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N. Yerdessov¹, O. Zhamantayev^{1*}

ENHANCING PRACTICAL COMPETENCIES THROUGH CASE-BASED LEARNING IN PUBLIC HEALTH EDUCATION

¹School of Public Health, Karaganda Medical University NC JSC (100008, Republic of Kazakhstan, Karaganda c., Gogolya str., 40; e-mail: info@qmu.kz)

***Olzhas Zhamantayev** – School of Public Health, Karaganda Medical University NC JSC (100008, Republic of Kazakhstan, Karaganda c., Gogolya str., 40; e-mail: zhamantaev@qmu.kz)

Case-based learning is an engaging teaching method that blends theory with real-world practice in public health education. In our paper, we explored the core educational theories behind this approach. We outlined different types of case studies used in our public health programs, such as epidemiological, organizational, social determinants, preventive, and ethical cases. At the School of Public Health, special attention is paid to how these cases are developed and implemented, as well as ways to assess their impact in the learning process. This approach helps students not only obtain theoretical concepts but also build practical skills needed to tackle complex healthcare challenges.

Using case studies in higher education programs encourages students to sharpen their critical thinking, analytical skills, and ability to work in teams. These skills are vital today, as societies grapple with both every day and unique challenges like pandemics, socioeconomic disparities, and environmental issues that demand well-rounded solutions and collaboration across fields. Moreover, with growing societal freedoms and liberalization, new ethical questions tied to public health keep arising. All stakeholders should not forget that creating and evaluating high-quality cases takes time and relies on adequate data and expert input. As public health issues get more complex, case-based learning remains a powerful way to prepare future leaders to address them effectively.

Key words: case-based learning; public health; medical education; active learning; Kazakhstan; competency-based education; pedagogy

INTRODUCTION

Case-based learning (CBL) is a learner-centered teaching approach that involves analyzing real or simulated public health cases to cultivate critical thinking, decision-making, and practical skills [17]. Widely implemented in medical and public health education, CBL allows students to connect theoretical concepts with real-life situations, better preparing them for the possible obstacles and complexities of healthcare systems [2]. Unlike problem-based learning (PBL), which encourages students to conduct independent research on open-ended problems, CBL focuses on applying existing knowledge to specific cases, thereby enhancing clinical reasoning and the ability to make swift, evidence-informed decisions [21]. This distinction is especially important in public health, where professionals often face urgent outbreaks, limited resources, and complex ethical issues.

The global trend toward active and interactive learning has accelerated the adoption of CBL in medical education worldwide, including Kazakhstan, where recent educational reforms emphasize hands-on training to meet national health priorities

[5, 6]. CBL's ability to simulate real-world scenarios enhances student engagement, motivation, and preparedness for professional practice. Studies from Uzbekistan further support these benefits, showing that CBL leads to better long-term retention of knowledge compared to traditional teaching methods [3]. In Kazakhstan, innovative approaches like "forum-theater" highlight CBL's role in developing interpersonal and emotional intelligence, critical for patient interactions [4]. Grounded in pedagogical theories such as constructivism, contextual learning, and social constructivism, this method aligns with modern educational paradigms that emphasize active learning and multisectoral collaboration [10, 14, 16, 19, 23, 24]. All stakeholders should not forget that developing high-quality cases is time-intensive, requiring access to credible data and expert input [20]. Instructors may need training to facilitate interactive discussions and mitigate subjectivity in assessments [1].

In this manuscript, we aimed to describe CBL approaches and application in public health education, drawing on theoretical frameworks, practical implementations, and our experience.

At the department of Public Health we detail our methodology for developing CBL cases and analyze key pedagogical challenges in their deployment.

THEORETICAL FOUNDATIONS OF CBL

CBL draws on several pedagogical theories that emphasize active, student-centered learning, making it highly effective for public health education. Lev Vygotsky's constructivism suggests that learners construct knowledge through active engagement and social interaction [23]. He developed the concept of the "zone of proximal development" which explains the importance of mentorship and collaborative learning in supporting student understanding. Complementing this, Jean Piaget's theories of assimilation and accommodation describe how learners incorporate new information into existing cognitive frameworks or adjust those frameworks to accommodate novel, complex public health scenarios [19]. Nowadays, in CBL classes we effectively apply these principles by engaging students in active problem construction through case analysis and group dialogue.

