



# Addressing Health Equity through AI-driven SDOH Insights

## Alvee Health SDOH Extractor Model Case Study

September 2024

### Key Themes:

- Health Equity
- Social Determinants of Health (SDOH)
- Artificial Intelligence in Healthcare
- Operational Efficiency
- Revenue Optimization
- Population Health Management

**SDOH Insights Meet Automation**

***Better Care, Bigger Impact***

# Alvee Health SDOH Extractor Model: A Case Study on Health Equity through AI-driven Insights

## Overview

Alvee Health developed the Social Determinants of Health (SDOH) Extractor Model, an innovative AI-powered solution aimed at addressing healthcare disparities by extracting actionable insights from unstructured clinical notes. This case study details the project's objectives, methodology, implementation, outcomes, and future expansion plans.

## Problem Statement

Healthcare providers frequently overlook critical social determinants of health such as housing instability, food insecurity, and social isolation due to difficulties in extracting structured insights from unstructured clinical data. This omission exacerbates health disparities, disproportionately impacting underserved populations. The traditional manual review process for identifying SDOH is inefficient, labor-intensive, and prone to inaccuracies.

## Methodology

Alvee Health identified the need through comprehensive healthcare provider interviews, literature reviews, and clinical data workflow analyses. Research indicates that up to 80% of health outcomes correlate with non-clinical factors like socioeconomic status and environment, yet these factors remain underrepresented due to unstructured clinical documentation. Correlation analyses between SDOH and health outcomes further validated the necessity for an automated extraction solution.

## Solution Implementation

Alvee Health developed the SDOH Extractor Model using advanced natural language processing (NLP) techniques. This model:

- Automatically extracts and categorizes SDOH from clinical notes into standardized formats (e.g., ICD-10 Z codes).

- Integrates seamlessly into existing Electronic Health Records (EHR) platforms, providing real-time insights.
- Replaces manual chart review, significantly reducing the review process from several hours per patient to less than one second.
- Enhances revenue capture by accurately coding complex patient visits involving social needs.

## Unique Approach

The Alvee SDOH Extractor uniquely leverages deep learning and semantic search techniques, providing high precision in real-time extraction. It features a dynamic feedback loop, continuously refining its accuracy based on clinician input. This capability ensures adaptability and sustained effectiveness.

An analysis of 400,000 outpatient visits demonstrated the solution's substantial financial impact, revealing a potential reimbursement opportunity of \$4.6 million when accurately identifying SDOH.

## Project Goals and Internal Stakeholders

The project aimed to:

- Improve health equity through automated, actionable SDOH insights.
- Enhance clinical workflow efficiency by reducing manual review processes.
- Optimize revenue through accurate billing and coding for SDOH-related visits.
- Ensure scalability through seamless EHR integration.

Key stakeholders included:

- **Dr. Rehan Choudhry (Lead Data Scientist):** Developed the NLP algorithms and models.
- **Nicole Cook (CEO):** Ensured practical healthcare integration aligned with technical development.
- **Mayo Platform\_Accelerate Team:** Provided mentorship and industry-aligned optimization.

## Challenges and Solutions

One of the primary challenges was the variability in how SDOH are recorded across different healthcare systems. SDOH data often lacks standardization, with differences in terminology and documentation practices complicating the extraction process. Additionally, SDOH data was previously uncharted territory, as healthcare systems

traditionally focused on structured clinical data, leaving SDOH data fragmented or hidden within unstructured text.

