

TEACHING OCCUPATIONAL DISEASES IN UKRAINE DURING WARTIME: CHALLENGES, RESOURCES, AND DEVELOPMENT PROSPECTS

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Specialized clinical disciplines may be difficult to sustain when disruption limits access to relevant patients, expert diagnostic pathways, and bedside-based learning. Occupational diseases education is an illustrative example because it requires integration of clinical manifestations, exposure history, occupational hygiene, prevention, and expert causality assessment. We conducted a national cross-sectional teaching-unit needs assessment of Ukrainian occupational diseases education during the 2025/2026 academic year. A structured electronic questionnaire was distributed through institutional e-mail channels and professional contacts before a national academic meeting. The survey captured teaching-unit profile, delivery format, student load, staffing, access to clinical material, digital infrastructure, resources, perceived barriers, and proposed solutions. Twenty-six valid teaching-unit responses were analysed. Teaching was delivered predominantly offline in 11/26 units (42.3%), hybrid in 8/26 (30.8%), and online in 7/26 (26.9%); 15/26 (57.7%) reported at least partial digital delivery. Access to clinical learning material was uneven, ranging from inpatient occupational pathology patients and outpatient encounters to archived or simulated cases. Recurring barriers included limited specialized clinical bases, fragmented case resources, inconsistent teaching materials, heterogeneous digital infrastructure, staffing constraints, and war-related disruption. Findings show how a specialized clinical discipline can remain active under wartime conditions while becoming highly dependent on local clinical access and institutional capacity. A national anonymized peer-reviewed case repository may support case-based learning, clinical reasoning material, and curriculum resilience, but requires pilot evaluation.

Key words: medical education, occupational diseases, occupational pathology, case-based learning, clinical education, wartime disruption.

Шелест Борис, Савельєва Наталія, Капустник Валерій, Калмиков Олексій, Литвиненко Микола. Викладання професійних хвороб в Україні в умовах війни: проблеми, ресурси та перспективи розвитку

Спеціалізовані клінічні дисципліни особливо уразливі до порушень освітнього процесу, коли обмежується доступ до профільних пацієнтів, експертних діагностичних маршрутів і навчання біля ліжка хворого. Професійні хвороби є показовим прикладом, оскільки їх викладання потребує інтеграції клінічних проявів, професійного та експозиційного анамнезу, гігієни праці, профілактики й експертної оцінки причинного зв'язку. Метою роботи було оцінити організацію викладання професійних хвороб в українських навчальних підрозділах у 2025/2026 навчальному році, визначити основні труднощі, ресурсні прогалини та можливі напрями міжкафедральної координації. Проведено національне поперечне дослідження потреб навчальних підрозділів із використанням структурованої електронної анкети, яку поширювали офіційними інституційними каналами та через професійні контакти перед національною академічною нарадою. Анкета охоплювала профіль підрозділу, формат навчання, студентське навантаження, кадрові забезпечення, доступ до клінічного матеріалу, цифрову інфраструктуру, навчальні ресурси, бар'єри та запропоновані рішення. Проаналізовано 26 валідних відповідей від окремих навчальних підрозділів. Переважно очне навчання здійснювали 11 із 26 підрозділів (42,3%), змішане – 8 із 26 (30,8%), дистанційне – 7 із 26 (26,9%); щонайменше часткове використання цифрового формату повідомили 15 із 26 підрозділів (57,7%). Доступ до клінічного матеріалу був нерівномірним – від стаціонарних пацієнтів із професійною патологією та амбулаторних консультацій до архівних документів і змодельованих клінічних випадків. Серед повторюваних проблем зазначали обмежені спеціалізовані клінічні бази, фрагментарність банків клінічних випадків, неоднорідність методичних матеріалів і цифрової інфраструктури, кадрові обмеження та вплив війни. Результати демонструють, що викладання професійних хвороб в Україні зберігається, однак значною мірою залежить від локального доступу до клінічних баз та інституційних можливостей. Національний анонімізований і рецензований банк клінічних випадків може доповнити очне навчання, підтримати клінічне мислення та стійкість навчальних програм, але потребує пілотного впровадження й подальшої оцінки.

Ключові слова: медична освіта, професійні хвороби, професійна патологія, кейс-орієнтоване навчання, клінічна освіта, навчання в умовах війни.

