Project Report

Project- *Impact of Social Determinants of Health on Patient Readmissions*

By Aqsa Khan

Impact of Social Determinants of Health on Patient Readmissions

Executive Summary

Social determinants of health, a relatively new term but often used to put blame on failures in any healthcare setting. The increasing rates of patient readmissions are tremendously attributed to SDOH. However, the strategies to deal with this situation are still in their infancy. While some hospitals are ignorant of readmission rates in their clinical context, other institutions are attempting to use the EHR data on SDOH to analyze the readmission rates.

There is an urgent requirement to assess our present situation, identify the loopholes in our present system and move forward with new strategies to reduce patient readmissions while accounting for SDOH. To begin with, we need to identify the potential sources to get information on SODH (EHR, EMR, Survey Instruments, etc.) and start recording and updating data on SDOH in our systems on regular basis. The idea of consolidation of National Readmissions Data in the HCUP database was a great initiative, but there are still plenty of issues that are needed to be resolved. There are several data analytic techniques (ML and AI) to analyze and study the trends of the data that has been collected. After identifying the pain points our next step should be the allocation of our resources in the right domains. And we often forget the most important aspect of all this hassle i.e., patient outcome. Besides not having resources (food access, walkable neighborhood, income, education, etc.), some patients may not have family support and are non-adherent to treatment and medications. Post-discharge planning, linking patients to a primary care provider, engaging families in care transitions, providing medication assistance and addressing additional factors that hinder care must be implemented as our strategies to overcome increasing readmission rates.

1. Background

According to the CDC, *"Social determinants of health (SDOH) are the conditions in the environments where people are born, live learn, work, play, worship and age that affect a wide range of health, functioning and quality of life outcomes an risk"*. In technical terms, SDOH can be further categorized into five groups- economic stability, education access and quality, healthcare access and quality, neighborhood and built environment, and social and community context (*Refer to Fig1*).

Figure1. Categories of social determinants of health

(Source- https://health.gov/healthypeople/priority-areas/social-determinants-health)

Despite United States' significant efforts to overcome health inequity, health disparities by race, ethnicity, gender, sex, geographic location, income, education, etc., continue to exist. Cardiovascular diseases, cancer, hypertension, diabetes, mental illness, infant and maternal mortality are some of the outcomes where these inequalities exist. In a County Health Ranking study, SDOH were estimated to affect 50% of the health outcomes, while clinical care impacts 20% of health outcomes, and the remaining 40% are contributed by health behavior (30%) and physical environment (10%) [1].

Most hospital readmissions in the US are due to nonmedical factors. SDOH are among the common causes of hospital readmissions in the US. A cohort study conducted on 202 patients at Massachusetts General Hospital indicated that nearly half of the respondents needed assistance to stay healthy after discharge from the hospital. Majority of the respondents had issues with housing and food [2]. It is now certain that SDOH determines a major chunk of health outcomes and patient care. The introduction of Z codes to capture information about SDOH is one of the prominent moves. Z codes are a collection of ICD-10-CM codes used to identify social, economic, and environmental factors that impact health and wellbeing (*Refer to Table1*). Any healthcare professional (such as a doctor, registered nurse, or hospital) may utilize Z codes in skilled nursing facilities (SNFs), doctor's offices, and hospitals. However, despite their potential to close this care gap, Z codes have not been fully implemented, primarily due to administrative complexity and a lack of provider understanding. The irregular and inconsistent usage of Z codes associated with SDOH in different marketplaces make it more challenging to reduce health equity disparities [3].

