin has been shown to influence bone regeneration. However, its impact on human placenta-derived mesenchymal stem cells (PL-MSCs) remains unknown.

Objectives: This study aimed to investigate the effects of metformin on the viability and osteogenic differentiation of PL-MSCs.

Methods: After characterization, PL-MSCs were treated with metformin. The cell viability was examined using an MTT assay. The osteogenic differentiation potential after metformin treatment was investigated using alkaline phosphatase (ALP) activity assay and Alizarin red staining. The phosphorylated and unphosphorylated adenosine 5'-monophosphate-activated protein kinase (AMPK) were quantified by Western blot analysis in response to metformin.

Results: The results showed that PL-MSCs exhibited the characteristics of mesenchymal stem cells. Metformin at a concentration of less than 320 μM did not affect the viability of PL-MSCs. Metformin stimulated alkaline phosphatase activity and enhanced mineralized nodule formation. Metformin activated the AMPK pathway in a dose-dependent manner.

Conclusions: This study demonstrated that metformin enhanced the osteogenic differentiation and mineralization of PL-MSCs. This essential information could increase the possibility of using metformin for bone repair.

Keywords: Mesenchymal stem cells, Metformin, Osteogenic differentiation, Placenta

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Abstracts *(Oral Presentation)*

A Phytoestrogen from *Curcuma comosa* Roxb Enhances *in vitro* Osteogenesis of Mesenchymal Stem Cells

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Abstract

Backgroud: Human umbilical cord-derived mesenchymal stem cells (UC-MSCs) are one of attractive candidates for cell-based therapy and regenerative medicine. However, the diferentiation ability is inefficient when compared to MSCs derived from bone marrow (BM-MSCs). Therefore, efforts to increase the osteogenic potential of UC-MScs would be a significant step forward in regenerative medicine.

Objectives: We aimed to investigate the potential of A phytoestrogen (AS-DT01) from *Curcuma comosa* Roxb on *in vitro* osteogenesis of UC-MSCs

Methods: Mesenchymal stem cells were isolated from full-term normal human umbilical cords and were characterized before using. Cell cytotoxicity effect of AS-DT01 were examined by MTT. The non-toxicity concentrations of AS-DT01 were further examined for osteogenic effect determined by alkaline phosphatase (ALP) expression and activity, alizarin red staining and osteoblast-specific gene expressions.

Results: The results demonstrated that AS-DT01 at 1-10 μM had no cytotoxic effect on the UC-MSCs. AS-DT01 also accelerated the osteogenic differentiation of UC-MSCs as indicated by the increased of ALP staining, ALP activity, calcium deposition by Alizarin Red S stain and osteogenic markers genes such as RUNX2, OSX, ALP, OCN, COL1A1. Furthermore, DPHD increased the OPG/RANKL ratio to improved bone formation.

Conclusions: AS-DT01 has the potential in promoting osteogenesis of UC-MSCs which appears to be a promising new agent for improving osteogenic differentiation capability of hUC-MSCs and for use in stem cell-based bone regeneration therapy.

Keywords: Phytoestrogen, osteogenesis, mesenchymal stem cells, regenerative medicine

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Abstracts *(Oral Presentation)*

Development of A Chemical Analysis Method for Thatbunjob Remedy

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Abstract

Introduction: The formulation of medicinal products often involves combining different active and inactive substances. To accurately assess these formulations, it is necessary to use reliable analytical methods. Relying only on a single herb-based validation method using high-performance liquid chromatography (HPLC) may not provide a complete understanding and can potentially change the chemical composition. This study focuses on Thatbunjob, a traditional herbal remedy from Thailand. It used to treat non-infectious diarrhea and flatulence. However, there is limited research on the active compounds present in commercially available Thatbunjob products, making it challenging to control their quality standards.

Objectives: To develop a validated HPLC method for determining active compounds in Thatbunjob. The main compounds, gallic acid, chebulagic acid, rutin and eugenol, were estimated following the International Conference on Harmonization (ICH) guideline.

Methods: The HPLC samples were prepared using a methanolic extract of Thatbunjob powder. The extract was injected into a C18 reverse-phase column, and the separation was achieved using a mobile phase consisting of water with 0.1% phosphoric acid and acetonitrile. The concentration ratios of the mobile phases were adjusted during the analysis. The analytical method was validated according to the ICH guidelines.

