ORIGINAL RESEARCH

# Teaching students to identify and document social determinants of health

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**Purpose:** Social determinants of health (SDH) are responsible for significant health disparities, morbidity and mortality. It is important to acculturate trainees to identify and document SDH. This can elevate their perceptions related to the importance and relevance of SDH. Documentation can encourage trainees to see SDH as factors which medical providers should address.

**Patients and methods:** Researchers devised a novel approach to demonstrate the value of SDH to undergraduate medical students. Proprietary diagnostic codes for SDH and procedure codes for action taken to address them, were developed. Students were encouraged to log these into electronic records for clinical encounters. Students' voluntary use of these codes was evaluated. Additionally, students were surveyed on their familiarity with the concept of SDH, their perceptions of the importance of SDH, as well as documenting SDH, twice in the study period, and results were compared. In their second year of use, proprietary codes were compared to newly available SDH related ICD-10 codes.

**Results:** Students utilized proprietary codes more often than SDH related ICD-10 codes. Over 20,000 codes were logged. Comparison of survey items showed modest increases in students' positive perception about the role of SDH in patient health.

**Conclusion:** Students' voluntary logging of SDH codes demonstrates they perceived these factors to be important and relevant to patient encounters. Future analyses will examine students' knowledge, attitudes, beliefs and practice patterns related to SDH.

**Keywords:** social determinants of health, medical education, constructivist learning, electronic health record

## Introduction

The significant health effects of social factors such as the environment, community, family structures and circumstances are well recognized.[1] Known as the social determinants of health (SDH), the World Health Organization (WHO) identifies these factors as responsible for the avoidable health disparities that exist between communities. SDH are highly intersectional and continue to affect health outcomes in additive capacities.[2] They are also responsible for observed rates of excess morbidity and mortality: In 2000, an estimated 119,000 deaths were due to income inequality, 162,000 to low social support, 176,000 to racial segregation and 245,000 to low levels of education.[3]

Given the significant impact SDH have on health and well-being, it is important for medical providers to recognize SDH and be acculturated to identify and document them like other clinical conditions. The American College of Physicians (ACP) emphasizes that health care professionals should know how to screen for

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and identify SDH and should work with others to address the important social factors influencing patients.[4] The ACP further recommends SDH and health inequities be integrated into medical education at all levels.[4] The salient goal of training medical students to identify and address SDH is to equip practitioners with the worldview necessary to alleviate disparities.[5] Competency in SDH is a necessary skill for trainee doctors to possess in order for them to address all needs of their patients.[6]

One tool in promoting SDH competency is the Electronic Health Record (EHR), which is increasingly becoming important for individual and population health, and can be harnessed to address SDH. The National Academy of Medicine (NAM), formerly known as the Institute of Medicine, calls to incorporate at least 16 patient-reported SDH measures and one neighborhood characteristic measure in electronic health records.[7] EHRs have been used to connect patients in need with necessary social services to provide care to special populations, such as homeless veterans.[8] With accessibility in the EHR, SDH become part of what must be considered by health care teams. This allows providers to address SDH alongside clinical conditions. Documenting SDH in the medical record is a way to acknowledge these factors as medically relevant. It is critical to ensure medical students are proficient at documenting all important patient conditions and care, including SDH.[9]

Following a 2004 NAM recommendation to integrate social and behavioral science competencies in medical curriculum, the Accreditation Council for Graduate Medical Education developed SDH competencies. However, a reliable method of teaching SDH to students, which may also help transform their future practice, is yet to be determined. A literature review on the subject of methods for teaching SDH in medical curriculum yielded very few results, and none of the approaches found were evaluated for efficacy.[10,11] Pedagogical approaches to teaching SDH that are innovative, collaborative, participatory and transformative are key to making future practitioners well-equipped and service-ready to face the challenges posed by health disparities.[12]

Practical programs are needed to train students to appreciate the importance of identifying and addressing SDH. Students at the A.T. Still Univeristy School of Osteopathic Medicine in Arizona (ATSU SOMA) are exposed to service learning opportunities from their second year of medical education when they are embedded in community health centers as student doctors serving underserved communities under the stewardship and guidance of regional directors of medical education. As such, ATSU SOMA students encounter SDH frequently in their patient encounters.

In 2015 a student wrote in a report to her professor reflecting on a particular patient encounter.