Originating from the work of Howard Barrows and Robin Tamblyn in the 1980s, problem-based learning promotes learning through problem-solving in realistic scenarios [10]. While PBL encourages exploration and independent research, CBL focuses more on applying established knowledge to specific cases, allowing students to practice clinical reasoning and decision-making within structured scenarios [14]. This approach suits the public health field, where professionals need to apply epidemiological and policy knowledge to emerging challenges like disease outbreaks or resource allocation. Jean Lave and Etienne Wenger's situated learning theory further supports the use of authentic, context-rich cases, arguing that learning is most effective when embedded in real professional environments [16]. By situating learning within contextual public health scenarios, such as designing vaccination campaigns or addressing social determinants of health, CBL ensures that students engage with challenges that

closely mirror their future professional roles, thereby enhancing both retention and practical application.

Another classic figure of social constructivism, James Wertsch, highlighted the importance of social interactions in knowledge construction [24]. That is why CBL's group-based discussions foster collaborative learning, allowing students to share perspectives, debate solutions, and co-create knowledge. This social dimension is critical in public health, where interdisciplinary teamwork is important for addressing complex issues like pandemics or health disparities.

COMPARISON OF EDUCATIONAL METHODS

CBL is a prominent pedagogical approach in public health education, distinct from traditional lectures, PBL, and simulation-based learning. Traditional lectures focus on systematic knowledge transmission but are often criticized for limited engagement and superficial retention [1]. PBL encourages self-directed research to explore open-ended problems, enhancing critical thinking and research skills, though its time-intensive nature can challenge students [20]. Simulation-based learning provides hands-on practice in controlled environments, building technical skills without risking patient safety, yet it may not fully capture the complexity of real-world public health scenarios, such as policy development or community interventions [1].

CBL balances structured guidance with practical application, enabling students to apply theoretical knowledge to realistic cases while developing skills for public health practice [15]. In Table 1, we outlined these distinctions.

TYPES AND EXAMPLES OF CASE STUDIES IN PUBLIC HEALTH

There must be a strong focus placed in public health education on equipping students with the skills to analyze complex, real-world problems and develop evidence-based solutions. In our opinion, case-based

Table 1 – Comparison of educational methods

Method	Primary focus	Characteristics	Advantages in Public Health
Traditional lectures	Knowledge transmission	Passive learning, systematic presentation of theory	Provides foundational knowledge
Problem-Based Learning	Problem solving	Self-directed research, open-ended problem exploration	Enhances critical thinking and research skills, ideal for addressing novel challenges
Case-Based Learning	Case analysis	Application of knowledge to specific, structured scenarios	Develops decision-making, analytical, and practical skills for real-world applications
Simulation-Based Learning	Skill practice	Simulated clinical or operational scenarios	Builds technical and procedural skills without risking patient safety

learning supports this goal by immersing students in reasonably designed scenarios that reflect the miscellaneous challenges faced in population health. Different categories of cases are used to build competencies across essential domains such as epidemiology, health systems management, health promotion, and ethics. Below, we outlined the key types of cases with original examples drawn from Kazakhstan's public health context.

Epidemiological cases are designed to teach students how to interpret and apply data on disease distribution and determinants. These cases typically involve infectious or chronic disease scenarios requiring learners to assess risk patterns, transmission dynamics, and intervention strategies. One such example is the measles outbreak that occurred in East Kazakhstan in 2023 [9]. A total of 278 people were infected, most of them children, resulting in an incidence rate of 38.1 per 100,000 population despite the absence of cases the previous year. Students working on this case are asked to identify key drivers such as migration or vaccine hesitancy and to propose a targeted plan for outbreak containment. This example illustrates how epidemiological thinking informs critical decisions in public health protection.