Introduction. Clinical education depends not only on transmission of disciplinary knowledge, but also on exposure to patients, diagnostic uncertainty, contextual reasoning, and expert feedback. This dependence is especially visible in specialized clinical disciplines, where attainment of curricular outcomes may rely on access to specific patient groups, expert diagnostic settings, multidisciplinary pathways, or geographically concentrated clinical services rather than on classroom teaching alone [1–3].

Occupational diseases education is a particularly useful illustrative case of this broader educational problem. The field is clinically specialized and requires students to integrate clinical manifestations and symptom analysis with occupational and environmental exposure history, workplace conditions, occupational hygiene, prevention, expert clinical assessment, medico-legal referral pathways, and evaluation of causal relationships between exposure and disease. European literature suggests that undergraduate occupational medicine education remains uneven and requires strengthening and harmonization across institutions [4]. In Ukraine, the educational context is additionally shaped by a formal regulatory framework that defines the official list of occupational diseases, the organization of mandatory medical examinations for workers in certain categories, and the authorized institutional framework for final diagnosis of chronic occupational diseases [5–8].

War-related disruption has intensified existing vulnerabilities in clinical education. Ukrainian medical schools have had to preserve educational continuity under conditions of safety constraints, displacement of students and faculty, unstable access to clinical sites, and increased reliance on hybrid or distance learning [9–12]. Comparable challenges were also documented in Sudan, where the war disrupted curriculum delivery and hospital-based clinical training, caused widespread student displacement, and limited the feasibility of online learning because of unstable internet access [13]. Taken together, these reports suggest that continuity during conflict depends not only on digital access, but also on the ability to preserve meaningful clinical learning.

Occupational diseases education makes this challenge especially visible. Students must learn to take a structured occupational history, identify harmful workplace exposures, interpret clinical and instrumental findings, consider differential diagnoses, understand causality assessment, and recognize when referral to an authorized expert institution is indicated. These competencies cannot be developed through passive theoretical instruction alone. They are strongly supported by bedside-based learning with real patients and expert feedback; when this is disrupted, non-bedside case-based learning, archived clinical cases, and digital or asynchronous case-based formats may provide complementary educational scaffolding.

Case-based learning is well suited to this context because it links theoretical knowledge to authentic clinical problems and supports clinical reasoning [14; 15]. Virtual patients and online case-based learning can also support clinical reasoning when access to bedside teaching is limited, although their value depends on case quality, interactivity, feedback, and curricular integration [16–18]. Digital cases should therefore be viewed as complementary educational scaffolding rather than a substitute for patient contact.

Previous studies have described war-related disruption in Ukrainian medical education and uneven occupational medicine education in Europe, but little is known about how specialized clinical disciplines that depend on expert diagnostic centres preserve teaching under wartime disruption.

The study aimed to examine how Ukrainian teaching units responsible for occupational diseases education organized teaching during wartime disruption, to identify difficulties, barriers, and resource gaps, and to explore whether non-bedside case-based approaches, including a shared national repository of anonymized clinical cases, might represent a reasonable complementary response when access to bedside-based learning and expert clinical-diagnostic centres is disrupted. Broader inferences about other specialized clinical disciplines are interpretive and transferability-oriented rather than evidentiary.

This study therefore contributes a national teaching-unit-level perspective on how a specialized clinical discipline is maintained under wartime disruption. Rather than evaluating one institution or one course, it maps educational delivery, clinical access, staffing, digital infrastructure, and perceived resource needs across Ukrainian teaching units. Occupational diseases education is used as a discipline-specific case to identify vulnerabilities and potential resilience strategies that may be relevant to other specialized clinical disciplines where learning depends on access to particular patient groups, expert diagnostic pathways, and case-based clinical reasoning.

Materials and Methods. Study design and setting. We conducted a national cross-sectional teaching-unit needs assessment among Ukrainian departments, courses, and teaching units responsible for occupational diseases or occupational pathology during the 2025/2026 academic year.

Occupational diseases education in Ukraine is typically delivered within departments or courses of occupational diseases, occupational pathology, internal medicine, family medicine, therapy, pulmonology, phthisiology, or related clinical disciplines.