> Today I had the privilege of being able to talk to a gentleman (my patient) for almost twenty minutes. When I log him into E*Value, the school's logging program for patients, he will be reduced to 'hypertensive crisis, sleep apnea, pacemaker, obesity, and substance abuse.' I wish we could log 'insufficient resources' or 'experiencing homelessness' or any of a number of social challenges he faces that compromise his health. He isn't able to hold a job because he falls asleep when he sits. Why? Because his sleep apnea is so bad he doesn't sleep. If he had stable housing he would be on CPAP at night. But to have stable housing you have to have income.

This incentivized faculty to devise a constructivist learning method and objective for medical curriculum which would help students recognize, document and value SDH at par with medical conditions. A constructivist learning approach emphasizes that learning occurs when students are actively involved in constructing meaning.[13] The objective of this intervention was to teach students to recognize SDH as independent and important factors affecting health, which are within the realm of what medical providers should address.

The teaching method which involved coding SDH in a teaching EHR, was implemented and then evaluated over two years with five cohorts of students. Primary questions that drove the evaluation were:

1. How many times were SDH codes recorded?
2. Are students familiar with the concept of SDH? Were there changes in their self-perception of SDH over the study period?
3. Do students think that addressing the role of SDH is important while providing care? Were there changes in this value over the study period?
4. Do students think that documenting SDH in EHR is important to the health of patients? Were there changes in their perception over the study period?

## Materials and methods

ATSU SOMA uses E*Value, a MedHub product designed as both a learning tool and mechanism for ensuring standardization of instruction. Starting in their second academic-year, students are required to log diagnostic and

procedure codes for all patient encounters. Procedures were logged irrespective of whether they were observed, assisted or independently performed.

Early in 2015, faculty created a list of 18 diagnosis and 7 procedure codes for SDH and added these proprietary codes to E*Value (Table 1). These were based on factors widely defined as SDH and commonly encountered in medical settings. The codes were developed from the NAM's committee on the recommended social and behavioural measures for electronic health report,[14] and the

**Table 1** Proprietary social determinants of health diagnosis and procedure codes defined

| Diagnosis Code | Definition |
|---|---|
| Poverty | Income below poverty line; lack of basic needs such as nutrition, clothing, shelter. |
| Near Poverty | Just enough money to meet basic needs but not enough for extras. Qualifies for sliding fee discounts at Federally Qualified Health Centers. |
| Food Insecurity | Does not have reliable access to sufficient quantity of affordable, nutritious food. Does not know where next meal is coming from. May live in food desert. |
| Experiencing Unstable Housing or Homelessness | Does not have permanent housing, may live on the streets, in a shelter, mission, abandoned building, vehicle or any unstable non-permanent situation. |
| Poor Quality Housing | Living in housing unit with physical problems (deficiencies in plumbing, heating, electricity, hallways and upkeep) or the presence of negative characteristics (evidence of rodents, water leaks, peeling paint, absences of working smoke detector). |
| Lack of or No Insurance | Either no health insurance or has insurance which is not sufficient to cover medical expenses or doesn't cover medications. Prohibits seeking care or follow through. |
| Lack of Access to Healthcare | Living in a medically underserved area where access to primary care and other services is limited. |
| Health Literacy Limitations | Not having the capacity to obtain, process and understand basic health information and services needed to make appropriate health decisions. |
| Unemployed or Underemployed | Being unemployed or having employment which is insufficient in some way including low pay or unavailability of hours to work. |
| Unstable Work Schedule | Difficulty scheduling or keeping appointments due to variable work schedule; multiple jobs, varying start/stop times, long shifts or unsure when will work. Person may be a migrant worker who relocates frequently due to work availability. |
| Family Care Demands | Responsibilities at home caring for others (children, partner, parents, and family) which prevent person from caring for themselves. |
| Transportation Issues | Hard to get to appointments due to lack of transportation. Does not own vehicle, can't afford public transportation, lives far from public transportation or services unreliable. |
| Educational Limitations | Observed difficulty processing and understanding information. Can include difficulty reading, listening, asking questions or applying information. |
| Language Barriers | Primary language not English; inability to communicate freely and openly with provider. |
| Cultural Barrier | Cultural background is not in concordance with Western Medicine. May believe Western Medicine can be detrimental or is the place of last resort. Beliefs may conflict with medical care - prohibit patient from seeking care or adhering to treatment plan. |
| Immigrant Status | Not born in US, now living here legally or illegally. Can have difficulty obtaining public assistance if "illegal". May be child with legal status whose parents do not have legal status. |
| Poor Neighborhood Composition | Not feel safe going outside in neighborhood, threat of crime/violence. Under stress from environment. Children can't play outside, can't exercise, hard to get to appointments. |
| Social Isolation | Lacking a sense of belonging socially, lacking engagement with others, has a minimal number of social contacts and is deficient in fulfilling and quality relationships. |
| **Procedure Code** | **Definition** |
| Crisis Intervention | Immediate, short-term help to resolve emotional, mental, physical and behavioral distress or problems. |
| Educational Materials Provided | Provision of materials to help educate on conditions, medications, treatments, services, etc. |
| Extended Appointment Time | Patient encounter lasting beyond regularly scheduled appointment time. |
| Family Counseling | Working with a whole family unit to improve communication, resolve conflicts and encourage changes for a healthier lifestyle. |
| Lifestyle Counseling | Working with a patient to improve healthy choices and discontinue habits that may be impeding health. |
| Referral to Health Center Services | Referral to a service or program offered within the health center. |
| Referral to External Services | Referral to a service or program provided by external institutions. |