Z code	Description
Z55	Problems related to education and literacy
Z56	Problems related to employment and unemployment
Z57	Occupational exposure to risk factors
Z59	Problems related to housing and economic circumstances
Z60	Problems related to social environment
Z62	Problems related to upbringing
Z63	Other problems related to primary support group, including family circumstances
Z64	Problems related to certain psychosocial circumstances
Z65	Problems related to other psychosocial circumstances

Table1: Most prominently used Z codes with description

(Source - https://www.cms.gov/files/document/z-codes-data-highlight.pdf)

Leading healthcare organizations, such as the American Medical Association (AMA) and United Healthcare, recently joined hands to promote the extension of Z-codes to collect data on health-related social needs while promoting research to better design and enhance solutions. Social determinants can influence the readmission rate even when the patient that is discharged receives quality care at the hospital. Nationwide Readmission Database, a subset of the Healthcare Cost and Utilization Project (HCUP) database, records demographic data of patients as well as socioeconomic status, among other things like hospital stays, deliverables, discharge data etc. This data can be used to make inferences about the patient readmissions using the Z codes specific to SDOH.

2. Literature survey

2.1. Social determinants of health

There are several definitions for social determinants of health as previously mentioned. In general, social determinants are categorized into five groups – education access and quality, healthcare access and quality, neighborhood and built environment (safe housing, transportation, access to food and physical activity opportunities), social and community context, and economic stability [4].

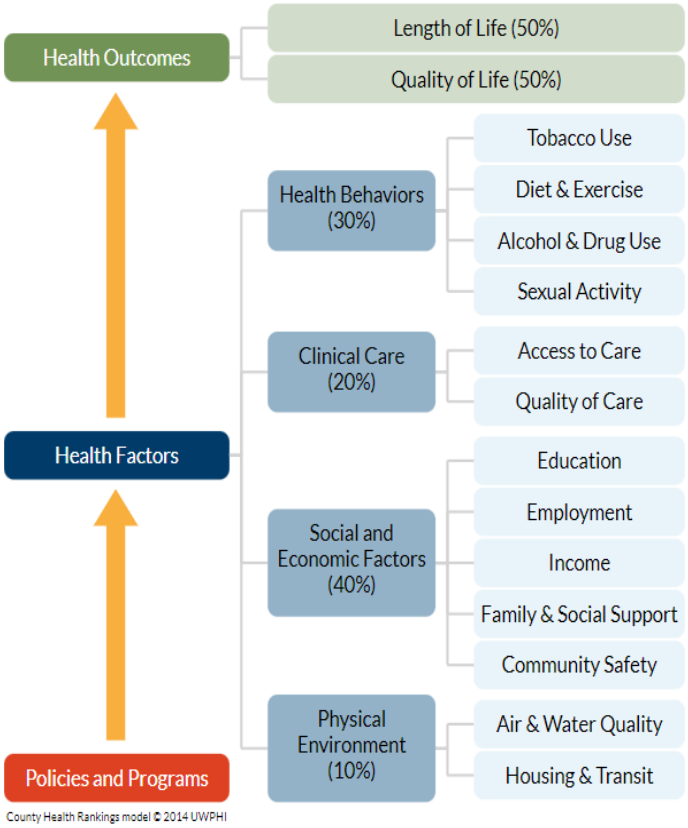


Figure2. County Health Rankings Model represents the interactions between SDOH, health outcomes, health factors and policies. (https://www.countyhealthrankings.org/explore-health-rankings/measures-data-sources/county-health-rankings-model)

2.2. Effect of SDOH on readmissions

A study published in 2011 reported that black patients with Medicare are more likely to get readmitted to the hospital for myocardial infarction, pneumonia and congestive heart failure [5]. In a county-level study, socioeconomic factors and demographic characteristics have shown to play a significant role in readmission rate variations. Measures like high proportion of single residents, residents with Medicare and low employment status were linked with higher hospital readmissions [6]. The data obtained from Nationwide Readmission Database shows that there were 17,978,754 hospitalizations of 13,217,506 patients in 2017. Out of these, 2.4% of the patients had at least one SDOH recorded which was further attributed to housing (1.2%), socioeconomic status (0.5%), family situations (0.5%), employment (0.4%) and psychological factors (0.2%) [7].

