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Designing Culturally Competent Clinical Decision Support Systems to Reduce Health Disparities in Underserved Populations

Shiven Sharma
School Delhi Public School, Sector 45, Gurgaon
Email: shiven190310@gmail.com

ABSTRACT

Income inequality is associated with poor health. Both the cost of medical care and the utilization of services vary. The high expense of health care pushes a significant portion of Indian households into poverty. The surroundings in which people live, grow, work, and interact with one another are known as social determinants, and they have a big influence on people's well-being which can be reduced by computerized clinical decision support systems. In today's healthcare, computerized clinical decision support systems, or CDSS, represent a paradigm change. Clinicians can use CDSS to support them in making complicated decisions. Rapid advancements have been made in CDSS since they were used in the 1980s. Due to the growing worldwide usage of advanced electronic medical records, they are frequently administered using computerized clinical processes and electronic medical records.

Keywords: Decision support system, health disparities, culturally competent

1. INTRODUCTION

Poor health is linked to income disparity. There are disparities in the use of services and the cost of medical treatment. In India, a large percentage of households fall into poverty due to health care costs. Many social determinants—the environments in which individuals live, grow, work, and interact with one another—have a significant impact on an individual's well-being(Thomas and Sudhakar, 2000). Research has also revealed a connection between social justice and health equity. Consequently, the healthcare experience of a socially and economically affluent person will differ significantly from that of a poor and marginalized person living in a nation where health disparities are pervasive. India still has health disparities even if there has been a noticeable decline in these disparities across several metrics.

The correlation between females' education and better health status is further supported by the rise in the literacy rate that has been accompanied by a drop in the percentage of adolescent mothers, an increase in baby immunization rate, and a decline in TFR. Although there has been increased access to water and sanitation, over half of the households lack access to better sanitation options. Also as ICDS, a large percentage of anaemic and wasted youngsters indicates a nutrient shortage. The financial strain of covering healthcare costs falls heavily on households, which makes the behavior of those who are marginalized less likely to seek medical attention. Over two-thirds of households do not have any insurance coverage. However, our insurance system needs to broaden its scope to include inpatient and outpatient care, laboratory tests, medications, consultations, etc., since over 50% of the OOPE's Inequalities in Outcomes of Health are spent on purchasing medications, and another 10% is spent in medical and diagnostic labs(Thomas and Sudhakar, 2000). The measures of child mortality and nutrition that have improved over the past ten years demonstrate the success of interventions aimed at enhancing maternal and child health. Nonetheless, the government still needs to give nutrition its full focus. Even though receiving medical care is essential, many people choose not to pursue therapy. A person's degree of mobility, housing situation, and financial independence are all factors that influence their likelihood of getting treatment(Thomas and Sudhakar, 2000). This also explains why rural communities do badly on practically every health metric. There is a noticeable urban bias in healthcare facility accessibility. Therefore, the additional burden of inadequate access falls on the rural population, contributing to their higher proportion of the unwell population. Even though things are getting better, there is still an excessive reliance on private healthcare institutions; entirely private hospitals provide 55% of inpatient treatment and 75% of outpatient care. To the Rescue clinical decision support system helps government to curb healthcare disparity.

The rest of this work is organized as follows, following a brief introduction to health disparity in India and the clinical decision support system is described in section 2. The research approach used to carry out this study is described in

Section 3. Additionally, the author present the analysis of the secondary data collected from different government published reports are summarized in Section 4. This section also covers how a culturally competent decision support system can remove health disparity. The conclusion is summarized in Section 5.

2. LITERATURE REVIEW

2.1 Health Disparity and Inequalities

It is essential to understand that health disparities are a result of health inequalities associated with adverse social, economic, and environmental circumstances. Groups of people who have systematically faced more social and economic barriers to health due to their race or ethnicity, religion, socioeconomic status, gender, age, or mental health; physical, cognitive, or sensory disability; sexual orientation or gender identity; location; or other characteristics historically associated with exclusion or discrimination are negatively impacted by health disparities(Thomas and Sudhakar, 2000). Health is a necessary component of physical, economic, and social well-being, so everyone should have an equal opportunity to be healthy in a just society. The following example clarifies the health disparities. Women over 50 years old are at risk for uterine cancer. The likelihood of being impacted is lower among people under 50. Age is hence the variable generating the disparity in sickness. It is, however, a health inequality if women who possess particular socio-economic traits—like poor income and low social rank—are impacted more than the others. This is an unfair and avoidable disparity. Social influences shape disparities, which result in various but avoidable consequences for distinct populations. Health equality may be able to reduce inequities in certain situations, particularly if those gaps result from unfair treatment (Mahendru, 2021).