Participants and recruitment. The target population comprised heads of departments, course leaders, and faculty members responsible for occupational diseases or related teaching in Ukrainian medical higher education institutions. The questionnaire link was disseminated primarily through official institutional or departmental e-mail channels and direct professional contacts within the national professional network before a national academic meeting. The questionnaire was created in Google Forms and configured to limit completion to one response per respondent. E-mail addresses were recorded at submission for administrative screening and duplicate control, but personal identifiers were removed before analysis. After export, responses were screened for duplicate or incomplete entries, and the final analytic dataset comprised 26 unique teaching-unit responses.

Because the link could be redistributed within the professional network, the exact number of individuals or teaching units that received the invitation could not be verified with sufficient certainty; therefore, a conventional response rate was not calculated. All percentages were calculated using the full analytic denominator of 26 valid teaching-unit responses unless otherwise specified. For questions with missing, blank, or non-classifiable responses, these were retained in the denominator and reported explicitly. The unit of analysis was the teaching unit (department, course, or equivalent structural unit) rather than the institution. Where more than one response originated from the same institution, entries were retained only if they represented distinct teaching units; if multiple responses referred to the same teaching unit, the most complete response was retained.

Questionnaire development and variables. The questionnaire was developed by the study team for a descriptive educational needs assessment and was informed by the curricular and organizational domains discussed within the national network of departments involved in occupational diseases education. Items were designed to capture teaching-unit profile, delivery format, student load, staffing, access to clinical material, digital infrastructure, teaching resources, perceived barriers, and proposed solutions.

Before dissemination, the draft form was reviewed by the study team and senior faculty from the coordinating department for face validity, clarity, and completeness; minor wording refinements were made before launch. Because the instrument was intended to describe educational processes rather than measure latent constructs, formal psychometric

validation was not undertaken. The invitation requested one consolidated response per teaching unit. Most items were optional to reduce respondent burden. The survey platform was configured to limit completion to one response per respondent; it did not use cookie- or IP-based restrictions. Duplicate control was additionally supported by recorded e-mail addresses and manual screening during data cleaning.

The questionnaire covered departmental profile; specialties in which occupational diseases or related content were taught; predominant teaching format; approximate number of students taught; faculty involved in teaching; number of faculty with additional specialization in occupational pathology; English-language teaching; access to patients and clinical training sites; availability of standardized clinical cases; use of learning management systems and digital platforms; perceived barriers; and proposed solutions, including shared educational resources and interdepartmental collaboration.

Data collection. Data were collected electronically during the 2025/2026 academic year before the national academic meeting. Respondents were informed that aggregated data could be used for educational analysis and publication without personal identifiers. Responses were exported from Google Forms for analysis.

Quantitative analysis. Quantitative responses were summarized descriptively. Unless otherwise specified, frequencies and percentages were calculated using the full analytic denominator of 26 valid teaching-unit responses. Missing, blank, or non-classifiable responses were not imputed and were reported explicitly where relevant. For multiple-choice items, percentages indicate the proportion of all 26 responding units selecting each option; therefore, totals may exceed 100%. Where a specific sub-analysis used only interpretable responses, the denominator is stated explicitly.

Qualitative and free-text analysis. Free-text responses were analyzed using descriptive qualitative content analysis. Two researchers (B.O.S. and O.O.K.) independently reviewed the responses and generated initial codes reflecting recurring educational challenges, resource gaps, and proposed solutions. Codes were then grouped into broader thematic categories, including limited clinical access, the need for methodological updating, fragmented digital infrastructure, lack of standardized clinical cases, staffing limitations, non-unified assessment approaches, wartime constraints on educational continuity, the need for interdepartmental coordination, and interest in shared

educational resources. Differences in coding or theme interpretation were discussed until consensus was reached; when needed, a third researcher (V.A.K.) supported final agreement.

Reporting standards. Items relevant to web-based survey reporting were considered with reference to CHERRIES, and the study is otherwise reported in accordance with the STROBE statement for cross-sectional studies [19; 20].

Post-hoc subgroup analysis. As an exploratory post-hoc subgroup analysis, teaching units were grouped according to whether their institution was located in a war-risk region or in a non-risk region. Associations between regional war-risk status and selected categorical educational indicators were examined using Fisher's exact test for 2×2 comparisons. For the three-category teaching-format variable, Pearson's chi-square test was used, with Cramer's V and Pearson's contingency coefficient reported as descriptive measures of association. Because of the small sample size and sparse cells, these analyses were interpreted cautiously and treated as exploratory.