2.3. HCUP Database

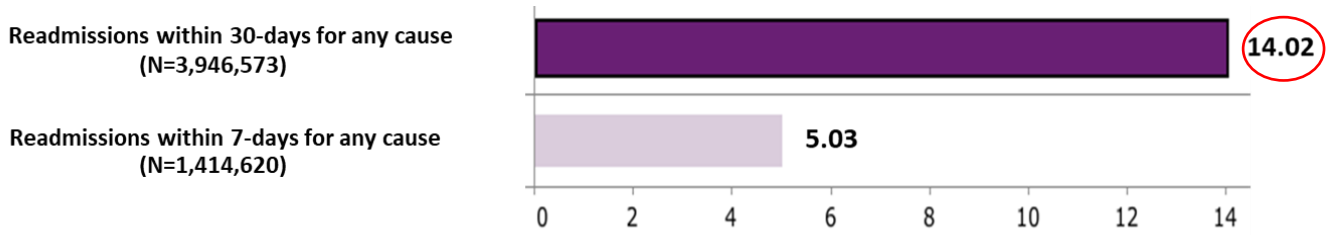
For my project, I am using the HCUPnet tool. It is an online tool based on the data obtained from Healthcare Cost and Utilization Project database which stores the statistical data on patient readmissions in the USA from Nationwide Readmissions Database. HCUPnet provides statistical information (graphs and tables) on patient readmissions by age, sex, payer, residence, income, etc [8].

3.HCUP data analysis

To get an overview of what the HCUP database comprises for readmissions, I have conducted a primary analysis, which gives me the following results on the database. Overall, 3,946,573 patients have been readmitted within 30 days of discharge, almost triple the rate of readmissions within 7 days for any cause.

A. **Readmissions Rate Overall, 2019**

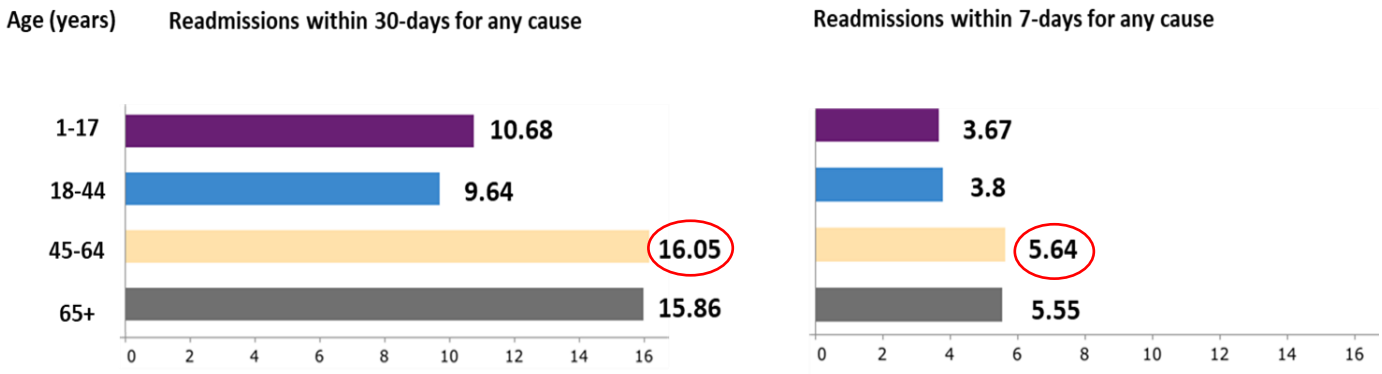
Figure3. Represents the overall rate of readmissions within 30-days and 7-days for any cause in 2019. For comparison, both rates and numbers are shown.



- ***The rate of readmissions within 30-days was higher compared with rate of readmissions with 7-days for any cause.***

B. **Readmissions Rate by Age Group, 2019**

Figure4. Displays any cause readmission rates with 7-days and 30-days in 2019, according to age groups.