Health equity and inequities are intertwined. Social justice in health is implied by health equity. Stated differently, no individual is denied the chance to pursue health because they are a member of a historically marginalized group (s). Measuring progress towards achieving health equity is made possible by health disparities. Greater health equity is reflected in low health disparities. This can be accomplished in two ways: either by compromising the health of the privileged or advantaged groups or by improving the health of those who are socially and economically disadvantaged on a selective basis rather than granting equal access to all(Whitehead and Dahlgren, 2006).

2.2 Clinical Decision Support System

Computer programs known as clinical decision support systems, or CDSS, are intended to influence physician decisions regarding specific patients at the moment such decisions are being made. Considering the heightened emphasis on medical error prevention. Numerous systems have the potential to assist in making healthcare judgments(Kohn et al, 2000). Clinical judgments can be aided by databases such as Medline and other comparable healthcare literature sources. Healthcare information systems have traditionally included decision support systems, although these systems have typically allowed for the analysis of financial and administrative data in the past. More recently, complex data mining techniques have been proposed for comparable retrospective studies of clinical and administrative data(Galanter et al, 2002).

The majority of CDSS is divided into three sections. These components consist of a user communication mechanism, an inference or reasoning engine, and a knowledge base. A large portion of knowledge-based CDSS that are used today originated from earlier expert systems research, which aimed to create a computer program that could mimic human thought processes(Kohn et al, 2000). It was thought that applying these ideas to medicine would be beneficial. The creators of these systems have started to modify them during the past 20 years to facilitate the use of these systems in actual patient care procedures (Galanter et al, 2002). Inference engines, also known as reasoning mechanisms, are the second component of the CDSS. They hold the formulae for fusing the rules or associations in the knowledge base with real patient data.

To bring patient data into the system and system output to the user who will make the choice, there must also be a communication mechanism. Some stand-alone systems need the user to enter the patient data directly (Geissbuhler et al, 1998; Galanter et al, 2002). The majority of CDSS integrated into electronic medical record (EMR) systems use pre-

existing electronic data from computer-based patient records (PCPRs), which were initially recorded by clinicians. Other potential sources of data include laboratory, pharmacies, and other systems.