Healthy People 2020 Social Determinants of Health Framework,[15] along with insight from the WHO definition of SDH.[16] A list was developed from these inputs and then reviewed by clinical faculty at ATSU SOMA, who have significant experience working in health center settings. This resulted in small revisions and a comprehensive list. The list was pilot tested as part of a health center clinic-based "card study" and then further refined.[17]

## Project year 1

Project year 1 (PY1) ran concurrently with Academic Year 2015–2016. At the start of this year, students and faculty were informed about the additional proprietary SDH codes available within E*Value. Students were given the ability to log "SDH diagnoses" and any of the corresponding procedures performed to address the SDH. A code for "other" was included. This code was to record any factors students observed and deemed to be a SDH not included in the available codes.

## Project year 2

Project year 2 (PY2) began with the start of Academic Year 2016–2017. At this time, the US Department of Health and Human Services mandate for use of the ICD Tenth Revision, Clinical Modification (ICD-10-CM) came into effect. The ICD codes were now incorporated into E*Value, replacing the prior system of codes organized by body system.

The ICD-10-CM includes almost 92,000 codes, including a collection related to SDH (subsection Z55 – Z65); hereafter referred to as Z-codes. These Z-codes are identified as codes for persons having potential health risks related to socioeconomic and psychosocial circumstances. Some overlap was found between the proprietary SDH codes and the newly added Z-codes. A full comparison of the proprietary SDH diagnostic does and the Z-codes is provided in Table 2. While the full ICD-10-CM was available to students, the proprietary SDH codes remained as options within E*Value. Students were free to utilize all codes.

## Measures

The first evaluation question was measured by tallying the total number of codes (any) reported on E*Value by 2nd, 3rd and 4th year students and how often they utilized SDH codes. The remaining evaluation questions were measured through a survey that was administered twice, first at the end of PY1 and again at the end of PY2.

After PY1, students in academic years 2, 3 and 4 (Classes of 2018, 2017 and 2016, respectively) had accessed the proprietary codes and were able to utilize them during clinical experiences. They were surveyed on their experience using the codes and their perceptions of the importance of SDH and the need for documenting them in the medical record.

Students in their first academic year (Class of 2019) were surveyed prior to their introduction to the codes and starting their clinical experience. This class was asked similar questions about their perceptions of the importance of SDH and addressing them during clinical encounters. This survey was used as a baseline to identify their perceptions prior to utilizing SDH codes, which could be used to compare any changes after each year of use.

The same survey was administered similarly in PY2; this time to the classes of 2017, 2018, 2019, and 2020. Students in the classes of 2018 and 2017, now 3rd and 4th year students, were responding based on 2 years of using the proprietary codes. Students in the class of 2019, 2nd years, were responding based on their first year of using the codes. As in PY1, the class of 2020 (1st year) was surveyed as a baseline measure.

Results were reported by project year and item response using descriptive statistics in order to show differences in frequency or proportion of response change over the project period.

## Results
## Use of codes

Table 3 shows the frequency of students logging proprietary SDH codes over the 2 project years with the addition of Z-codes in PY2. During PY1, 193 individual students utilized the SDH codes and logged a total of 12,765 SDH diagnoses and 5,040 procedures. All 18 diagnosis codes, and the option for "other" were logged. SDH codes accounted for 3.11% of the 410,142 diagnosis codes logged by all students.

During PY2, 181 individual students utilized all SDH codes, logging a total of 11,808 diagnoses and 3,798 procedures. An additional 745 Z-codes relating to social factors were recorded. Proprietary SDH diagnosis codes accounted for 3.54% of the 333,530 diagnosis codes logged by all students. With the inclusion of Z-codes, SDH related diagnoses accounted for 3.76% of all logged codes.