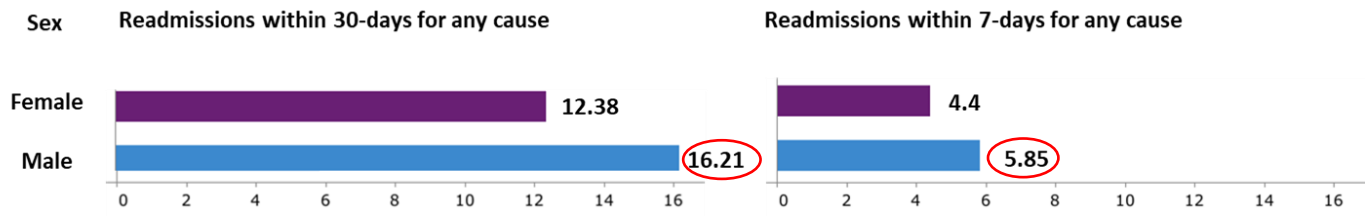
- ***Overall, patients within the age group of 45-64 had the highest readmissions rate with 30-days and 7-days for any cause.***

The readmission rate among patients aged 18-44 years was the lowest (9.64), followed by patients aged 1-17 years (10.68), for any cause within 30-days. Whereas the rate of readmissions

within 7-days for any cause among patients aged 1-17 years was the lowest (3.67), followed by patients aged 18-44 years (3.8) and older adults (5.55).

C. **Readmissions Rate by Sex, 2019**

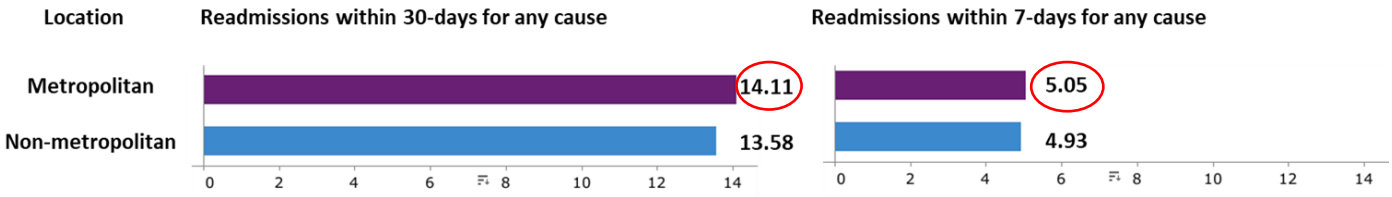
Figure5. Represents the readmission rates within 30-days and 7-days for any cause by sex.



- ***For males, the rate of readmissions within 30-days and 7-days for any cause was higher than females.***

D. **Readmissions Rate by Location, 2019**

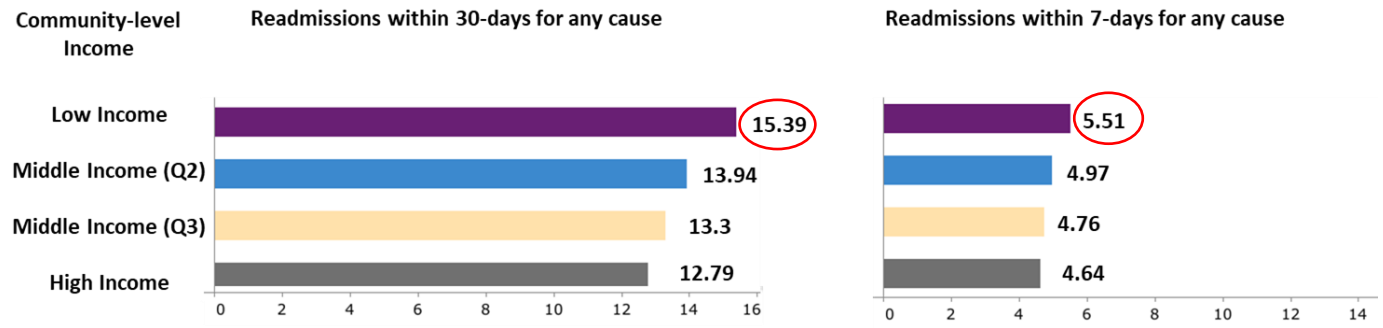
Figure6. Displays the rate of readmissions with 30-days and 7-days for any cause by residence.



