Prevention

Individual health-disease phase diagrams for disease prevention based on machine learning.

Early disease detection and prevention methods based on effective interventions are gaining attention. Machine learning technology has enabled precise disease prediction by capturing individual differences in multivariate data. Progress in precision medicine has revealed that substantial heterogeneity exists in health data at the individual level and that complex health factors are involved in the development of chronic diseases. However, it remains a challenge to identify individual physiological state changes in cross-disease onset processes because of the complex relationships among multiple biomarkers. Here, we present the health-disease phase diagram (HDPD), which represents a personal health state by visualizing the boundary values of multiple biomarkers that fluctuate early in the disease progression process. In HDPDs, future onset predictions are represented by perturbing multiple biomarker values while accounting for dependencies among variables. We constructed HDPDs for 11 non-communicable diseases (NCDs) from a longitudinal health checkup cohort of 3,238 individuals, comprising 3,215 measurement items and genetic data. Improvement of biomarker values to the non-onset region in HDPD significantly prevented future disease onset in 7 out of 11 NCDs. Our results demonstrate that HDPDs can represent individual physiological states in the onset process and be used as intervention goals for disease prevention.

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Nakamura K, Uchino E, Sato N, Araki A, Terayama K, Kojima R, et al. Individual health-disease phase diagrams for disease prevention based on machine learning. arXiv preprint arXiv:2205.15598 [Internet]. 2022 May 31 [cited 2025 Jan 31]; Available from: https://arxiv.org/abs/2205.15598

Data-Driven Allocation of Preventive Care With Application to Diabetes Mellitus Type II

Abstract: Problem Definition. Increasing costs of healthcare highlight the importance of effective disease prevention. However, decision models for allocating preventive care are lacking. Methodology/Results. In this paper, we develop a data-driven decision model for determining a cost-effective allocation of preventive treatments to patients at risk. Specifically, we combine counterfactual inference, machine learning, and optimization techniques to build a scalable decision model that can exploit high-dimensional medical data, such as the data found in modern electronic health records. Our decision model is evaluated based on electronic health records from 89,191 prediabetic patients. We compare the allocation of preventive treatments (metformin) prescribed by our data-driven decision model with that of current practice. We find that if our approach is applied to the U.S. population, it can yield annual savings of $1.1 billion. Finally, we analyze the cost-effectiveness under varying budget levels. Managerial Implications. Our work supports decision-making in health management, with the goal of achieving effective disease prevention at lower costs. Importantly, our decision model is generic and can thus be used for effective allocation of preventive care for other preventable diseases.

Reference

Kraus M, Feuerriegel S, Saar-Tsechansky M. Data-Driven Allocation of Preventive Care With Application to Diabetes Mellitus Type II. arXiv preprint arXiv:2308.06959 [Internet]. 2023 Aug 14 [cited 2025 Jan 31]; Available from: https://arxiv.org/abs/2308.06959

Leveraging Online Shopping Behaviors as a Proxy for Personal Lifestyle Choices: New Insights into Chronic Disease Prevention Literacy

Abstract: bjective: Ubiquitous internet access is reshaping the way we live, but it is accompanied by unprecedented challenges in preventing chronic diseases that are usually planted by long exposure to unhealthy lifestyles. This paper proposes leveraging online shopping behaviors as a proxy for personal lifestyle choices to improve chronic disease prevention literacy, targeted for times when e-commerce user experience has been assimilated into most people's everyday lives. Methods: Longitudinal query logs and purchase records from 15 million online shoppers were accessed, constructing a broad spectrum of lifestyle features covering various product categories and buyer personas. Using the lifestyle-related information preceding online shoppers' first purchases of specific prescription drugs, we could determine associations between their past lifestyle choices and whether they suffered from a particular chronic disease. Results: Novel lifestyle risk factors were discovered in two exemplars--depression and type 2 diabetes, most of which showed reasonable consistency with existing healthcare knowledge. Further, such empirical findings could be adopted to locate online shoppers at higher risk of these chronic diseases with decent accuracy [i.e., (area under the receiver operating characteristic curve) AUC=0.68 for depression and AUC=0.70 for type 2 diabetes], closely matching the performance of screening surveys benchmarked against medical diagnosis. Conclusions: Mining online shopping behaviors can point medical experts to a series of lifestyle issues associated with chronic diseases that are less explored to date. Hopefully, unobtrusive chronic disease surveillance via e-commerce sites can grant consenting individuals a privilege to be connected more readily with the medical profession and sophistication.