Ethical considerations. The study was approved by the Ethics Committee of Kharkiv National Medical University, Protocol No. 4, dated 01 April 2026. Participation was voluntary, and completion of the questionnaire was taken to indicate consent to participate. Responses were analyzed in aggregated form, and no identifiable personal data are reported in this manuscript.

The authors declare the use of generative artificial intelligence (AI) in the research and manuscript preparation process according to the GAIDeT taxonomy (2025), the following tasks were delegated to generative AI tools under full human supervision: proofreading and editing of the manuscript of the article; translation. Generative AI tool used: ChatGPT 5.5 (OpenAI, USA). Generative AI tools are not listed as authors and are not responsible for the final results.

Results:

Responding teaching units and organizational profile. Twenty-six valid responses representing distinct teaching units involved in occupational diseases education were analyzed. The sample should be interpreted as an exploratory dataset of participating teaching units rather than as a complete national census.

The organizational profile was heterogeneous. In many institutions, occupational diseases content was delivered within broader internal medicine or related clinical departments rather than within stand-alone occupational diseases departments. Occupational diseases education was reported most consistently

within Medicine and less consistently within Pediatrics and other programmes.

Teaching formats, staffing, and student load.

Teaching formats were heterogeneous. Teaching-format data were classifiable for 26 valid responses: 11/26 (42.3%) reported predominantly offline teaching, 8/26 (30.8%) hybrid teaching, and 7/26 (26.9%) online teaching. Overall, 15/26 (57.7%) reported at least partial reliance on digital delivery through hybrid or online teaching (Table 1). These findings indicate that digital and hybrid formats had become a structural component of teaching in this field during wartime disruption.

Reported student load varied substantially across responding units. Staffing capacity also varied. Many units reported only one or two faculty members with additional specialization in occupational pathology, and some relied primarily on teachers whose main specialization lay in broader internal medicine or related disciplines. English-language teaching was present in some, but not all, responding units.

In an exploratory subgroup analysis, regional risk status was associated with teaching format (Table 2).

At least partial digital delivery, defined as hybrid or predominantly online teaching, was reported by 10/12 teaching units (83.3%) in high-risk regions (war) compared with 5/14 units (35.7%) in low-risk regions (war) (Fisher's exact $p = 0.021$). The overall distribution of offline, hybrid, and online teaching also differed by regional risk status ($\chi^2 = 7.919$, $df = 2$, $p = 0.019$). The association was of moderate magnitude (Cramer's $V = 0.552$; Pearson's contingency coefficient = 0.483).

In contrast, war-risk status was not clearly associated with reported access to patients, inpatient or bedside clinical exposure, or availability of larger standardized case collections.

Access to clinical material and case resources.

Access to clinical learning material was uneven. Some responding units reported direct or semi-direct access to inpatient occupational pathology patients, whereas others relied mainly on outpatient encounters, follow-up consultations, archived documentation, or simulated materials. This unevenness was one of the clearest structural findings of the survey.

Availability of standardized clinical cases also varied substantially. Some teaching units reported local case collections, whereas others had few or no structured anonymized cases available for systematic case-based teaching. Digital infrastructure was similarly fragmented, with use of multiple learning platforms and differing levels of integration of teaching resources.

Perceived barriers and proposed priorities.

Recurring barriers included limited specialized clinical bases, fragmented case resources, inconsistent teaching materials, heterogeneous digital infrastructure, non-unified assessment approaches, staffing constraints, and wartime disruption of educational continuity. Respondents recurrently identified the need for shared clinical cases, updated methodological materials, common assessment tools, and stronger interdepartmental collaboration.

Across both closed-ended and free-text responses, these needs converged around the idea of coordinated educational infrastructure rather than isolated local solutions (Table 3).

Table 1

Predominant teaching format reported by participating teaching units during the 2025/2026 academic year (N = 26)

Teaching format / indicator	n	% of all responses	Notes
Predominantly offline teaching	11	42.3	In-person teaching was the main format.
Hybrid teaching	8	30.8	Teaching combined face-to-face and digital components.
Predominantly online teaching	7	26.9	Remote/distance delivery was the main format.
At least partial digital delivery	15	57.7	Derived indicator combining hybrid and online teaching; not an additional response category.