Results: The developed analytical method exhibited excellent linearity, with correlation coefficients (R^2) ranging from 0.9992 to 0.9998. The LOD and LOQ values were determined based on the calibration curve and were found to be in the ranges of 7.29-14.99 µg/ml and 22.09-45.42 µg/ml, respectively. The method demonstrated precision, with relative standard deviation values below 2%. Accuracy assessment using recovery percentage within the acceptable range of 90.12% to 105.39%. Furthermore, the validated method was applied to analyze the concentrations of an active compounds in eight different commercially available Thatbunjob products in Thailand.

Conclusions: The developed and validated analytical method has demonstrated its suitability for the accurate quantification of an active compound in Thatbunjob. This validated method can serve as a valuable tool for quality control of Thatbunjob formulations.

Keywords: Gallic acid, Chebulagic acid, Rutin, Eugenol, Validation

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Abstracts *(Oral Presentation)*

Inhibition of Colorectal Cancer Cell Proliferation by A Molecular Hybrid of miR-143 and AS1411 Aptamer Used as Carrier for Doxorubicin

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Abstract

Background: Colorectal cancer (CRC) is the third most common cancer worldwide and the second leading cause of death in 2020. However, there are many limitations of current therapy, including undesired side effects. Therefore, smart drug delivery systems (SDDSs) are promising methods to improve treatment efficiency.

Objectives: This research aims to investigate the effectiveness of a molecular hybrid (MAH) composed of tumor-suppressor miR-143 and AS1411 aptamer as an anticancer drug carrier.

Methods: The MAH was constructed by combining miR-143 and AS1411 aptamer via a hybridization strand, and subsequently loading doxorubicin (Dox), a chemotherapeutic drug, into the molecule. The uptake capability of MAH into the SW480 cells was explored by a fluorescence microscope. The expression levels of miR-143 before and after treatment of MAH were detected using RT-qPCR. Changes in miR-143 target genes, *KRAS*, were measured at both mRNA and protein levels using RT-qPCR and western blotting. MTS assay was used to determine cell proliferation, and flow cytometry was performed to assess cell apoptosis following Dox-MAH treatment.

Results: AS1411 aptamer can specifically bind to the nucleolin receptors on SW480 cells, leading to the endocytosis of MAH. MiR-143 level was significantly increased, while KRAS mRNA and protein levels were subsequently decreased in MAH-treated SW480 cells. Treating cells with Dox-MAH resulted in the inhibition of cell proliferation and induction of apoptosis.

Conclusions: The success of this research proposed a new strategy to use MAH as a Dox carrier with multiple functions. Therapeutic efficacy could be increased due to SDDSs' ability.

Keywords: MicroRNA-143, AS1411 aptamer, Colorectal cancer, SDDSs

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Abstracts *(Oral Presentation)*

Efficacy and Safety of 0.13% CBD Acne Cream with 2.5% Benzoyl Peroxide vs. 1% Standardized Clindamycin Gel with 2.5% Benzoyl Peroxide in Acne Vulgaris Treatment.

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Abstract

Background: Acne vulgaris is a common dermatological condition affecting populations worldwide. In vitro studies have indicated that cannabidiol (CBD), derived from cannabis, has anti-inflammatory, antibiotic, and lipostatic properties, which may be used for acne treatment.

Objectives: This study aimed to compare the efficacy and adverse effects of a 0.13% CBD-containing acne cream and 1% clindamycin gel.

Methods: Twenty-nine patients were randomly assigned to receive either the 0.13% CBD acne cream or the clindamycin gel, both with applied 2.5% benzoyl peroxide, applied on the different sides of the face twice daily for four consecutive weeks. The study outcomes were assessed at four weeks.

Results: Of the participants, about 62% were female with average age of 23.45 years old. At 4 weeks, both groups demonstrated significant reductions in acne lesions compared to baseline ($p<0.001$) and the mean reductions were comparable between CBD and clindamycin groups (-8.48 vs – 8.97, $p = 0.88$). Acne severity of patients who had mild to moderate acne decreased from 27 to 20 cases in the CBD group and from 26 to 22 cases in the Clindamycin group, respectively. The reported adverse effects occurred in less than 20% of the patients and were mild, and not significant different between the two groups.