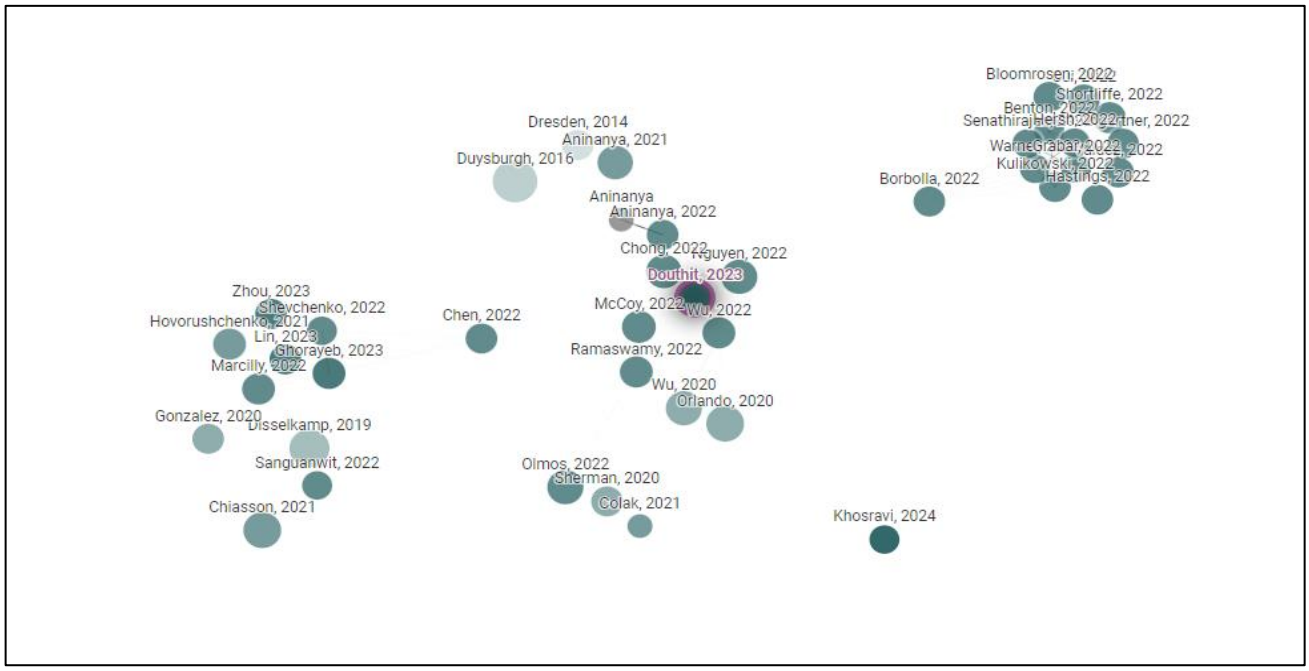
Table I Past literature combining Clinical Decision Support System and Health Disparity

Title	Author	Year	Citation	References
The Impact of Clinical Decision Support on Health Disparities and the Digital Divide	Brian J. Douthit, A. McCoy, S. Nelson	2023	2	46
Effects of computerized decision support on maternal and neonatal health-worker performance in the context of combined implementation with performance-based incentivization in Upper East Region, Ghana: a qualitative study of professional perspectives	G. A. Aninanya, John E. O. Williams, Afua Williams, E. Otupiri, N. Howard	2022	2	52
Using a Knowledge-Based Clinical Decision Support System to Reduce the Time to Appropriate Antimicrobial Therapy in Hospitalized Patients With Bloodstream Infections: A Single-Center Observational Study	C. Chen, Tsi-Shu Huang, S. Lee, Fu-Chin Chien, Ching-Hsiang Yang, Sin-Sian Li, Chia-Jung Hsu, C. Sy, Kuan-Sheng Wu	2022	2	27
Effects of computerized decision support in the context of a performance-based incentive intervention on maternal and neonatal health-worker performance in Upper East Region, Ghana: A qualitative study of professional perspectives	G. A. Aninanya, John E. Williams, Natasha Howard		0	57
Clinician collaboration to improve clinical Decision support: the Click Busters initiative	A. McCoy, Elise M. Russo, K. B. Johnson, Bobby Addison, N. Patel, J. Wanderer, D. Mize, Jon G. Jackson, Thomas J. Reese, Sylinda Littlejohn, Lorraine Patterson, Tina French, Debbie Preston, Audra Rosenbury, Charlie Valdez, S. Nelson, Chetan V. Aher, M. Alrifai, J. Andrews, Cheryl Cobb, S. Horst, David P. Johnson, Lindsey A. Knake, Adam A. Lewis, Lorinda Parks, S. Parr, Pratik Patel, B. Patterson, Chr. Smith, Krystle D. Suszter, R. Turer, Lyndy J. Wilcox, A. Wright, Adam Wright	2022	4	55