- ***The rate of readmissions within 30-days and 7-days for any cause is higher in metropolitan areas compared with non-metropolitan (rural) areas.***

E. **Readmissions Rate by Community-Level Income, 2019**

Figure7. Displays the readmissions rate within 30-days and 7-days for any cause by income level.

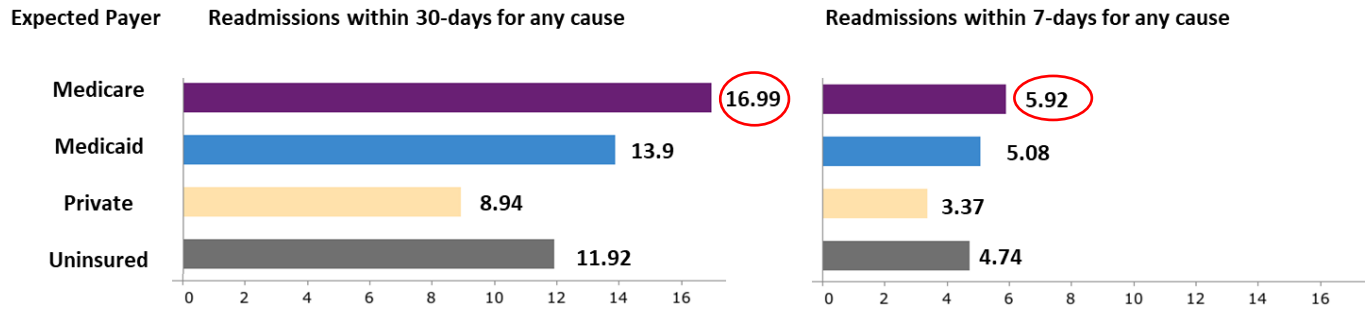


- ***The rate of readmissions was the highest among the low-income patients, within 30-days and 7-days for any cause.***

The rate of readmissions within 30-days for any cause was higher for each income quartile compared with readmissions within 7-days for any cause. The readmission rate within 30-days (12.79) and 7-days (4.64) for any cause for patients living in high income level communities was the lowest.

F. **Readmissions Rate by Expected Payer, 2019**

Figure8. Represents readmission rates within 30-days and 7-days for any cause by expected payer in 2019.



- ***Patients with Medicare have the highest readmission rate within 30-days and 7-days for any cause.***

Among Medicare covered patients, readmission rates within 30-days for any cause were highest (16.99), followed by Medicaid (13.9), uninsured (11.92) and private insurance (8.94). Similarly, readmission rates within 7-days for any cause among Medicare covered patients were highest (5.92), followed by Medicaid (5.08), uninsured (4.74) and private insurance (3.37).

4. Limitations associated with NRD data of HCUP database

1) De-identified data is freely available for use. For complete data, one has to pay and follow the instructions.
2) Limited data availability. Data on all diagnostic procedures is only available from the year 2016-2019.
3) A lot of data is missing.
4) No data was provided on patients' access to healthcare facilities, geographic location, race and ethnicity.
5) No recent data is available. The latest data is for the year 2019.

5. Challenges in reducing patient readmissions

1) *Limited information on hospital readmissions*

   Most healthcare providers have limited or no knowledge about the metrics of patient readmissions. Even though some hospitals have a tracking mechanism to identify the number of patients readmitted to their hospital, but none could really track readmissions in other facilities. So, the readmission rates of the hospital are not 100% accurate.

2) *Negative impact of HRRP on hospital readmissions*

   Even though the Hospital Readmission Reduction Program established in 2012 aided in the reduction of readmissions but several high minority hospitals are concerned over limited adjustment for social determinants of health, as well as patients' compliance to medications and treatments. All these factors add to high readmission rates and penalties in the HRRP taking away some of the essential resources from the hospital.