Organizational cases explore the structural and managerial challenges within health systems. These include issues of resource allocation, health workforce distribution, financing, and service delivery optimization. Learners are tasked with simulating real-world administrative settings, from local clinics to national ministries. An illustrative example is the case addressing the shortage of healthcare professionals in Kazakhstan as of January 2024 [13]. Despite having over 271,000 health workers, the country faced a deficit of nearly 5,000 medical specialists, particularly in large urban centers such as Nur-Sultan, Almaty, and Shymkent. Students examine regional disparities and propose policy responses to attract professionals to underserved areas, such as rural regions. Through this case, future practitioners gain insight into leadership, strategic planning, and system-level problem-solving.

Cases addressing the social determinants of health focus on the influence of socioeconomic and environmental conditions on health outcomes. These cases challenge students to investigate how variables such as income, education, working conditions, and access to care contribute to population-level disparities. A powerful example involves the relationship between air pollution and respiratory illness in Karaganda. In autumn 2021, the city reported PM_{2.5} concentrations 15.3 times above the safe threshold, along with elevated levels of hydrogen sulfide and nitrogen oxide [11]. Learners are asked to explore the causal links between environmental exposures and disease burden, evaluate existing regulatory responses, and develop evidence-based proposals for ecological improvement. This case cultivates a nuanced

understanding of how broader structural factors influence individual and community health.

Prevention-focused cases revolve around public health campaigns and interventions aimed at disease prevention and health promotion. Students evaluate ongoing initiatives, identify barriers to effectiveness, and develop tailored improvements. One such case examines tobacco use among the adult population of Kazakhstan, based on the 2019 WHO GATS survey. The smoking rate among individuals over 15 years of age was 21.5 percent overall, with significant gender differences — about 38 percent of men and 6.4 percent of women reported smoking [12]. Students analyze behavioral patterns, assess policy measures, and recommend more effective communication strategies or legislative changes to enhance tobacco control. This kind of case fosters competencies in campaign design, evaluation, and community engagement.

Ethical cases engage learners with morally complex dilemmas that often arise in public health practice. These may concern fairness in resource distribution, individual rights, patient autonomy, or conflicts of interest. A compelling example involves the debate surrounding mandatory vaccination, which has gained visibility in Kazakhstan in recent years (fig. 1) [8]. Students are tasked with navigating the tension between personal freedom and collective safety, analyzing public discourse, and proposing ethically sound policy recommendations. In another ethical case, students consider alcohol control measures in rural Kazakhstan, where excessive alcohol use has been linked to poor health outcomes, family dysfunction, and reduced productivity. Local authorities have introduced restrictions on alcohol sales, established educational initiatives, and opened rehabilitation centers. However, resistance has emerged from both residents and local vendors. Students must weigh the effectiveness and ethical implications of these interventions, exploring how to balance individual liberties with public health responsibilities.

Ethical cases in public health education engage students with complex moral dilemmas frequently encountered in practice. These cases often revolve around issues such as equitable resource distribution, individual rights, patient autonomy, and conflicts of interest. A particularly relevant example that we use in our classes is the ongoing debate over mandatory vaccination in Kazakhstan, which has gained prominence in recent years amid rising vaccine hesitancy and refusal rates (fig. 1). Students are challenged to navigate the delicate balance between respecting personal freedoms and ensuring collective safety, critically analyzing public discourse and formulating ethically justified policy recommendations. Another illustrative ethical case we implemented involves alcohol control efforts in rural Kazakhstan, where excessive alcohol consumption has been linked to adverse health outcomes, family disruption, and

"Прививки – это твой личный выбор, но не твоё личное дело. Потому что таким образом ты влияешь на своё окружение", – подчеркнул политолог.

Он подтвердил, что призывает к введению в Казахстане административной и даже уголовной ответственности к родителям-антиваксерам в зависимости от тяжести последствий. И пояснил свою позицию с точки зрения отца:

"Я не хочу, чтобы с моими детьми в одном классе учились дети, не привитые, к примеру, от кори, оспы или полиомиелита. От всех тех заболеваний, против которых детей должны прививать в соответствии с возрастом. Все эти всплески заболеваний, которые мы наблюдаем сегодня, вакциноуправляемы".