Ethics in the History of Medical Informatics for Decision-Making: Early Challenges to Digital Health Goals	C. Kulikowski	2022	2	63
Design and validation of a new Healthcare Systems Usability Scale (HSUS) for clinical decision support systems: a mixed-methods approach	Abir Ghorayeb, J. Darbyshire, M. W. Wronikowska, P. Watkinson	2023	3	88
Effects of combined decision-support and performance-based incentives on reported client satisfaction with maternal health services in primary facilities: A quasi-experimental study in the Upper East Region of Ghana	G. A. Aninanya, E. Otupiri, N. Howard	2021	6	80
A systematic review of reviews on the advantages of mHealth utilization in mental health services: A viable option for large populations in low-resource settings	Mohsen Khosravi, Ghazaleh Azar	2024	1	51
A Case-Finding Clinical Decision Support System to Identify Subjects with Chronic Obstructive Pulmonary Disease Based on Public Health Data	Xinshan Lin, Yi Lei, Jun Chen, Zhihui Xing, Ting Yang, Qing Wang, Chen Wang	2023	2	18
Improving the usability and usefulness of computerized decision support systems for medication review by clinical pharmacists: A convergent, parallel evaluation.	R. Marcilly, Jérémie Colliaux, L. Robert, S. Pelayo, J. Beuscart, C. Rousselière, B. Décaudin	2022	3	39
Quality of antenatal and childbirth care in rural health facilities in Burkina Faso, Ghana, and Tanzania: an intervention study	E. Duysburgh, M. Temmerman, M. Yé, Afua Williams, S. Massawe, John E. O. Williams, R. Mpembeni, S. Loukanova, W. Haefeli, A. Blank	2016	29	49
At the intersection of precision medicine and population health: an implementation-effectiveness study of family health history based systematic risk assessment in primary care	Lori A. Orlando, R. R. Wu, Rachel A. Myers, J. Neuner, Catherine McCarty, Irina V. Haller, Melissa L. Harry, Kimberly G. Fulda, D. Dimmock, Tejinder K. Rakhra-Burris, A. Buchanan, Geoffrey S. Ginsburg	2020	10	60

Source: Author Compilation

Figure I Past literature combining Clinical Decision Support System and Health Disparity(Connected following Co-authorship)



Source: Author Compilation

3. RESEARCH METHODOLOGY

In this study, secondary data from National Family Health Survey (NFHS) has been derived from (http://rchiips.org/nfhsnew/nfhsuser/index.php) to evaluate the level of health disparity in India among different parameters as geography, gender, and social groups. The analysis is described in the next section of the study.

4. DISCUSSION

4.1 Current Health Disparity Situation in India

As in most other countries, women in India have a longer life expectancy than men. The life expectancy of women increased by 3.5 years to 70 in ten years, while that of men increased by 3.2 years to 66.9. The difference in life expectancy between men and women has also grown, from 2.8 to 3.1 years. Research has shown that Indian women have benefited from an increasing health advantage over men since the 1980s. This is linked to mortality among adult and elderly males from non-communicable and external diseases.

Table II Life Expectancy by Gender

	Male	Female	Total
2005-06	63.7	66.5	65
2015-16	66.9	70	69

Source: NFHS

Table III Life Expectancy by Residence

	Rural	Urban	Total
2005-06	63.8	69	65
2015-16	67.1	71.9	69

Source: NFHS

The likelihood of a kid surviving is determined by IMR and U5MR, which also have an immediate impact on life expectancy. They also serve as a reflection of the social, economic, and environmental contexts of children's (and other people's) upbringing.194.4.1. IMR Described as the number of deaths per 1,000 live births of children under one year of age, the IMR has decreased over the past ten years, from 57 in 2005–06 to 40.7 in 2015–16. It decreased to 32 in 2018, which is more in line with the global average of 28.920, according to the most recent data from the Registrar General of India. Nevertheless, India lags well behind the UN's SDG 3, which set an IMR target. The proportion of youngsters that are anemic is decreasing; it was 69.5 in 2005–06 but just 58.5 in 2015–16. Still, one out of every two children is anemic. Compared to metropolitan regions, a higher percentage of children in rural areas are anemic. The rural-urban gap decreased from 8.5 percent in 2005–06 to 3.5 percent in 2015–16. Three out of every five children in SC and ST homes are anemic, with the percentage of anemic children in these households being highest in ST households and then SC households, respectively, with a difference of 9.1 and 6.4 percent from the general category.