3) *Limited care outside the walls of a hospital*

   Many hospitals try to use the readmission guides and toolkits, but find them too resource-intensive to target specific strata of the patient population. Many patients may resist home visits by healthcare providers because they don't want to allow a stranger inside the house for their safety.

4) *Difficulty in implementing change outside the hospital*

   Access to care outside hospitals is one of the biggest challenges. Most patients living in low-income communities don't have access to primary care. And it is something not possible for the hospital to implement a change outside its jurisdiction [9].

6. MetroHealth Case Management

Being able to connect with one of the healthcare providers at MetroHealth, I was able to gain some insights into their strategy for reducing patient readmissions (some of these are discussed below).

- Post Discharge Planning – Coordinate with care facilities to ease the transition of patients to new surroundings.
- Counseling – Connect with agencies to address issues like pregnancy, substance abuse, alcohol abuse, domestic violence, etc.
- Medication Assistance – Provide assistance to identify sources for more economical medications.
- Psychosocial Assessment – Obtain information on social factors that affect patients' health and recovery.
- Consultation- Connect with a healthcare team to aid with medical management.

6. Discussion

Based on all the rates obtained in the analysis, we can conclude that readmission rates within 30-days and 7-days for any cause were highest in,

- patients aged 45-64 years
- males
- patients residing in metropolitan areas

- patients in low-income communities
- Medicare covered patients

which also means these areas should be the focal point of our resource allocation.

AGENCY	CMS	HRSA	CDC	ACL	ACF	SAMHSA
Housing Related Services	X	X		X	X	X
Home Modifications and Improvements	X	X	X	X		
Food Access	X		X	X	X	
Non-Emergency Medical Transportation	X	X		X		
Public Transportation			X	X		
Case Management & Social Service Connection	X			X	X	X
Community Health Workers	X	X	X	X		
Social and Economic Mobility			X		X	

Table2. Selected Evidence Based Interventions used in HHS Agencies.

To date, some of the major interventions like housing-related services, home modifications, food access, case management etc., have been made by several agencies like CMS, CDC, HRSA, ACL, ACF and SAMHSA to reduce patient readmissions [10].

The analysis and literature study revealed more fundamental issues –

- There is no standard method of collection of SDOH data in hospitals.
- The data in the HCUP database is not recent and has a lot of missing values.
- Not everyone in a healthcare setting is aware of the readmission rates of their institute.

The work that has been done till now in this domain seems haphazard. There is an urgent need to start afresh and implement a system adoption life cycle to assess the present state and make changes for the future state accordingly.

7. Go Forward

There are plenty of political, legal, financial and technological issues with increased rates of hospital readmissions, but one of the most pressing among them is social determinants of health. We are stuck at the very first transition of the data science life cycle, we know what the problem we are solving is, but there isn't enough data!!

