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The Importance of Hierarchical Regression in Public Health Data Modeling

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Hierarchical regression is an important statistical technique through which multiple predictors can be tested for their impact on an outcome variable in an orderly, structured manner [1]. For public health, with complex, multi-level data, hierarchical regression is an important tool for determining the most impactful drivers of health outcomes and informing the development of useful interventions [2]. One of the main strengths of hierarchical regression over other regression techniques is its capacity for modeling the nested nature of the data. Public health data is typically collected at various hierarchical levels of analyses, such as individual, family, community, or geographic areas. Hierarchical regression enables the researcher to control for the interdependency within these different hierarchical levels as well as model individual-level measures and group-level measures influencing health outcomes [3].

Additionally, hierarchical regression allows researchers to test the independent contribution of every predictor variable toward the outcome variable with other variables held constant. This is especially useful in public health studies, as several variables may impact health outcomes at the same time. Using hierarchical regression, the researcher can identify what the strongest predictors of health care and target them accordingly for intervention [2, 4]. Furthermore, hierarchical regression offers insight into complex interactions between multiple predictor variables [5]. Public health issues tend to be complex in nature as they have an array of individual, social, economic, as well as environmental causes [6]. This method allows researchers to examine how different variables interact and better understand their roles in shaping health outcomes.

Additionally, hierarchical regression allows for the detection of potential modifiers or mediators of the relation between predictor variables and the outcome variable [7]. This is critical in public health research, as knowledge of the mechanisms by which the variables affect health is important in creating tailored interventions as well as policies. One of the key features of hierarchical regression in public health modeling is its capacity for measuring the influence of time-varying variables on health outcomes [8, 9]. Public health concerns are dynamic in nature and can evolve over time as a function of diverse sets of drivers, including policy shifts, social trends, or environmental phenomena [10]. Hierarchical regression enables researchers to identify such trends over time and include them in their models.

In addition, hierarchical regression allows researchers to control for confounding variables that could distort the association between health outcomes and predictor variables [11]. Public health data is often subject to confounding bias, where the association between variables is confounded by the effects of other variables. Hierarchical regression allows researchers to account for these confounding factors and obtain more accurate estimates of the true relationships between variables [12, 13]. Ultimately, hierarchical regression provides a flexible framework for evaluating whether observed relationships hold across subgroups or contexts. This makes it especially valuable in public health research, where interventions must often account for population-level variability and complex implementation environments.

By way of summary, hierarchical regression is an effective tool for public health data modeling that enables scientists to unravel the complexity of health determinants, discern the main drivers of health outcomes, and inform the establishment of effective interventions. Hierarchical regression can capture nested structures of the data, test interactions between variables, control for confounding variables, and test the generalizability of results, which makes the tool invaluable for public health investigation.

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REFERENCES

1. Ross, A., V.L. Willson, A. Ross, and V.L. Willson, Hierarchical multiple regression analysis using at least two sets of variables (in two blocks). Basic and Advanced Statistical Tests: Writing Results Sections and Creating Tables and Figures, 2017: p. 61-74.
2. Lobo, M. and S.L. Normand, Hierarchical models in health services research. Wiley StatsRef: Statistics Reference Online, 2014: p. 1-7.
3. Dwivedi, S.N., S. Begum, A.K. Dwived, and A. Pandey, Community effects on public health in India: A hierarchical model. Health, 2012. 4(8): p. 526-536.
4. Gatsonis, C. Aspects of hierarchical regression modeling in health services and outcomes research. in Proceedings of the 23rd International Conference on Information Technology Interfaces, 2001. ITI 2001. 2001. IEEE.
5. Cohen, J., P. Cohen, S.G. West, and L.S. Aiken, Applied multiple regression/correlation analysis for the behavioral sciences. 2013: Routledge.
6. Mahajan, K.C., A. Suryawanshi, S. Shendage, S. Agawane, A. Kurhade, and H. Bhor, A Comprehensive Review of Various Factors Impacting Human Health: Implications for Pharmaceutical Education.
7. Pretorius, T.B., Pathways to health: Conceptual clarification and appropriate statistical treatment of mediator, moderator, and indirect effects using examples from burnout research. South African Journal of Psychology, 2020. 50(3): p. 320-335.
8. Młynarczyk, D., C. Armero, V. Gómez-Rubio, and P. Puig, Bayesian analysis of population health data. Mathematics, 2021. 9(5): p. 577.
9. Richardson, D.B., R.F. MacLehose, B. Langholz, and S.R. Cole, Hierarchical latency models for dose-time-response associations. American journal of epidemiology, 2011. 173(6): p. 695-702.
10. Currie, D.J., C. Smith, and P. Jagals, The application of system dynamics modelling to environmental health decision-making and policy-a scoping review. BMC public health, 2018. 18: p. 1-11.
11. Richardson, D.B., G.B. Hamra, R.F. MacLehose, S.R. Cole, and H. Chu, Hierarchical regression for analyses of multiple outcomes. American journal of epidemiology, 2015. 182(5): p. 459-467.
12. De Roos, A.J., C. Poole, K. Teschke, and A.F. Olshan, An application of hierarchical regression in the investigation of multiple paternal occupational exposures and neuroblastoma in offspring. American journal of industrial medicine, 2001. 39(5): p. 477-486.
13. Gelman, A. and J. Hill, Data analysis using regression and multilevel/hierarchical models. 2007: Cambridge university press.