**Table 2** Comparison of social determinants of health (SDH) codes and ICD 10-CM Z-codes

| Applicable ICD-10 Codes | Comparisons |
|---|---|
| **Poverty** | |
| **Z59.5** Extreme poverty | Removal of the word extreme may make the ICD-10 code more applicable to a larger range of individuals who may need services or assistance. |
| **Near Poverty** | |
| **Z59.6** Low income | Relatively good match. |
| **Food Insecure** | |
| **Z59.4** Lack of adequate food and safedrinking water | Relatively good match. It would be advantageous to have additional codes which address ability to afford food separately from food access. |
| **Unstable Housing or Experiencing Homelessness** | |
| **Z59.0** Homelessness<br>**Z59.1** Inadequate housing | Relatively good matches. It may be advantageous to combine the ICD-10 codes into one code as a patient's living situation may change regularly and the health implications remain the same. |
| **Poor Quality Housing** | |
| **Z59.8** Other problems related to housing and economic conditions<br>**Z59.9** Problem related to housing and economic conditions, unspecified | ICD-10 codes are too general to be actionable. One, more specific code would allow better identification of issues related to housing conditions which may be impacting health. |
| **Lack of or No Insurance** | |
| **Z59.7** Insufficient social insurance and welfare support | ICD-10 code does not directly reference health insurance. |
| **Lack of Access to Healthcare** | |
| None Identified | A code related to healthcare access could help identify patients who do not regularly receive medical care and may be unable to easily meet with specialists or receive regular preventive services. |
| **Health Literacy Limitations** | |
| None Identified | Health literacy is an important issue and should be identified separately from education level. Level of health literacy should be considered for all patients and a specific code could help identify those who may be at-risk of non-compliance due to lack of understanding. |
| **Unemployed or Underemployed** | |
| **Z56.0** Unemployment, unspecified<br>**Z56.89** Other problems related to employment<br>**Z56.9** Unspecified problems related to employment | Relatively good matches. The addition of underemployed allows identification of patients who may be employed but are not earning enough income to able to meet all of their basic needs. One code addressing insufficient level of employment, could apply to more individuals both unemployed and underemployed. |
| **Unstable Work Schedule** | |
| **Z56.3** Stressful work schedule | Relatively good match. ICD-10 code may include schedules which are consistent but perceived to be stressful, whereas the SDH code accounts for work schedules which fluctuate, inhibiting ability to plan health appointments. Suggest combination of stressful and unstable work schedules into one code. |

(*Continued*)

**Table 2** (Continued).

| Applicable ICD-10 Codes | Comparisons |
|---|---|
| **Family Care Demands** | |
| **Z63.6** Dependent relative needing care at home<br>**Z63.72** Alcoholism and drug addiction in family<br>**Z63.79** Other stressful life events affecting family and household<br>**Z63.8** Other specified problems related to primary support group<br>**Z63.9** Problem related to primary support group, unspecified | Relatively good matches. ICD-10 codes may be overly specific. One code which encompasses family circumstances which prevent a patient from properly caring for themselves may be easier to document and follow-up on. The codes need a connection to the effect on the patient's own health. |
| **Transportation Issues** | |
| None Identified | Lack of transportation is commonly identified as a social determinant of health and plays a paramount role in a patient's ability to seek medical care. Documenting this may help patients receive services to assist with transportation. |
| **Educational Limitations** | |
| **Z55.0** Illiteracy and low-level literacy<br>**Z55.1** Schooling unavailable and unattainable<br>**Z55.2** Failed school examinations<br>**Z55.3** Underachievement in school<br>**Z55.4** Educational maladjustment and discord with teachers and classmates<br>**Z55.8** Other problems related to education and literacy<br>**Z55.9** Problem related to education and literacy, unspecified | Relatively good matches include 55.0, 55.8 and 55.9. Issues relating to literacy are included as part of the SDH code and may not need a separate code. The remaining codes are most likely relevant to children only and are overly specific. The SDH code could be made into two codes, one specific to adults and one specific to children. |
| **Language Barrier** | |
| None Identified | It is not uncommon for patients to speak a primary language different to their provider. This barrier to communication should be an important consideration and documentation of it may help place patients with translators or providers who may be better able to communicate with them. |
| **Cultural Barrier** | |
| **Z60.3** Acculturation difficulty | Relatively good match. The SDH code is better suited to identify patients who have beliefs or customs prohibiting them from complying with medical treatment or recommendations. This is important to distinguish as it directly impacts a patient's health decisions. |
| **Immigrant Status** | |
| None Identified | Although not inherently a source of issue, it is important to document the residency status of patients who have immigrated, as they may have limited resources due to their status. Logging of this code may facilitate connection to available resources. |
| **Poor Neighborhood Composition** | |
| **Z59.2** Discord with neighbors, lodgers or landlord | The ICD-10 code is one issue which may contribute to poor neighborhood composition, but does not address other potential issues such as neighborhood violence, lack of recreational area or environmental pollution. The SDH code allows for greater identification of patients who may be experiencing issues in their neighborhood not commonly discussed. |
| **Social Isolation** | |