Figure 1 – Public discourse on vaccination in the Republic of Kazakhstan. Sourced from Informburo.kz [8]

diminished productivity. In response, local authorities have implemented sales restrictions, launched educational campaigns, and established rehabilitation centers. Despite these measures, resistance persists among residents and local vendors. Students must evaluate both the effectiveness and ethical implications of these interventions, carefully weighing individual liberties against public health responsibilities. This case exemplifies the tensions inherent in public health ethics, highlighting the need for culturally sensitive and community-engaged approaches.

Each case follows a structured format:

1. Contextual background with relevant data
2. Specific analytical tasks
3. Curated data sources
4. Expected competency outcomes

CHARACTERISTICS AND INTEGRATION OF CBL

CBL's effectiveness results from its practical orientation, interactivity, and alignment with real-world challenges [3]. Unlike lectures, which prioritize knowledge transmission, CBL immerses students in realistic scenarios, requiring them to apply theoretical knowledge, analyze data, and propose evidence-based solutions [17]. Group-based discussions enhance communication, teamwork, and critical reflection, equipping students to address root causes, evaluate alternatives, and collaborate on solutions [24].

Claire Toogood's framework, known as RADAR, provides a guide for designing effective case studies [22]. Authentic scenarios engage students by connecting to real-world issues, such as

regional disease outbreaks or healthcare disparities. We design cases to align with course objectives and student interests, ensuring relevance to their future roles. Detailed cases including epidemiological data, policy contexts, and social factors encourage thorough exploration. Well-structured materials with clear visuals enhance engagement and clarity, while concise yet comprehensive cases optimize learning efficiency without overwhelming students.

Integrating CBL into public health curricula requires a staged approach to match student capabilities. Early cases focus on foundational concepts, such as basic epidemiological analysis, while advanced cases incorporate interdisciplinary challenges, combining epidemiology, policy analysis, health policy, and biostatistics, and ethics [18].

The practical implementation of case-based learning requires careful time management planning. Based on our teaching experience, we recommend assigning specific time allocations for each phase of the session. We have found that using minute-based rather than hour-based scheduling helps prevent confusion and facilitates smoother session organization. For instance, a typical 90-minute case-based learning session can be effectively structured as follows: approximately 15 minutes for initial case familiarization, followed by 20 minutes for problem identification and discussion. The subsequent 30 minutes should be dedicated to data analysis and group deliberation, while 15 minutes are allocated for solution development and presentation preparation. The session concludes with a 10-minute instructor-led debriefing and feedback period to consolidate

Table 2 – Case performance assessment rubric

Criterion	Excellent (5)	Good (4)	Satisfactory (3)	Unsatisfactory (2)
Data Analysis	Comprehensive, statistically sound	Minor inaccuracies, good depth	Superficial, incorrect methods	Absent or erroneous
Logical conclusions	Coherent, well-argued	Minor logical gaps	Weak or contradictory	Illogical or absent
Creativity	Innovative, context-specific	Realistic but conventional	Standard, context-agnostic	Absent or unrealistic
Teamwork	Active, equitable contribution	Uneven participation	Minimal contribution	Disruptive or absent
Presentation	Clear, structured, visually engaging	Minor structural issues	Poor structure, no visuals	Inadequate or absent
Source use	Credible, correctly cited	Minor citation errors	Limited, error-prone citations	Unreliable or absent
Practicality	Realistic, resource-aware	Needs minor refinement	Partially realistic	Unrealistic or absent

learning outcomes. This structured approach ensures comprehensive learning while accommodating diverse learning paces. Feedback from students and instructors refines the process, optimizing educational outcomes.

ASSESSMENT OF CASE STUDIES

Evaluating CBL performance requires a systematic approach to assess analytical, collaborative, and creative competencies [21]. Depth of data analysis is demonstrated through the ability to interpret statistical data, identify risk factors, and apply appropriate methods like regression or cohort analysis. Logical conclusions are supported by coherent, evidence-based reasoning. Creative interventions address local context-specific challenges with innovative solutions. Teamwork is evidenced by effective collaboration, role distribution, and clear communication within groups. Presentation skills are shown through clear, structured delivery with effective data visualization. Source utilization requires reliable, properly cited references, while practical applicability ensures interventions are feasible given resource constraints and local contexts. Table 2 provides a rubric which we use for assessing case performance to ensure consistency and transparency.