Table 2

Exploratory association between war-risk status and predominant teaching format

Teaching-format indicator	War-risk regions, n/N (%)	Non-risk regions, n/N (%)	Test	p value
Hybrid or online vs offline	10/12 (83.3%)	5/14 (35.7%)	Fisher's exact test	0.021
Overall distribution: offline / hybrid / online	2 / 4 / 6 of 12	9 / 4 / 1 of 14	Pearson's χ^2 test	0.019

Table 3

Main educational challenges identified in the survey and corresponding coordinated responses proposed in the manuscript

Survey domain	Observed pattern	Educational implication / proposed response
Clinical access	Access to occupational pathology patients and expert pathways was uneven across units.	Use shared anonymized cases to complement, not replace, bedside-based teaching.
Case resources	Some units reported local case collections, whereas others had few structured cases for systematic teaching.	Develop a peer-reviewed national clinical case repository with standardized case structure.
Teaching materials	Teaching materials and methodological resources were not uniformly available or updated.	Create a common methodological core aligned with current regulatory and clinical requirements.
Digital infrastructure	Learning platforms and levels of integration differed across institutions.	Prepare platform-neutral, asynchronous resources that can be used in offline, hybrid, or online formats.
Assessment	Assessment approaches were not unified across teaching units.	Develop shared competency-oriented tasks, rubrics, and case-based assessment tools.
Staffing	Some units had limited faculty capacity with formal occupational pathology specialization.	Support faculty development and interdepartmental sharing of teaching resources.
Wartime continuity	Safety constraints and disrupted clinical access affected educational continuity.	Use a curriculum-resilience model combining bedside learning, non-bedside case-based learning, and asynchronous resources.

Discussion. Principal findings. The main finding of this national teaching-unit needs assessment is not only that occupational diseases education continued during wartime disruption, but that its implementation became highly dependent on local clinical access, staffing, and digital infrastructure. This creates an educational vulnerability that is likely to be shared by other specialized clinical disciplines where students require exposure to specific patient groups, expert diagnostic pathways, and supervised clinical reasoning rather than generic classroom teaching alone.

This exploratory educational needs assessment suggests that occupational diseases education in Ukraine remained active during wartime disruption, but under markedly heterogeneous conditions. Participating teaching units differed in teaching format, staffing, access to clinical material, case availability, and digital infrastructure. The findings do not suggest educational collapse; rather, they describe a functioning but uneven field that has adapted pragmatically to a highly disrupted environment.

The exploratory regional subgroup analysis adds nuance to the interpretation of teaching-format heterogeneity. Teaching units located in high-risk regions (war) were more likely to rely on hybrid or online delivery, which is consistent with the expectation that safety constraints and logistical limitations shape educational format. However, this finding should be interpreted cautiously because of the small sample size and exploratory nature of the analysis.

The most important finding is the asymmetry of clinical access. Some teaching units retained contact

with inpatient occupational pathology cases or related expert pathways, whereas others depended on outpatient material, archived documentation, or simulated resources. This finding is consistent with broader wartime medical education literature from Ukraine and other conflict-affected settings, where continuity depends not only on platform access but also on preservation of experiential learning opportunities [9–13].

Implications for medical educators. For medical educators, these findings support three practical implications. First, specialized clinical disciplines require shared case-based educational infrastructure when local patient access is uneven. Second, anonymized clinical cases should be linked to competencies, diagnostic reasoning steps, and assessment tools rather than stored only as illustrative examples. Third, digital resources should be designed to support both emergency online delivery and routine blended learning, so that they strengthen the curriculum beyond the immediate crisis.

Occupational diseases education as an illustrative case. Although the empirical study concerns occupational diseases education only, the field is a suitable illustrative case for cautiously considering transferability to other specialized clinical disciplines. It is clinically specialized, depends on access to relatively rare or geographically concentrated cases, incorporates regulatory and expert-institution components, and requires structured case-based reasoning rather than simple factual recall. In this respect, it makes visible a broader educational problem: specialized clinical

learning can become strongly dependent on local infrastructure rather than on a shared curriculum.

This broader interpretation should nonetheless remain cautious. The study should not be read as evidence about all specialized clinical disciplines in Ukraine.