(*Continued*)

**Table 2** (Continued).

| Applicable ICD-10 Codes | Comparisons |
|---|---|
| **Z60.2** Problems living alone<br>**Z60.4** Social exclusion and rejection<br>**Z60.8** Other problems related to social environment<br>**Z60.9** Problem related to social environment, unspecified | Relatively good matches. The SDH code may be applicable to a greater number of patients who might not overtly express discontent or trouble with being alone, but may be at-risk for such issues due to a lack of support. |
| **Other** | |
| **Z56.1** Change of job<br>**Z56.2** Threat of job loss<br>**Z56.4** Discord with boss and workmates<br>**Z56.5** Uncongenial work environment<br>**Z56.6** Other physical and mental strain related to work<br>**Z56.81** Sexual harassment on the job<br>**Z56.82** Military deployment status | This selection of ICD-10 codes is worth considering and could perhaps be included in an additional SDH code related to work conditions. |
| **Z57.0** Occupational exposure to noise<br>**Z57.1** Occupational exposure to radiation<br>**Z57.2** Occupational exposure to dust<br>**Z57.31** Occupational exposure to environmental tobacco smoke<br>**Z57.39** Occupational exposure to other air contaminants<br>**Z57.4** Occupational exposure to toxic agents in agriculture<br>**Z57.5** Occupational exposure to toxic agents in other industries<br>**Z57.6** Occupational exposure to extreme temperature<br>**Z57.7** Occupational exposure to vibration<br>**Z57.8** Occupational exposure to other risk factors<br>**Z57.9** Occupational exposure to unspecified risk factor | This selection of ICD-10 codes is important, but addresses environmental rather than social factors. These codes would be improved with the inclusion of similar exposures in the home environment. |
| **Z59.3** Problems related to living in residential institution | This ICD-10 code addresses an important issue relevant to individuals in the foster system and those in treatment at hospitals or clinics. However, the implications extend beyond living situation. A SDH code related to adverse experiences should be considered. |
| **Z60.0** Problems of adjustment to life-cycle transitions<br>**Z60.5** Target of (perceived) adverse discrimination and persecution | This selection of codes describes issues related to social environment and could be included in a SDH code related to lack of social support. |
| **Z62.0** Inadequate parental supervision and control<br>**Z62.1** Parental overprotection<br>**Z62.21** Child in welfare custody<br>**Z62.22** Institutional upbringing<br>**Z62.29** Other upbringing away from parents<br>**Z62.3** Hostility towards and scapegoating of child<br>**Z62.6** Inappropriate (excessive) parental pressure<br>**Z62.810** Personal history of physical and sexual abuse in childhood<br>**Z62.811** Personal history of psychological abuse in childhood<br>**Z62.812** Personal history of neglect in childhood<br>**Z62.819** Personal history of unspecified abuse in childhood<br>**Z62.820** Parent-biological child conflict<br>**Z62.821** Parent-adopted child conflict<br>**Z62.822** Parent-foster child conflict<br>**Z62.890** Parent-child estrangement NEC<br>**Z62.891** Sibling rivalry<br>**Z62.898** Other specified problems related to upbringing<br>**Z62.9** Problem related to upbringing, unspecified | This selection of ICD-10 codes includes childhood and family difficulties worth considering. These could be included in a SDH code related to adverse experiences. |

(*Continued*)

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**Table 2** (Continued).