A critical implementation challenge involves limited time for comprehensive case analysis, potentially resulting in superficial outcomes. Effective mitigation requires developers to: (1) accurately scope analytical requirements, (2) enforce structured time management protocols for each phase, and (3) guarantee unrestricted access to validated information repositories and support materials. Other challenges include subjectivity and variability in student preparedness [20]. Standardized rubrics and clear criteria mitigate subjectivity, while formative feedback during case work supports skill development

[3]. To ensure equitable assessment, evaluators should consider not only final outcomes but also each student's individual progress and their contribution to the team's overall success.

Summative assessments, such as oral presentations or written reports, evaluate intervention outcomes [1]. Engaging external experts, like public health officials from the Regional Health Departments or the National Center for Public Health (NCOPH), enhances assessment realism [6]. To address subjective bias, standard rubrics must be shared with students in advance. Instructors are encouraged to combine formative (ongoing) and summative (final) assessment, providing feedback at multiple stages. This holistic model ensures students not only reach desired outcomes but also improve their reasoning and professionalism along the way.

CASE DEVELOPMENT PROCESS

Developing effective CBL cases involves a systematic process, illustrated in Figure 2. The process begins with defining learning outcomes, such as skills in epidemiological analysis, policy development, or ethical reasoning. Usually, the topics we select and develop are based on regional or national public health priorities, such as disease outbreaks or workforce shortages. Credible data are compiled from sources like the Ministry of Health, WHO, or peer-reviewed studies. A detailed narrative is created, incorporating context, key questions, and supporting data. The case undergoes validation by public health and education specialists to ensure accuracy and pedagogical value. Pilot testing with a small student group identifies and addresses flaws. Instructors receive facilitation tips, discussion strategies, and assessment criteria to ensure effective use. Overall, the whole process ensures cases are educationally robust, relevant, and engaging, maximizing their impact on student learning.