Conclusions: Both the 0.13% CBD acne cream and the clindamycin gel used with 2.5% benzoyl peroxide demonstrated comparable efficacy in reducing acne lesions and mild adverse effects.

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Abstracts *(Oral Presentation)*

Prevalence and Factors Associated with Burnout and Depression of Thai medical Students During The COVID-19 pandemic

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Abstract

Background: Burnout and depression have always been the subject of concern in medical students. COVID-19 effects are uncertain.

Objectives: To investigate the prevalence of burnout and depression, associated factors, and the correlation between these conditions in medical students of COVID-19 era.

Methods: 1st-6th year medical students attending Thammasat university took part in this cross-sectional study. The online survey consisted of a demographic and health behavior questionnaire, the Maslach Burnout Inventory-student survey (MBI-SS), and the Patient Health Questionnaire-9 (PHQ-9). Students' social network platforms were used as distribution.

Results: Of the 386 participants, 57% were female. The mean age was 20.6 ± 2 years. The prevalence of burnout was 9.3%. Within this group, 79.3% had high emotional exhaustion, 70% had high depersonalization and 49% had low personal efficacy. Compared to before COVID-19, 64.8% of participants felt their burnout worsened. Lack of sleep was the associated factor with burnout ($p = 0.042$). The prevalence of mild, moderate and major depressive disorder were 35%, 23.8% and 10.9% respectively. 52.6% reported their depression has worsened after COVID-19. For moderate and major depressive groups, associated factors were interpersonal factors, lack of people to give advice, failing exams and thoughts of resignation ($p = 0.02$, 0.016, 0.022 and <0.001, respectively). Significant correlation was found ($p < 0.001$) between three dimensions of burnout (emotional exhaustion, depersonalization and personal efficacy) with depression.

Conclusions: Burnout and depression are common problems medical students face, and the COVID-19 pandemic makes them even more prominent.

Keywords: Burnout, depression, Covid-19

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Abstracts *(Oral Presentation)*

Survey of The Knowledge of And Attitude Toward Antibiotic Use and Resistance Among Thammasat University Medical Students

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Abstract

Background: Antibiotic resistance is a global threat, highlighting the importance of medical professionals' knowledge of appropriate antibiotic use and fostering a positive attitude towards antibiotic usage and resistance management.

Objectives: To evaluate knowledge of and attitude toward antibiotic use and resistance among medical students.

Methods: An online survey study was conducted from January to April 2023 among Thammasat University medical students in preclinical and clinical years. Knowledge levels were assessed based on responses to the 15 statements, and attitudes were evaluated using a 5-point Likert scale.

Results: Of the 313 participating students, 65% and 35% were preclinical-year and clinical-year students, respectively. The male population accounted for 44%, and the median grade point average was 3.5. Furthermore, 71% reported having searched for antibiotics online. Clinical-year students had a higher median knowledge score compared to preclinical-year students (12 vs. 9; $p<0.001$). Less than 50% of preclinical-year students answered specific statements correctly, such as those related to antibiotic resistance in gonorrhea and the transmission of antibiotic resistance. Similarly, less than 50% of both preclinical- and clinical-year students responded correctly to the statement linking antibiotic use in animals to antibiotic resistance in humans. Attitudinal differences were observed, with preclinical-year students more likely to support early antibiotic resistance education in high schools and the belief that we can always discover and develop new antibiotics. Clinical-year students were less likely to agree that the Faculty of Medicine provided sufficient knowledge about antibiotic use and resistance ($p<0.05$). Multivariable regression analysis indicated that higher academic year, monthly household income of $USD 3,000 or more, and high English proficiency were associated with higher knowledge scores.

Conclusions: Tailored interventions should be developed, considering the specific academic years of medical students, to enhance knowledge and improve attitudes regarding antibiotic use and resistance. Additionally, the identified factors associated with knowledge scores should be considered when implementing interventions, aiming to improve understanding and attitudes towards antibiotic use and resistance among the students.

Keywords: Knowledge, Attitude, Medical students, Antibiotic use, Antibiotic resistance

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