| Applicable ICD-10 Codes | Comparisons |
|---|---|
| **Z63.0** Problems in relationship with spouse or partner<br>**Z63.1** Problems in relationship with in-laws<br>**Z63.31** Absence of family member due to military deployment<br>**Z63.32** Other absence of family member<br>**Z63.4** Disappearance and death of family member<br>**Z63.5** Disruption of family by separation and divorce<br>**Z63.71** Stress on family due to return of family member from military deployment | This selection of codes describes issues related to family circumstances and could be included in a SDH code related to lack of social support. |
| **Z64.0** Problems related to unwanted pregnancy<br>**Z64.1** Problems related to multiparity<br>**Z64.4** Discord with counselors<br>**Z65.0** Conviction in civil and criminal proceedings without imprisonment<br>**Z65.1** Imprisonment and other incarceration<br>**Z65.2** Problems related to release from prison<br>**Z65.3** Problems related to other legal circumstances<br>**Z65.4** Victim of crime and terrorism<br>**Z65.5** Exposure to disaster, war and other hostilities<br>**Z65.8** Other specified problems related to psychosocial circumstances<br>**Z65.9** Problem related to unspecified psychosocial circumstances | This selection of codes includes various issues related to psychosocial circumstances. Their inclusion in factors related to social determinants of health is worth considering. |

## Survey

At the completion of PY1, all students in each class were surveyed. A total of 318 students (73.66%) responded. Two hundred and twenty two students (51.51%) completed the survey after PY2. A complete overview of response rates is provided in Table 4.

Tables 5 and 6 show results from the surveys. Table 5 presents the results for 3 survey items as the percentage of students who selected completely disagree/disagree, neutral or agree/completely agree for each.

A majority of students who responded (96.6% in PY1 and 99.1% PY2) felt that they were familiar with the concept of SDH. Additionally, the majority of responding students (96.23% in PY1 and 98.65% in PY2) felt it was important to address the role of SDH when providing care to patients. They also felt that logging SDH into EHR is important to the health of patients (81% in PY1 and 85.22% in PY2).

Table 6 presents the mean score for the same survey items, as calculated using a 1 to 5 scale (1= completely disagree, 3= neutral, 5= completely agree). The table further shows the calculated significance for the 3 survey items by class and project year and additionally, the significance for overall survey. Although the differences were not statistically significant, each item showed a slight increase in average score and the proportion of students in agreement over the 2 project years.

Results were analyzed from two open-response questions. First year students (class of 2019 in PY1 and class of 2020 in PY2) were asked if they felt it important to learn about SDH during medical education. Open-ended responses were reviewed and categorized into positive, neutral and negative responses. Percentages in each category were calculated. Forty five students from the class of 2020 responded to this question with 97.8% responding positively that they do feel it is important and 2.2% responding negatively. Similarly, 75 students from the class of 2019 responded to this question with 94.7% responding positively and 5.3% responding negatively. There were no comments categorized as neutral.

Second, third and fourth year students were all asked if they felt coding SDH was beneficial to their undergraduate medical education. For the responses to this item repeat themes were identified and condensed into summary statements. Statements representing the results for question two are presented in Table 7.

**Table 3** Counts of all codes logged: proprietary social determinants of health (SDH) and ICD 10-CM Z-codes

| Codes | Project year 1 | Project year 2 |
|---|---|---|
| Unique Codes Logged | 812 | 13,530 |
| Total Codes Logged | 410,142 | 333,530 |
| Unique Students Logging SDH Codes | 193 | 181 |
| Total Proprietary SDH Diagnosis Codes | 12,765 | 11,808 |
| Poverty | 636 | 601 |
| Near Poverty | 493 | 477 |
| Food Insecure | 238 | 219 |
| Unstable Housing or Homelessness | 1579 | 1486 |
| Poor Quality Housing | 407 | 376 |
| Lack of or No Insurance | 602 | 550 |
| Lack of Access to Healthcare | 443 | 399 |
| Health Literacy Limitations | 1211 | 1106 |
| Unemployed or Underemployed | 511 | 479 |
| Unstable Work Schedule | 154 | 143 |
| Family Care Demands | 486 | 448 |
| Transportation Issues | 453 | 401 |
| Educational Limitations | 1083 | 1001 |
| Language Barrier | 1278 | 1203 |
| Cultural Barrier | 597 | 562 |
| Immigrant Status | 448 | 415 |
| Poor Neighborhood Composition | 255 | 235 |
| Social Isolation | 421 | 391 |
| Other | 1470 | 1316 |
| Total Proprietary SDH Procedure Codes | 5,040 | 3,798 |
| Crisis Intervention | 42 | 33 |
| Education Materials Provided | 1000 | 963 |
| Extended Appointment Time | 3 | 3 |
| Family Counselling | 454 | 414 |
| Lifestyle Counselling | 1956 | 1691 |
| Referral to CHC Services | 316 | 308 |
| Referral to External Services | 1269 | 386 |
| Total ICD-10-CM Z-Codes | ICD Codes Not Available | 745 (64 unique codes) |