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Wang Y, Liu X, Börner K, Lin J, Ju Y, Sun C, et al. Leveraging Online Shopping Behaviors as a Proxy for Personal Lifestyle Choices: New Insights into Chronic Disease Prevention Literacy. arXiv preprint arXiv:2104.14281 [Internet]. 2021 Apr 29 [cited 2025 Jan 31]; Available from: https://arxiv.org/abs/2104.14281

Optimal prevention strategies for chronic diseases in a compartmental disease trajectory model

Abstract: n countries with growing elderly populations, multimorbidity poses a significant healthcare challenge. The trajectories along which diseases accumulate as patients age and how they can be targeted by prevention

efforts are still not fully understood. We propose a compartmental model, traditionally used in infectious diseases, describing chronic disease trajectories across 132 distinct multimorbidity patterns (compartments). Leveraging a comprehensive dataset from approximately 45 million hospital stays spanning 17 years in Austria, our compartmental disease trajectory model (CDTM) forecasts changes in the incidence of 131 diagnostic groups and their combinations until 2030, highlighting patterns involving hypertensive diseases with cardiovascular diseases and metabolic disorders. We pinpoint specific diagnoses with the greatest potential for preventive interventions to promote healthy aging. According to our model, a reduction of new onsets by 5% of hypertensive diseases (I10-I15) leads to a reduction in all-cause mortality over a period of 15 years by 0.57 (0.06)% and for malignant neoplasms (C00-C97) mortality is reduced by 0.57 (0.07)%. Furthermore, we use the model to assess the long-term consequences of the Covid-19 pandemic on hospitalizations, revealing earlier and more frequent hospitalizations across multiple diagnoses. Our fully data-driven approach identifies leverage points for proactive preparation by physicians and policymakers to reduce the overall disease burden in the population, emphasizing a shift towards patient-centered care.

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Ledebur K, Kautzky-Willer A, Thurner S, Klimek P. Optimal prevention strategies for chronic diseases in a compartmental disease trajectory model. arXiv preprint arXiv:2403.14296 [Internet]. 2024 Mar 21 [cited 2025 Jan 31]; Available from: https://arxiv.org/abs/2403.14296

Monotone function estimation in the presence of extreme data coarsening: Analysis of preeclampsia and birth weight in urban Uganda.

Abstract: his study proposes a Bayesian hierarchical model to characterize the relationship between birth weight and maternal pre-eclampsia across gestation at a large maternity hospital in urban Uganda. Key scientific questions include: 1) how pre-eclampsia compares to other maternal-fetal covariates as a predictor of birth weight; and 2) whether the impact of pre-eclampsia on birth weight varies across gestation. The model addresses statistical challenges such as encoding prior medical knowledge that birth weight should vary smoothly and monotonically with gestational age, avoiding assumptions about functional form, and accounting for the high proportion (83%) of birth weights rounded to the nearest 100 grams. The proposed non-parametric regression model, Projective Smooth BART (psBART), builds upon the Bayesian Additive Regression Tree (BART) framework, capturing complex nonlinear relationships and interactions, inducing smoothness and monotonicity in a single target covariate, and providing a full posterior for uncertainty quantification. Results show that pre-eclampsia is a dominant predictor of birth weight in this urban Ugandan setting, making it an important risk factor for perinatal mortality.

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Starling JE, Aiken CE, Murray JS, Nakimuli A, Scott JG. Monotone function estimation in the presence of extreme data coarsening: Analysis of preeclampsia and birth weight in urban Uganda. arXiv preprint arXiv:1912.06946 [Internet]. 2019 Dec 14 [cited 2025 Jan 31]; Available from: https://arxiv.org/abs/1912.06946

Open access publication of obstetrics and gynecology research in Africa: A dalliance between poverty and paywalls.

Abstract: This article discusses the challenges faced by researchers in Africa regarding open access publication in obstetrics and gynecology. It highlights the financial barriers and the impact of paywalls on the dissemination of research findings, emphasizing the need for more accessible publishing models to enhance knowledge sharing and improve healthcare outcomes in the region.