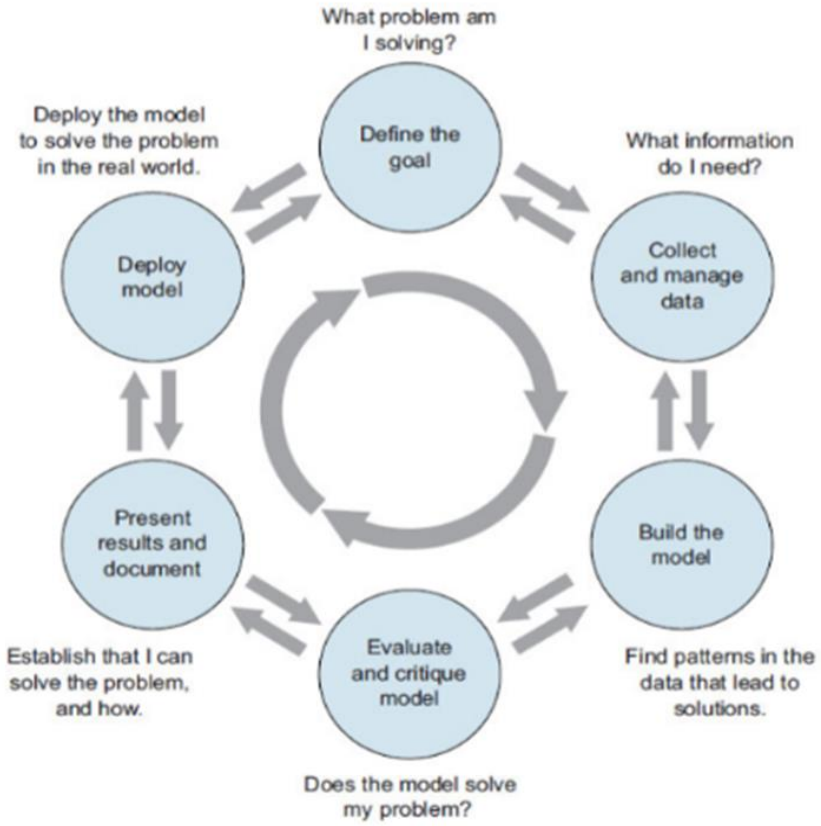


Figure9. Data Science Life Cycle

To deal with this situation, first, we need to collect all the critical data on race, ethnicity, language, disability, education, family support, etc., and the list goes on. And this should not be limited to data collection, but keeping a check if the data is up to date is also critical to make meaningful predictions on a diverse population. With the information gained from the analysis, we can identify the roadmap and address the root causes and disparities. One way to address the root problem is to build a multi-disciplinary team to address the grievances of patients from diverse communities. A great support team will aid in overcoming obstacles in patients' lives.

We must also use EHR data on SDOH (on variables like income status, education, occupation, housing status, food security, race, ethnicity, immigration status, sexual orientation, gender identity, intimate partner violence, social connectedness, disability status, family size and status, religion and spirituality, access to services, and neighborhood socioeconomic conditions, and others) and implement models to predict readmissions rates on regular intervals using NLP and artificial intelligence. There are plenty of tools at our disposal. The data on SDOH can be collected from physicians' notes or survey instruments [11].

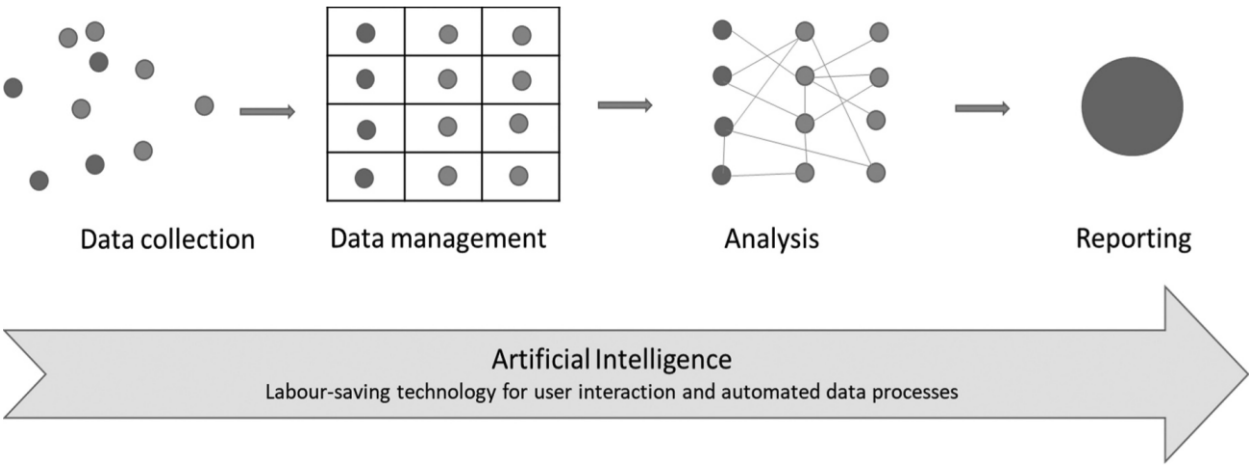


Figure10. Flow of information.