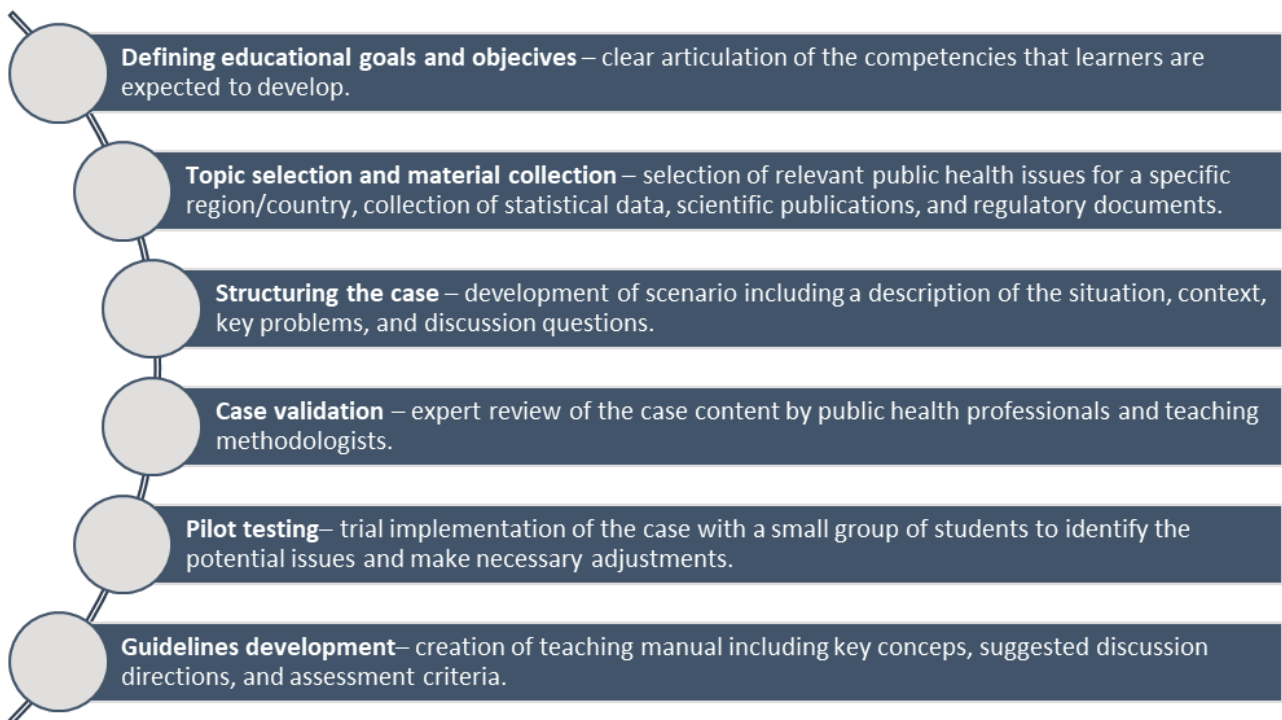


Figure 2 – Case development in Public Health education

CONCLUSIONS

1. Case-based learning is a robust approach in public health education, equipping students with the analytical, collaborative, and ethical competencies necessary to tackle complex health challenges. Rooted in theories of constructivism, contextual learning, and social constructivism, CBL effectively bridges the gap between theory and practice by engaging learners with real-world scenarios.

2. The integration of the case method into higher education programs improves the development of critical thinking, analytical skills, and teamwork among students. These competencies are playing a key role as societies confront both common and extraordinary challenges, such as pandemics, socioeconomic inequalities, and environmental crises, that demand comprehensive, interdisciplinary solutions. Furthermore, as freedom indices rise and societal liberalization progresses, new ethical issues emerge that are directly relevant to public health practice. The case method proves especially valuable in preparing professionals to navigate these complex scenarios where ethical considerations intersect with public health decision-making.

3. Sustained investment in the development of high-quality cases, faculty training, and collaboration with stakeholders is essential to maximizing the impact of CBL. Developing and evaluating effective cases requires significant time, access to reliable data, and expert input. As public health challenges continue to grow in complexity, CBL remains a powerful tool

for preparing future public health leaders capable of advancing population health in Kazakhstan and beyond.

Authors' contribution:

O. Zhamantayev, N. Yerdessov – concept and design of the study, collection and processing of materials, writing the original draft, editing, reviewing the final manuscript.

Conflict of interest:

No conflict of interest declared.

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Н. Ж. Ердесов¹, О. К. Жамантаев^{1*}

ПОВЫШЕНИЕ ПРАКТИЧЕСКИХ КОМПЕТЕНЦИЙ ПОСРЕДСТВОМ CASE-BASED LEARNING В ОБРАЗОВАТЕЛЬНОМ ПРОЦЕССЕ В ОБЛАСТИ ОБЩЕСТВЕННОГО ЗДРАВООХРАНЕНИЯ

¹Школа общественного здоровья НАО «Карагандинский медицинский университет» (100008, Республика Казахстан, г. Караганда, ул. Гоголя, 40; e-mail: info@qmu.kz)

***Олжас Кенжеғалиевич Жамантаев** – Школа общественного здоровья НАО «Карагандинский медицинский университет»; 100008, Республика Казахстан, г. Караганда, ул. Гоголя, 40; e-mail: zhamantaev@qmu.kz

Обучение на основе кейсов в образовательном процессе в области общественного здравоохранения – это динамичный педагогический подход, который объединяет в себе теоретические знания и их применение на практике. В представленной статье рассмотрены ключевые педагогические теории, лежащие в основе кейс-метода, описаны различные типы кейсов, используемых в обучении общественному здравоохранению, включая эпидемиологические, организационные, а также кейсы по социальным детерминантам здоровья, профилактические и этические кейсы.

Особое внимание уделено этапам разработки и внедрения кейсов, а также методам оценки их эффективности в образовательном процессе. Кейс-метод позволяет студентам не только овладеть теоретическими знаниями, но и развить практические навыки, необходимые для решения сложных задач в сфере здравоохранения.