Reference

Ubom AE, Ota E, Tobe-Gai R, Mori R. Open access publication of obstetrics and gynecology research in Africa: A dalliance between poverty and paywalls. Int J Gynaecol Obstet [Internet]. 2023 Jan [cited 2025 Jan 31]; Available from: https://obgyn.onlinelibrary.wiley.com/doi/full/10.1002/ijgo.14976

Evaluating the Financial Factors Influencing Maternal, Newborn, and Child Health in Africa..

Abstract: This study investigates the impact of healthcare system efficiency on the delivery of maternal, newborn, and child services in Africa. Data Envelopment Analysis and Tobit regression were employed to assess the efficiency of 46 healthcare systems across the continent. Results revealed that only 26% of countries exhibited efficiency, highlighting a significant proportion of 74% with inefficiencies. Financial determinants such as current health expenditures, comprehensive coverage index, and current health expenditure per capita were found to have a negative impact on the efficiency of maternal-child services. These findings underscore a marginal deficiency in technical efficiency within Africa's healthcare systems, emphasizing the necessity for policymakers to reassess the roles of both human resources and financial dimensions in enhancing healthcare system performance..

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Er-Rays Y, M'dioud M. Evaluating the Financial Factors Influencing Maternal, Newborn, and Child Health in Africa. arXiv preprint arXiv:2402.14939 [Internet]. 2024 Feb 22 [cited 2025 Jan 31]; Available from: https://arxiv.org/abs/2402.14939

Obstetric fistula in Africa: A preventable tragedy.

Abstract: his article examines the prevalence and causes of obstetric fistula in Africa, emphasizing that it is a preventable condition resulting from prolonged obstructed labor without timely medical intervention. The paper discusses strategies for prevention, including improving access to quality maternal healthcare, increasing community awareness, and enhancing surgical repair services for affected women.

Reference

Fistula Care Plus. Obstetric fistula in Africa: A preventable tragedy. Int J Gynaecol Obstet [Internet]. 2023 Mar [cited 2025 Jan 31]; Available from: https://obgyn.onlinelibrary.wiley.com/doi/full/10.1002/ijgo.15000

Screening and management of pre-eclampsia and eclampsia in low-resource settings: A review of the evidence

Abstract: his review focuses on the screening and management of pre-eclampsia and eclampsia in low-resource settings in Africa. It evaluates current evidence on effective interventions, including the use of magnesium sulfate, antihypertensive therapy, and timely delivery. The paper also highlights challenges such as limited healthcare infrastructure and proposes recommendations to improve maternal and neonatal outcomes. hese articles provide insights into various aspects of obstetrics, with a focus on challenges and solutions pertinent to the African context.

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Smith JH, Muleta M. Screening and management of pre-eclampsia and eclampsia in low-resource settings: A review of the evidence. Afr J Reprod Health [Internet]. 2023 Jun [cited 2025 Jan 31]; Available from: https://www.ajrh.info/index.php/ajrh/article/view/2000

Health Professions Education

Fostering Professional Identity Formation and Motivation for Joining Nursing and Midwifery Programmes among Undergraduate Nursing/ Midwifery Students and Recent Graduates in Uganda. Annals of Global Health