References

Special thanks to Dr. Kiron Nair, MD, MetroHealth, Cleveland.

[1] C. M. Hood, K. P. Gennuso, G. R. Swain, and B. B. Catlin, "County Health Rankings: Relationships Between Determinant Factors and Health Outcomes," *Am. J. Prev. Med.*, vol. 50, no. 2, pp. 129–135, Feb. 2016, doi: 10.1016/J.AMEPRE.2015.08.024.

[2] J. Carter, C. Ward, A. Thorndike, K. Donelan, and D. J. Wexler, "Social Factors and Patient Perceptions Associated With Preventable Hospital Readmissions," *J. patient Exp.*, vol. 7, no. 1, pp. 19–26, Feb. 2020, doi: 10.1177/2374373518825143.

[3] HHS and CMS, "Utilization of Z Codes for Social Determinants of Health among Medicare Fee-for-Service Beneficiaries, 2019 Background," 2019, Accessed: Sep. 22, 2022. [Online]. Available: https://www.google.com/search?q=Utilization+of+Z+Codes+for+Social+Determinants+of+Health+among+Medicare+Fee-for-Service+Beneficiaries%2C+2019&rlz=1C1EJFC_enIN918IN918&oq=Utilization+of+Z+Codes+for+Social+Determinants+of+Health+among+Medicare+Fee-for-Servi.

[4] Office of Disease Prevention and Health Promotion, "Social Determinants of Health - Healthy People 2030 | health.gov," *U.S Deparment of Health and Human Services*, 2021. https://health.gov/healthypeople/priority-areas/social-determinants-health (accessed Sep. 21, 2022).

[5] K. E. Joynt, E. J. Orav, and A. K. Jha, "Thirty-day readmission rates for Medicare beneficiaries by race and site of care," *JAMA*, vol. 305, no. 7, pp. 675–681, Feb. 2011, doi: 10.1001/JAMA.2011.123.

[6] J. Herrin, J. St. Andre, K. Kenward, M. S. Joshi, A. M. J. Audet, and S. C. Hines, "Community Factors and Hospital Readmission Rates," *Health Serv. Res.*, vol. 50, no. 1, p. 20, Feb. 2015, doi: 10.1111/1475-6773.12177.

[7] W. P. Bensken, P. M. Alberti, and S. M. Koroukian, "Health-Related Social Needs and Increased Readmission Rates: Findings from the Nationwide Readmissions Database," *J. Gen. Intern. Med.*, vol. 36, no. 5, pp. 1173–1180, May 2021, doi: 10.1007/S11606-021-06646-3.

[8] "HCUPnet Data Tools | AHRQ Data Tools." https://datatools.ahrq.gov/hcupnet?count=12&tab=hcnir&type=subtab (accessed Oct. 19, 2022).

[9] K. E. Joynt, N. Sarma, A. M. Epstein, A. K. Jha, and J. S. Weissman, "Challenges in Reducing Readmissions: Lessons from Leadership and Frontline Personnel at Eight

Minority-Serving Hospitals," *Jt. Comm. J. Qual. patient Saf.*, vol. 40, no. 10, p. 435, Oct. 2014, doi: 10.1016/S1553-7250(14)40056-4.

[10] A. Whitman, N. De Lew, A. Chappel, V. Aysola, R. Zuckerman, and B. D. Sommers, "Addressing Social Determinants of Health: Examples of Successful Evidence-Based Strategies and Current Federal Efforts."

[11] K. Berg, C. Doktorchik, H. Quan, and V. Saini, "Automating data collection methods in electronic health record systems: a Social Determinant of Health (SDOH) viewpoint," *https://doi.org/10.1080/20476965.2022.2075796*, 2022, doi: 10.1080/20476965.2022.2075796.