**Table 4** Survey response rates by class and project year

| Class | Project year 1 | | Project year 2 | |
|---|---|---|---|---|
| | Program year | Response rate | Program year | response rate |
| 2016 | 4th Year | 72 (67.6%) | n/a | – |
| 2017 | 3rd Year | 83 (77.6%) | 4th Year | 51 (48.6%) |
| 2018 | 2nd Year | 86 (79.4%) | 3rd Year | 64 (59.8%) |
| 2019 | 1st Year | 77 (70.0%) | 2nd Year | 61 (47.3%) |
| 2020 | n/a | – | 1st Year | 45 (42.1%) |
| TOTAL | | 318 (73.66%) | | 221 (51.51%) |

Responses from second, third and fourth year students related to the benefit of coding SDH were varied. The positive comments included statements indicating that logging made a difference in patient care, helped students remember their patients better, and that the codes were a great tool to help keep SDH on the forefront of the visit. Negative

**Table 5** Survey items and response proportions by project year

| Survey Item | Project year 1 | | | Project year 2 | | |
|---|---|---|---|---|---|---|
| | Response | | | | | |
| | Disagree | Neutral | Agree | Disagree | Neutral | Agree |
| I am familiar with the social determinants of health (SDH) concept | 0.31% | 2.83% | 96.6% | 0.45% | 0.45% | 99.10% |
| It is important to address the role of SDH when providing care to patients | 0% | 1.78% | 96.23% | 0% | 2.6% | 98.65% |
| Logging SDH into the electronic health record is important to the health of patients | 5.35% | 13.69% | 81.0% | 2.60% | 12.17% | 85.22% |

**Table 6** Survey items and response means by class and project year

| Q1. I am familiar with the Social Determinants of Health (SDH) Concept. | | | | | |
|---|---|---|---|---|---|
| Class | Project year 1 | | Project year 2 | | p |
| | n | Mean | n | Mean | |
| 2016 | 72 | 4.63 | n/a | n/a | – |
| 2017 | 83 | 4.66 | 51 | 4.69 | 0.3963153 |
| 2018 | 86 | 4.64 | 64 | 4.75 | 0.0938384 |
| 2019 | 77 | 4.44 | 61 | 4.56 | 0.0938384 |
| 2020 | n/a | n/a | 45 | 4.56 | – |
| TOTAL | 318 | 4.59 | 221 | 4.64 | 0.1564796 |

| Q2. It is important to address the role of SDH when providing care to patients. | | | | | |
|---|---|---|---|---|---|
| Class | Project year 1 | | Project year 2 | | p |
| | n | Mean | n | Mean | |
| 2016 | 72 | 4.49 | n/a | n/a | – |
| 2017 | 83 | 4.62 | 51 | 4.55 | 0.25337616 |
| 2018 | 86 | 4.64 | 64 | 4.63 | 0.43918941 |
| 2019 | 77 | 4.62 | 61 | 4.69 | 0.43918941 |
| 2020 | n/a | n/a | 45 | 4.69 | – |
| TOTAL | 318 | 4.59 | 221 | 4.64 | 0.18632202 |

| Q3. Logging SDH factors in the medical record is important to the health of patients. | | | | | |
|---|---|---|---|---|---|
| Class | Project year 1 | | Project year 2 | | p |
| | n | MEAN | n | MEAN | |
| 2016 | 72 | 3.89 | n/a | n/a | – |
| 2017 | 83 | 3.93 | 51 | 4.06 | 0.19981887 |
| 2018 | 86 | 4.15 | 64 | 4.19 | 0.39070199 |
| 2019 | 77 | 4.39 | 61 | 4.00 | 0.00144404 |
| 2020 | n/a | n/a | 45 | 4.44 | – |
| TOTAL | 318 | 4.09 | 221 | 4.17 | 0.17589849 |

comments were directed more towards external issues, rather than the use of SDH codes. Many students were frustrated with the E*Value platform, finding it to be difficult to use. Other students questioned the practice as SDH codes are not applicable to billing and most doctors they shadow do not record social factors. Some students who responded negatively to the question indicated their negative feelings were more about the requirement for them to log their patient encounters with codes and not about their feelings about the importance of identifying and addressing SDH.

**Table 7** Open-ended responses to the question "Do you feel the request for you to code SDH was beneficial to your undergraduate medical education?"

**Positive**

1. Documenting SDH helps me remember patients in a deeper way.

2. Identifying and addressing SDH can make a huge difference in patient care and bring awareness to non-medical factors.

3. Documenting SDH keeps these issues on the forefront of my mind and is a great reminder to address the needs of the whole person. It is a constant reminder of how many SDH are present in all patient interactions.