Why uneven clinical access matters. Clinical education remains tied to authentic experience, contextual reasoning, and repeated exposure to diagnostic decision-making [1–3]. In occupational diseases education, students must connect symptoms, examination findings, investigations, exposure history, workplace conditions, and causality assessment. When teaching units lack stable access to relevant patients or expert diagnostic environments, opportunities for repeated reasoning practice become uneven. That inequality may translate into unequal opportunities to achieve similar curricular aims.

Rationale for a national clinical case repository. A shared national clinical case repository is therefore a reasonable educational proposition. Such a repository could widen access to rare or geographically concentrated occupational disease cases, reduce duplication of local teaching materials, standardize case structure, and support non-bedside case-based learning where direct clinical access is limited. It should not be framed as a replacement for bedside clinical teaching, but as a resilience-oriented educational scaffold for periods or locations where access to real patients and expert centres is constrained. Existing literature suggests that case-based learning, online case-based learning, and virtual patient tools can support clinical reasoning when they are well structured, interactive, and embedded in active learning [14–18].

Online case-based learning may provide a complementary format when face-to-face clinical teaching is constrained, although the quality of evidence remains heterogeneous and implementation depends on technological access, facilitation, and instructional design [17].

The proposed repository could also be designed using competency-oriented tagging and shared outcome mapping, which would align better with competency-based educational planning across teaching units [21]. More broadly, the concept is consistent with the literature on technology-enhanced simulation and structured virtual-patient-based learning as adjuncts to clinical training rather than replacements for it [22–24].

The repository should not be described as a proven solution. This study supports the rationale for such infrastructure and demonstrates perceived need, but it does not provide outcome evidence that a repository

improves student performance, clinical reasoning, or educational equity. Pilot implementation and prospective evaluation are still required.

Strengths and limitations. A strength of this study is that it examines a specialized clinical educational field that has received limited direct attention in wartime medical education literature. It also captures the perspective of teaching units rather than only student respondents, enabling analysis of curriculum organization, staffing, access to clinical material, and perceived educational priorities.

Several limitations should be acknowledged. First, the study was exploratory and cross-sectional, and cannot describe temporal trends. Second, the sample was based on participating teaching units and may not represent all units involved in occupational diseases education in Ukraine. Third, because the invitation could be redistributed, the exact denominator of all eligible invited teaching units could not be verified; therefore, a conventional response rate was not calculated. Fourth, the data were self-reported and may be affected by response bias, variable interpretation of survey items, or incomplete responses. Fifth, denominators varied across questions because many items were optional. Sixth, the study did not assess learner outcomes, clinical reasoning performance, or patient-level outcomes. Finally, the proposed repository has not yet been piloted or evaluated.

Conclusions. Occupational diseases education in Ukraine remained active during wartime disruption, but its delivery varied across teaching units and depended on local clinical access, staffing, and digital capacity. As a national teaching-unit needs assessment, this study shows how specialized clinical disciplines may become vulnerable when authentic clinical exposure and expert diagnostic pathways are disrupted. A national anonymized, peer-reviewed clinical case repository, linked to competencies and assessment tools, may support case-based learning and curriculum resilience. This proposed educational infrastructure should be piloted and evaluated before wider implementation.

Statements and Declarations

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Competing interests. The authors have no relevant financial or non-financial interests to disclose.

Ethics approval. This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Kharkiv National Medical University (Protocol No. 4, 01 April 2026).

Consent to participate. Participation in the electronic questionnaire was voluntary. Respondents provided informed consent before completing the questionnaire.

Consent for publication. Not applicable. The manuscript reports aggregated and anonymized teaching-unit data and contains no identifiable individual participant information.

Data availability. The datasets generated and analysed during the current study are not publicly available because they contain department-level information and contextual details that could potentially allow identification of participating teaching units. Anonymised aggregated data are available from the corresponding author on reasonable request.

Author contributions. B.O.S. conceptualized the study, contributed to methodology, performed the

primary analysis, interpreted the findings, and drafted the manuscript. N.M.S. contributed to educational policy contextualization, interpretation of findings, and critical revision of the manuscript. O.O.K. contributed to questionnaire development, data collection and coordination, interpretation of findings, and critical revision of the manuscript. V.A.K. provided senior conceptual guidance, contributed to interpretation of findings, and critically revised the manuscript. M.I.L. contributed to educational contextualization, institutional coordination, and critical revision of the manuscript. All authors read and approved the final manuscript.

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