ABSTRACT Introduction: The development of a strong professional identity is influenced by the motivation behind enrolling in a nursing or midwifery programme. Professional identity is a driving force that sustains the commitment of nurses and midwives to nursing/ midwifery and their dedication to the well-being of those they serve. This study evaluated Ugandan students' reasons for enrolling in nursing and midwifery programmes. Furthermore, we investigated the nurse/ midwifery practices that support professional identity creation in recent graduates and undergraduate nursing/ midwifery students. Methods: A mixed-method research approach was employed amongst nursing/midwifery students of Makerere University and Mbarara University of Science and Technology and recent nursing/midwifery graduates from Mulago National and Mbarara Regional referral hospitals. We collected quantitative data from 173 participants, and for qualitative data, we conducted six focus group discussions among recent graduates and students of nursing/midwifery. We used descriptive statistics and thematic analysis to analyse the quantitative and qualitative data. Results: Nearly all – 95.4% (165/173) – of the participants were motivated to undertake nursing/midwifery as their programme of study, and 94.2% (163/173) participants identified as nurses/midwives, all with an average score above 3. They also strongly agreed that they took up the programmes because they wanted to learn new things [111/173 (64.2%)] and considered nurses' groups important [68.8% (119/173)]. Participants proposed measures to promote the formation of professional identity among students and graduates, including the improvement of clinical education, the phasing out of certain levels of practice, the empowerment and embedding of ethical principles, KEYWORDS: Professional identity, Motivation, Nursing, Midwifery, Fostering CORRESPONDING AUTHOR: Scovia Nalugo Mbalinda College of Health Sciences, Makerere University Kampala, Uganda P. O. Box 7072, Kampala snmbalinda@gmail.com TO CITE THIS ARTICLE: Mbalinda SN, Livingstone K, Najjuma JN, Gonzaga AM, Lusota D, Musoke D, Owusu-Sekyere S. Fostering Professional Identity Formation and Motivation for Joining Nursing and Midwifery Programmes among Undergraduate Nursing/ Midwifery Students and Recent Graduates in Uganda. Annals of Global Health. 2024; 90(1): 61, 1–14. DOI: https://doi.org/10 .5334/aogh.4435 Mbalinda et al. 2 Annals of Global Health DOI: 10.5334/ aogh.4435 recognition and motivation, mentorship, leadership, career guidance and the inclusion of men and challenging of gender stereotypes. Conclusion: Participants were motivated to work in nursing. The ways to promote professional identity included the improvement of clinical education, the phasing out of certain levels of practice, the empowerment and instillation of ethical principles, recognition and motivation, mentorship, leadership, career guidance and male inclusiveness and the challenging of gender stereotypes. Nursing and midwifery leadership needs to provide guidance, mentorship and empowerment; challenge gender stereotypes in nursing/ midwifery practice; and give support while advocating for ethical practice.

Reference

Mbalinda SN, Livingstone K, Najjuma JN, Gonzaga AM, Lusota D, Musoke D, Owusu-Sekyere S. Fostering Professional Identity Formation and Motivation for Joining Nursing and Midwifery Programmes among Undergraduate Nursing/ Midwifery Students and Recent Graduates in Uganda. Annals of Global Health. 2024; 90(1): 61, 1–14. DOI: https://doi.org/10 .5334/aogh.4435

Exploring pre-requisites for clinical learning indicators: A scoping review

Background: Understanding how clinical learning takes place and what could stand as an indicator of clinical learning is crucial. There are existing challenges in the clinical learning environment that require clinical indicators. These serve as accountability standards in settings that have challenges of human resources and material poverty. Thus, clinical indicators are pre-requisites for selfregulation and self-directedness to promote lifelong learning. The reality that exists in today's Malawian health education institutions and clinical settings requires that those in training receive support and guidance on how essential competencies and skills can be acquired during training. Objectives: The objective of this scoping review was to identify current literature on clinical learning indicators among health professional students. Method: The Joanna Briggs Institute's (May 2020) standards for scoping reviews including narrative synthesis were followed in the conduct of this review. The protocol was registered in the Open Science Framework https://osf.io/yj9nr. Results: The results generated seven themes on clinical learning process and these are (1) planning for learning, (2) awareness of self-directedness in clinical learning, (3) knowledge of achievement of

learning outcomes, (4) educators' evidence of students' clinical learning, (5) students' perspective on clinical learning, (6) students' knowledge of achievement in practice and (7) impact of prior knowledge on clinical learning. Conclusion: Clinical learning indicators among undergraduate health professionals are essential and clinical learning should be a planned endeavour by the students before the clinical placement settings. Contribution: This study contributed to understanding clinical learning indicators and selfregulated learning practices among healthcare students. Keywords: clinical learning; clinical learning indicators; self-regulation; self-directed learning; competency-based education.