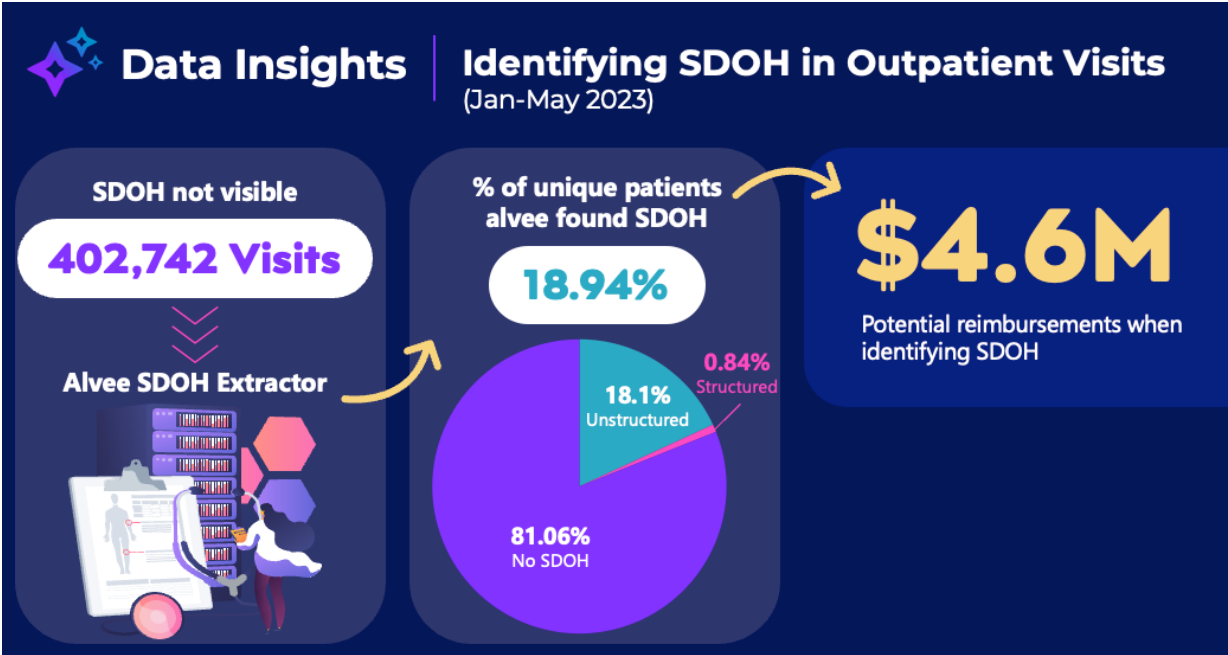
To address this, the SDOH Extractor incorporated semantic search algorithms that allowed it to understand the context and meaning of various terms and phrases related to SDOH, regardless of the specific wording used. These algorithms helped uncover hidden data elements that might otherwise go unnoticed due to the lack of structure in SDOH data. A dynamic feedback loop was also implemented, enabling healthcare providers to review the extracted data and provide feedback, which the model used to improve its accuracy over time.

Integrating the SDOH Extractor into existing EHR systems without disrupting established workflows was another significant challenge. This was successfully addressed through close collaboration with healthcare providers and other key stakeholders, ensuring a seamless integration that enhanced operational efficiency and maintained continuity of care.

## Outcomes

Based on the measurements from the project involving the development of the Alvee SDOH Extractor AI model, here are the outcomes achieved across different dimensions:

**Clinical Outcomes:** The model helped uncover 18.94% of patients with previously undetected social needs across 402,742 outpatient visits. This information allows for better care coordination and adjustments in medical decision-making, leading to improved patient outcomes.



**Operational Efficiency:** The extraction of SDOH from clinical notes reduced the time for chart reviews from 5 hours to less than 1 second. This dramatically improved workflow efficiency for healthcare providers.