Применение кейс-метода в программах высшего образования способствует развитию критического мышления, аналитических способностей и навыков работы в команде у студентов. Эти компетенции приобретают особую значимость в современных условиях, когда общество сталкивается с общими и чрезвычайными вызовами, включая пандемии, социально-экономическое неравенство и экологические проблемы, требующие комплексного подхода и междисциплинарного взаимодействия. Кроме того, с ростом индексов свободы и либерализацией общества возникают новые этические нормы и дилеммы, напрямую связанные с вопросами общественного здравоохранения. Кейс-метод особенно ценен при подготовке специалистов к работе в таких сложных ситуациях, где этические аспекты пересекаются с практикой общественного здравоохранения.

Ключевые слова: CBL; общественное здравоохранение; медицинское образование; активное обучение; Казахстан; конструктивизм; компетентностно-ориентированное образование; педагогика

Н. Ж. Ердесов¹, О. К. Жамантаев^{1*}

ҚОҒАМДЫҚ ДЕНСАУЛЫҚ САҚТАУ БІЛІМІНДЕ CASE-BASED LEARNING ӘДІСІМЕН ПРАКТИКАЛЫҚ ҚҰЗЫРЕТТЕРДІ ДАМУ

¹«Қарағанды медицина университеті» КеАҚ қоғамдық денсаулық сақтау мектебі (100008, Қазақстан Республикасы, Қарағанды қ., Гоголь к-сі, 40; e-mail: info@qmu.kz)

***Олжас Кенжеғалиұлы Жамантаев** – «Қарағанды медицина университеті» КеАҚ қоғамдық денсаулық сақтау мектебі; 100008, Қазақстан Республикасы, Қарағанды қ., Гоголь көш., 40; e-mail: zhamantaev@qmu.kz

Кейстер негізіндегі оқыту – бұл қоғамдық денсаулық сақтау саласындағы білім беру үдерісінде теориялық білім мен практикалық қолдануды біріктіретін динамикалық педагогикалық тәсіл. Бұл мақалада біз кейс-әдіске негіз болатын негізгі педагогикалық теорияларды қарастырдық. Қоғамдық денсаулық сақтау саласында біз қолданатын әртүрлі кейс түрлері сипатталған, олардың қатарына эпидемиологиялық, ұйымдастырушылық, денсаулықтың әлеуметтік детерминанттары, профилактикалық және этикалық кейстер кіреді.

Кейстерді әзірлеу және енгізу кезеңдеріне, сондай-ақ олардың білім беру үдерісіндегі тиімділігін бағалау әдістеріне ерекше назар аударылды. Кейс-әдіс студенттерге теориялық білімді меңгерумен қатар, денсаулық сақтау саласындағы күрделі міндеттерді шешу үшін қажетті практикалық дағдыларды дамытуға мүмкіндік береді.

Жоғары білім беру бағдарламаларында кейс-әдісті қолдану студенттердің сыни ойлауын, аналитикалық қабілеттерін және топпен жұмыс істеу дағдыларын дамытуға ықпал етеді. Бұл құзыреттер

қазіргі заманғы жағдайларда – пандемиялар, әлеуметтік-экономикалық теңсіздік және экологиялық мәселелер сияқты ортақ және төтенше сын-қатерлер туындаған кезде ерекше маңызға ие. Мұндай мәселелер кешенді тәсілді және пәнаралық өзара іс-қимылды талап етеді. Сонымен қатар, қоғамда бостандық деңгейінің артуы мен либерализация жағдайында қоғамдық денсаулық сақтау саласымен тікелей байланысты жаңа этикалық нормалар мен дилеммалар пайда болуда. Кейс-әдіс мамандарды этикалық аспектілер қоғамдық денсаулық сақтау тәжірибесімен тоғысатын осындай күрделі жағдайларда жұмыс істеуге дайындауда ерекше құнды.

Кілт сөздер: CBL; қоғамдық денсаулық сақтау; медициналық білім; белсенді оқыту; Қазақстан; конструктивизм; құзыреттілікке бағытталған білім беру; педагогика