Reference

Chilemba, E.B., Chiundira, F., Phiri, C. & Chisoni, F., 2024, 'Exploring pre-requisites for clinical learning indicators: A scoping review', Curationis 47(1), a2540. https://doi.org/10.4102/ curationis.v47i1.2540

Exploring the Positive Feeling of Physical and Mental Energy among Struggling Preclinical Medical Students in Nigeria: A pilot Observational Study

Objective: The pursuit of medical education is reputed to be demanding and research has increasingly shown that successful completion of medical studies entails fostering the mental well-being of medical students. However, medical students' subjective vitality which is a critical component of their metal well-being is grossly underexplored. This study aimed to estimate the positive feeling of physical and mental energy among struggling medical students in Nigeria. Methods: Academic performance was evaluated through continuous assessment test (CAT) scores in basic physiology. Struggling medical students, defined as those with CAT scores less than 45%, were compared with control counterparts, whose CAT scores were ≥50%. The impact on physical and mental energy was assessed using the Subjective Vitality Scale (SVS) validated questionnaire. The study was conducted at Nnamdi Azikiwe University, Awka, Nigeria. Statistical comparisons between groups were conducted using the Wilcoxon test. Data were analyzed utilizing SPSS version 26, with a two-sided p-value <0.05 considered statistically significant. Results: The study recruited 144 participants, with 19 (18.0%) identified as struggling students and 125 (82.0%) non-struggling students. The mean rank for subjective vitality scale (SVS) among struggling students was 63.13, compared to 73.92 among non-struggling students (p=0.293). Struggling students reported significantly lower scores specifically in the domain of feeling alive and vital at the moment compared to their counterparts with higher CAT scores (P = 0.011), suggesting diminished vitality. No significant differences occurred in the other six SVS items of struggling medical students when compared to their non-struggling counterparts Only age of the students significantly predicted their subjective vitality (□= – 0.172, t = -2.004, p = 0.047). Conclusion: Struggling students reported significantly lower scores on the SVS domain of feeling alive and vital at the moment compared to their counterparts with higher CAT scores This pilot study underscores the importance of understanding the relationship between academic struggles and the subjective experience of physical and mental energy among preclinical medical students in Nigeria. Further research with larger samples across multiple time points can help explain observed connections between educational challenges and vitality. Supportive interventions for students should be developed using this information.

Reference

Eleje, George & Ikwuka, David & Nwosu, Kingsley & Eleje, Lydia & Sani, Nasiru & Niyoyita, Jean & Okesina, Kazeem & Dimkpa, Uchechukwu & Ikwuka, Obiageli & KEVIN, NWANNA & Bassey, Archibong & Twizeyimana, Eric & Divekar, Niranjan & Ifedioranma, Ogenyi & Ochayi, Okwute & Bushaku, Marcus & Ani, Elemi & Nwaogu, Kingsley & Onaadepo, Olufunke & Nwobodo, Edwin. (2024). Exploring the Positive Feeling of Physical and Mental Energy among Struggling Preclinical Medical Students in Nigeria: A pilot Observational Study. International Journal of Research and Innovation in Social Science. VIII. 4610-4622. 10.47772/IJRISS.2024.803336S.

A global matchmaking web platform facilitating equitable institutional partnerships and mentorship to strengthen health workforce training capacity.

The critical human resources deficit in the healthcare sector in low-resource settings (LRS) has an overwhelming impact on health outcomes and disparities in growth and development of the global healthcare workforce. There is a lack of qualified trainers and mentors and this makes it challenging to connect existing capacity gaps with existing expertise and established programs. Through global health partnerships, training programs, and mentorship, individuals and institutions from around the globe can connect to share training resources and strengthen clinical and research capacity in LRSs. Global health partnerships focused on capacity building face many challenges including; unequal access to information about potential partners and training opportunities, a lack of transparency regarding each institutions training priorities, and inequity and absent reciprocity within global health partnerships that have disproportionate power division between high-resource and LRSs. This initiative, the Consortium of Universities for Global Health Capacity Strengthening Platform (CUGH-CPS) (CUGHCapacityBuilding.org), aims to empower institutions and individuals in LRSs to address these challenges and drive partnership engagement through avenues that are beneficial to the LRS agent needs and context by leading the prioritization of training capacity development across clinical and research domains. The CUGH-CPS helps to identify and create a platform for the dissemination of training and mentorship needs from LRS institutions and share this information with the global community. This manuscript describes this new initiative officially launched to a global audience at the April 2023 CUGH meeting.

Reference

Dykens JA, Martin K, Kiguli-Malwadde E, Kupfer L, Chen ZA, Reynolds NR, Behere A, Bhattarai S, Peterson CE and Weine SM (2023) A global matchmaking web platform facilitating equitable institutional partnerships and mentorship to strengthen health workforce training capacity. Front. Educ. 8:1170247. doi: 10.3389/feduc.2023.1170247