Table IV Anaemic Children by Residence

	Rural	**Urban**	**Total**
2005-06	63	71.5	69.5
2015-16	56	59.5	58.5

Source: NFHS

The rising cost of healthcare is concerning since it raises the risk of being impoverished. The vulnerable and marginalized population is more at risk.28 It also keeps the underprivileged from getting access to medical care. Between 2004 and 2017, the mean medical cost per hospitalized case29 increased thrice. In 2017–18, the total cost reached INR 20,135 in expenses. Improved health-seeking behavior brought on by increased health awareness30 and rising healthcare costs can be blamed for the rise in household health spending as a percentage of the overall household budget. Between 2004 and 2017–18, hospitalization costs rose significantly in both urban and rural locations. Nonetheless, it was greater in metropolitan regions, where there has been a decade-long increase in urban-rural inequality.

Table V Average Medical Expenditure Per Hospitalization case by type of Hospitalization(INR)

	Average Expenditure (current Price)	**Average Expenditure Constant Price:2004-05**
2004	6643	6643
2017	20135	10991

Source: NFHS

A nation's development is heavily influenced by its health, and poor health can hinder this process. Nonetheless, aggrieved parties overlook the inherent disparities in the health system when examining a nation's health status. For example, the country's average IMR of 40.7 presents a different picture than the IMRs of the rich (19.8) and the poor (56.3). This is because a variety of social and economic factors that impact healthcare quality and accessibility also have an impact on an individual's health(Thomas and Sudhakar, 2000). These gender, class, and caste-based socioeconomic disparities have an impact on access to high-quality healthcare. Research points to a social group bias in India's health results, resulting in disparities in health indices. For illiterate groups, there is a low utilization of healthcare services. Studies have indicated that individuals with reduced literacy levels are more likely to seek emergency medical attention and end up in a hospital rather than utilizing preventive services like medication and diagnostic testing(Thomas and Sudhakar, 2000; Mahendru, 2021). In rural places, it gets worse. Significant disparities in female education still exist, even though the urban-rural difference, which was 29% in 2005–06, shrank to 19.9% in 2015–16. Girls' literacy rates are low in rural areas mostly because parents are reluctant to educate their daughters, women are typically responsible for domestic tasks, and financial difficulties frequently result in girls quitting school.

4.2 How Culturally competent Decision Support system help to curb health disparity

Understanding and adapting to the various language, communication methods, nonverbal cues, attitudes, and values of each client and family treated is essential to providing care that is culturally competent(Aninanya et al, 2021). Doctors must become aware of both their ideas and the attitudes that their clients hold to become culturally competent healthcare providers. Being aware of other cultures is not a goal in itself. Instead, it's a way to provide a physician more influence,

vigor, and autonomy in a multicultural setting (Pearce et al, 2006). Before they can adapt to the value system of others, clinicians must first develop a cultural awareness of their values and beliefs. Clinicians should be cognizant of the cultural, linguistic, and nonverbal aspects that impact the clinical setting as well as the disparities that occur among their clients.

They discovered that the primary determinants of a successful CDSS implementation were four things. The elements were:

a) Incorporating automatic alerts and reminders into the workflow.
b) Presenting recommendations at the precise moment and place where decisions were being made.
c) Offering practical solutions; and
d) Automating the entire procedure.

5. CONCLUSION

The idea of health equity serves as the foundation for efforts to lessen and eventually eradicate differences in health and the factors that influence it, such as socioeconomic determinants. By focusing on the needs of those most at risk of ill health due to social circumstances, as well as aiming for the best possible standard of health for all, health equity is pursued. Healthcare disparities could be reduced by focusing on the consequences of racial bias and discrimination among non-clinical personnel as well as clinicians, using a patient-centered approach to cultural competency training, and having a general understanding of the cultural background of the patients served by clinicians.