4. It can help with tracking SDH and impact the effect from other comorbidities. It helped establish relationship between factors and helped me determine the overall health picture for patients.

5. Coding SDH can make a difference in our approach to patient care. The more you apply something, the more it is ingrained in your practice for the future.

6. Coding SDH made me even more familiar with important things I need to remember about my patients. This coding is a constant reminder that will shape my career. Like anything in medical school, repetition is the key to success.

7. It allowed me to address other areas that might limit the patient's ability to seek care or afford the current care. By addressing these areas you may enable the patient to follow a care plan.

8. It highlights the importance of considering SDH while providing care. It adds depth to a generic coding system and made me more cognizant of these factors during patient encounters.

**Neutral**

1. E*Value is difficult to use and time consuming.

2. We already spend a lot of time on web-based tasks, I am already aware of SDH.

**Negative**

1. I already know about SDH and coding doesn't help me know more or do more for patients. I would identify and address SDH without the need to code.

2. Spending time coding takes time away from patient care.

3. It is not applicable to billing so there is no point in coding the SDH.

4. SDH are too subjective and can cause bias.

5. We get significant training in SDH, other physicians don't code SDH.

6. There isn't enough time to address SDH during a patient exam

**Abbreviation:** SDH, social determinants of health.

## Discussion

This project addresses the need to integrate SDH into medical education. This is a step towards developing best practices for utilizing EHRs to improve individual and population health and toward using SDH data to assist with clinical decision making.[4]

In the first project year, 870 diagnosis codes were available to students for logging clinical encounters. In year two, students had access to over 92,000 codes. Despite this increase, there was no significant change in overall representation of SDH codes recorded. Students utilized the proprietary codes more often than the Z-codes. This could be because of their familiarity with the proprietary codes, or it could be that the proprietary codes were more straight forward and relevant to the clinical encounters.

Students' voluntary logging of SDH codes demonstrates they perceived these factors to be important. Additionally, the survey provided evidence that an overwhelming portion of ATSU SOMA students (who participated in the survey) are familiar with the SDH concept, feel that addressing SDH is important while providing care, and also feel that documenting SDH in EHRs is important to the health of patients. Modest increases in responses agreeing to items studied could be attributed to our intervention. This correlation does not imply causation. However, the combined evidence supports the fact that students value the ability to identify and address SDH. Thereby, we plan to continue to foster these beliefs in our undergraduate medical students and to continue to teach them to formally document and address SDH.

This study is limited to one learning institution, the results cannot be generalized to other education programs. These codes are one part of a curriculum with an emphasis on identifying the SDH and addressing health disparities. The proprietary codes were introduced into the curriculum before the ICD-10 codes were available. This sequence could have affected the differential use of the codes for the cohort of students who first logged patient encounters using the proprietary codes and then logged with the option

of the proprietary codes and the ICD-10. However, the class of 2019 students were introduced to the proprietary codes and the ICD-10 SDH codes at the same time and showed a similar preference for the use of the proprietary codes as that shown by the other classes. There is evidence the tools we provided our students to track and quantify SDH diagnoses and procedures were well utilized and can add value to the education environment.

Table 2 should be useful for clinical educators and students to use as a reference for ICD-10 SDH coding. We provide the SDH category, relevant codes and the authors' evaluation of how the Z-codes compare to the proprietary codes.

Future research can evaluate practicing physician's views of the proprietary SDH codes in comparison to the Z-codes. Most importantly, students and providers of all levels could be queried to discover their perceptions of the clinical relevance of the two sets of codes and the ease of use. Additionally, future work will involve evaluating and documenting clinical practices and partnerships which can be used to address identified SDH.

## Conclusion

We aim to positively affect practice culture by encouraging future providers to work towards addressing SDH and alleviating health inequities. SDH need to be included as integral parts of the health record. Only then will SDH be considered within the realm of what should be addressed by all medical providers. Coding of SDH will allow for evaluation and documentation of the significant impact of SDH on individual and population health. This can also lead to development of more mechanisms to address the SDH.

In clinical medicine, we evaluate the etiology of disease, disease characteristics, and the effects of the disease and treatment modalities. It is time to heighten the importance of SDH and to teach students how to evaluate these factors in the same manner we teach them to evaluate disease. Including SDH in the formal student documentation of medical encounters is an effective approach, easily replicable by other clinical educators.

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## Disclosure

The authors reports no conflicts of interest in this work.

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