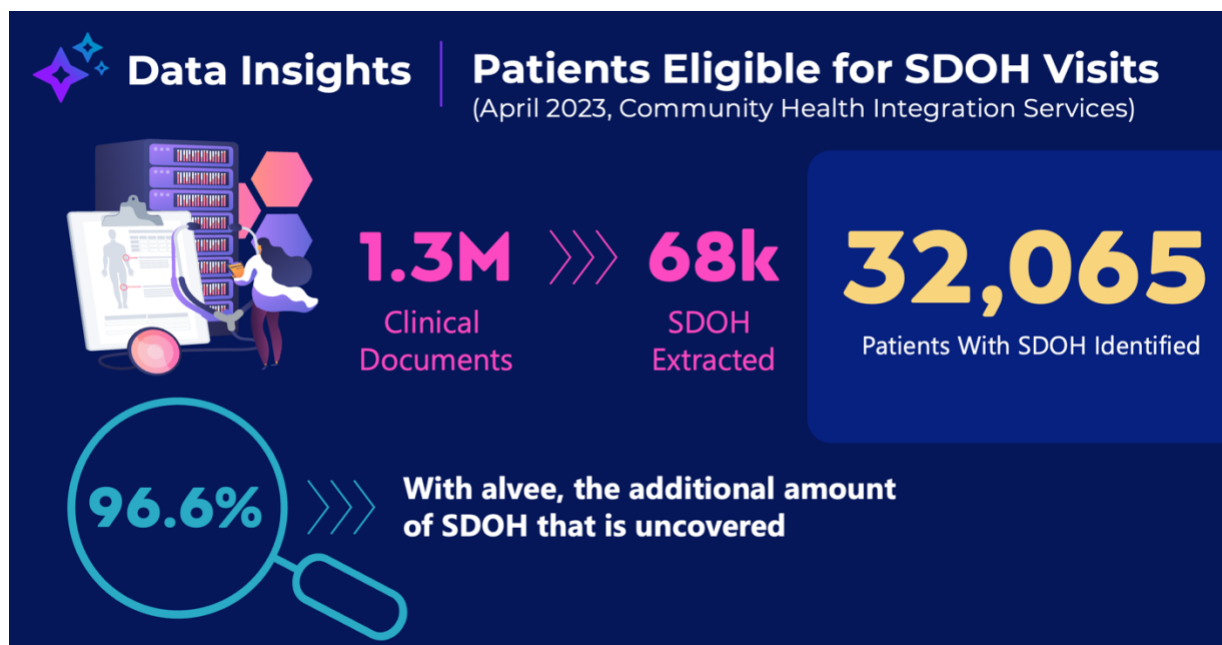
**Financial Outcomes:** The identification of SDOH led to potential additional reimbursements of approximately \$4.6 million by increasing medical decision-making complexity from "Low" to "Moderate" risk. Moreover, monthly projections showed an additional \$1.1 million from SDOH assessments, with a total of \$5.5 million potential reimbursements from January to May 2023.

**Population Health Outcomes:** The project highlighted that uncovering SDOH factors, such as problems related to living alone, correlated with increased risks of conditions like hypertension, enabling more targeted interventions.

These outcomes demonstrate the value of using AI to address health disparities, improve operational efficiency, and unlock significant financial opportunities for healthcare organizations.

## Metrics

Our team designed several fit-for-purpose metrics for this project, one of which focused on SDOH Visit Eligibility. This metric was key in identifying patients who were eligible for reimbursement under specific SDOH-related visits. By scanning 1.3 million clinical documents for 315,788 patients, we identified that 10.15% of patients had detectable SDOH, with the vast majority of these (96.58%) found in unstructured data. This SDOH Visit Eligibility metric became an essential component for estimating the financial impact of addressing SDOH needs.



Integration with the SDOH Reimbursement Calculator: The SDOH Visit Eligibility metric directly informed the default values used in our SDOH Reimbursement Calculator.

**For example:** Eligibility Rate: The detection of SDOH in 10.15% of patients helped us set a baseline estimate of the percentage of patients who could qualify for SDOH-related interventions. This default rate was incorporated into the calculator to help users gauge the number of eligible patients they might encounter in their practice. The SDOH Visit Eligibility metric not only informed the calculator's default values but also provided a real-world benchmark to guide healthcare providers in estimating both patient eligibility and potential reimbursement. These tailored metrics ensure the calculator can offer accurate, actionable insights to inform decision-making around SDOH interventions.

## Additional Impacts

Beyond measurable clinical and financial outcomes, a significant achievement not captured by traditional metrics is the re-humanization of care through AI-driven SDOH detection. By uncovering hidden social needs, our project enables healthcare providers to address barriers such as housing, food insecurity, and social isolation—factors that profoundly impact patient well-being but are often missed. This will lead to more holistic care and improved patient-provider relationships. Additionally, the project fosters health equity, ensuring that marginalized and vulnerable populations receive the support they need, even when SDOH are not readily visible in clinical workflows. These outcomes go beyond standard clinical or financial metrics.

## Sustainability and Expansion

Plans include expanding the SDOH Extractor to more healthcare organizations and further enhancing its capabilities by integrating additional social and economic factors. Partnerships with public health organizations are also being explored to ensure long-term sustainability and broader impact in addressing health inequities.

## Key Lessons Learned

- Automating SDOH extraction significantly advances health equity and operational efficiency.
- Continuous feedback loops ensure sustained accuracy and relevance of AI models.
- Addressing social determinants systematically can unlock substantial financial and clinical benefits for healthcare organizations.

This case study underscores the transformative potential of AI-driven solutions in bridging clinical and operational gaps, paving the way for equitable healthcare interventions.