REFERENCES

1. Aninanya, G. A., Otupiri, E., & Howard, N. (2021). Effects of combined decision-support and performance-based incentives on reported client satisfaction with maternal health services in primary facilities: A quasi-experimental study in the Upper East Region of Ghana. *PloS one*, *16*(4), e0249778.
2. Aninanya, G. A., Williams, J. E., Williams, A., Otupiri, E., & Howard, N. (2022). Effects of computerized decision support in the context of a performance-based incentive intervention on maternal and neonatal health-worker performance in Upper East Region, Ghana: A qualitative study of professional perspectives.
3. Chen, C. S., Huang, T. S., Lee, S. S. J., Chien, F. C., Yang, C. H., Li, S. S., ... & Wu, K. S. (2022, October). Using a knowledge-based clinical decision support system to reduce the time to appropriate antimicrobial therapy in hospitalized patients with bloodstream infections: A single-center observational study. In *Open Forum Infectious Diseases* (Vol. 9, No. 10, p. ofac522). US: Oxford University Press.
4. Duysburgh, E., Temmerman, M., Yé, M., Williams, A., Massawe, S., Williams, J., ... & Blank, A. (2016). Quality of antenatal and childbirth care in rural health facilities in Burkina Faso, Ghana, and Tanzania: an intervention study. *Tropical Medicine & International Health*, *21*(1), 70-83.
5. Douthit, B. J., McCoy, A. B., & Nelson, S. D. (2023). The impact of clinical decision support on health disparities and the digital divide. *Yearbook of Medical Informatics*.
6. Geissbuhler A, Miller RA. Clinical application of the UMLS in a computerized order entry and decision-support system. Proc AMIA Symp 1998:320–324.
7. Galanter WL, DiDomenico RJ, Polikaitis A. Preventing exacerbation of an ADE with automated decision support. J Healthc Inf Manage 2002;16(4):44–49.
8. Ghorayeb, A., Darbyshire, J. L., Wronikowska, M. W., & Watkinson, P. J. (2023). Design and validation of a new Healthcare Systems Usability Scale (HSUS) for clinical decision support systems: a mixed-methods approach. *BMJ open*, *13*(1), e065323.
9. Kohn LT, Corrigan JM, Donaldson MS, eds. To err is human: building a safer health system. Washington, DC: National Academy Press; 2000.
10. Kulikowski, C. A. (2022). Ethics in the history of medical informatics for decision-making: early challenges to digital health goals. *Yearbook of medical informatics*, *31*(01), 317-322.
11. Khosravi, M., & Azar, G. (2024). A systematic review of reviews on the advantages of mHealth utilization in mental health services: A viable option for large populations in low-resource settings. *Cambridge Prisms: Global Mental Health*, 1-20.

12. Lin, X., Lei, Y., Chen, J., Xing, Z., Yang, T., Wang, Q., & Wang, C. (2022). A case-finding clinical decision support system to identify subjects with chronic obstructive pulmonary disease based on public health data. *Tsinghua Science and Technology*, *28*(3), 525-540.
13. Mahendru, A. chapter 4: Inequalities in Outcomes of Health. *Inequality Report 2021: India's Unequal Healthcare Story*, 58.
14. Marcilly, R., Colliaux, J., Robert, L., Pelayo, S., Beuscart, J. B., Rousselière, C., & Décaudin, B. (2023). Improving the usability and usefulness of computerized decision support systems for medication review by clinical pharmacists: A convergent, parallel evaluation. *Research in Social and Administrative Pharmacy*, *19*(1), 144-154.
15. McCoy, A. B., Russo, E. M., Johnson, K. B., Addison, B., Patel, N., Wanderer, J. P., ... & Wright, A. (2022). Clinician collaboration to improve clinical decision support: the Clickbusters initiative. *Journal of the American Medical Informatics Association*, *29*(6), 1050-1059.
16. Orlando, L. A., Wu, R. R., Myers, R. A., Neuner, J., McCarty, C., Haller, I. V., ... & Ginsburg, G. S. (2020). At the intersection of precision medicine and population health: an implementation-effectiveness study of family health history based systematic risk assessment in primary care. *BMC Health Services Research*, *20*, 1-10.
17. Pearce, A. F., Lynch, M. J., & Hanson, C. E. (2006). The Hillarys Transect (1): seasonal and cross-shelf variability of physical and chemical water properties off Perth, Western Australia, 1996–98. *Continental Shelf Research*, *26*(15), 1689-1729.
18. Thomas, K., & Sudhakar, K. (2000). Health-care inequalities: an Indian perspective. *The Lancet*, *356*, S35.
19. Whitehead, M., Dahlgren, G., & World Health Organization. (2006). Levelling up (part 1): a discussion paper on concepts and principles for tackling social inequities in health.