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Social Health Surveillance: A Systematic Review

Zachary Pruitt[1]*, Nnadozie Emechebe[2], Sofia Fernandez[3], Ibrahim Akorede[4], Pamme Lyons Taylor[5]

[1]PhD, University of South Florida College of Public Health, 13201 Bruce B Downs Blvd, MDC 056, Tampa,

[2]University of South Florida College of Public Health

[3]University of South Florida College of Public Health

[4]Cincinnati Children's Hospital

[5]Nightingale Partners, LLC

Corresponding author: Zachary Pruitt, PhD, University of South Florida College of Public Health, 13201 Bruce B Downs Blvd, MDC 056, Tampa, FL 33612; **Email:** zpruitt@usf.edu

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Abstract

Context: Health service providers increasingly screen for health-related social risks and refer patients to social care resources. However, a national, individual-level social health surveillance system that supports this linkage between medical and social care does not yet exist. Public health surveillance provides the model for a national, individual-level social health surveillance system specifically designed to support the integration of social and medical care in order to address upstream contributors of illness.

Objective: To systematically review the literature describing existing social health surveillance systems in the United States that screen, address, collect, store, analyze, and disseminate social needs or risk factors for the purposes of developing activities that impact population health.

Design: Articles from PubMed, MEDLINE, and Social Intervention Research and Evaluation Network (SIREN) Evidence Library between January 1, 2008 and December 31, 2018 were searched using the Preferred Reporting Items for Systematic Review and Meta-analysis Protocols (PRISMA-P).

Eligibility Criteria: Epidemiological surveillance was used as a model to identify social health surveillance systems, defined as the ongoing collection, storage, analysis, and classification of social determinants of health data essential to the planning, implementation, and evaluation of interventions intended to improve health outcomes.

Study Selection: Thirteen articles met the inclusion and exclusion criteria, representing 9 different social health surveillance systems serving mostly low-income populations in 20 states.

Main Outcome Measures: The social health surveillance systems integrate social and medical care to improve health outcomes.

Results: All 9 social health surveillance systems continuously collected individual-level social determinants of health data from at least 2 of the 17 domains recommended by the Institute of Medicine. A wide variation existed in the social health surveillance systems capabilities.

Discussion: To build a 21st century social health surveillance system, public health leaders should expand epidemiological surveillance in collaboration with the medical and social care systems to include individual level social determinants of health.

Keywords: *social determinants of health, social care, social health surveillance.*

Introduction

The upstream social factors that contribute to illness can overwhelm clinicians practicing in an ill-equipped healthcare system [1, 2]. Innovations increasingly link social care needs, such as food, housing support, and financial assistance, to the healthcare system, [3] which includes physical, mental, dental, and pharmaceutical care. However, a national, individual-level social health surveillance system that supports medical and social care integration does not yet exist. Borrowed from the public health domain, a social health surveillance system can be defined as the ongoing collection, storage, analysis, and classification of social determinants of health (SDH) data essential to the planning, implementation, and evaluation of social care need interventions that are designed to improve health outcomes.

A consensus committee report of the National Academies of Sciences, Engineering, and Medicine (NASEM Committee) appealed for increased attention to individuals' social context by the United States (U.S.) health service delivery system [1]. The Committee recommended utilizing validated screening instruments, standardizing social risk terms, and facilitating interoperable data systems that enable advanced analytic approaches to population health. However, no best practice exists for social health surveillance systems [4, 5].

In contrast, U.S. epidemiological surveillance systems are sophisticated, robust, and long-standing [6]. Public health surveillance is the continuous collection of health information for the evaluation, analysis, and translation of data into knowledge about the health of communities that can enable action [7]. Surveillance of risk factors for non-communicable diseases, such as cancer, heart disease, stroke, diabetes, asthma, and poisonings, has informed public health interventions for over 30 years [1, 6, 8]. Public health surveillance systems may be the model for the development of national social health

surveillance system. However, existing social health surveillance systems have not yet been described.

A social health surveillance system should consist of three key components: 1) the ability to continuously and systematically collect, store, analyze, address, and classify patient-level social needs and social risk data, 2) the capacity to plan, implement, and evaluate programs or activities that are 3) specifically designed for the purposes to integrate social and medical care to improve health outcomes. That is, effective social health surveillance systems have the capability to link SDH information to health outcomes in order to address upstream contributors of illness–the "causes of the causes" of poor health [9].

Various systematic reviews analyzed other elements of social and medical care integration efforts, including the many different screening instruments available to assess SDH, [10, 11] social care intervention activities in the health care sector, [12-17] types of SDH collected, [18] and the adequacy of electronic health records systems to support social health data collection [19-21]. The purpose of the present study is to gather and synthesize the best available published evidence on current social health surveillance systems.

Methods

This systematic review was guided by the Preferred Reporting Items for Systematic Review and Meta-analysis Protocols (PRISMA-P) guidelines [22]. The research team conducted a search for articles from the following databases: PubMed, MEDLINE, and Social Intervention Research and Evaluation Network (SIREN) Evidence Library. SIREN Evidence Library is an archive of literature run by Center for Health and Community at University of California, San Francisco. PubMed Medical Subject Headings (MeSH) search headings included social determinants of health, mass screening, and population surveillance. Keywords in MEDLINE included "social prescribing," "social and medical care integration," "social care needs surveillance," "social determinants of health surveillance," "social determinants of health screening," "socioeconomic status surveillance," "socioeconomic status screening," "population surveillance," "social needs surveillance," "mass screening," "social needs screening," "screening and referral" and combinations of surveillance, screening, and social determinants. In the SIREN Evidence Library, the authors identified articles categorized as "screening research." The authors also searched citations of articles that met the inclusion criteria (Table 1).

Table 1. Keywords for database search

MEDLINE Keywords
Social prescribing
Social and medical care integration
Social care needs surveillance
Social determinants of health surveillance
Social determinants of health screening
Socioeconomic status surveillance
Socioeconomic status screening
Population surveillance
Social needs surveillance
Mass screening
Social needs screening
Screening and referral

The search strategy was limited to articles regarding social health surveillance programs based in the U.S. The title and abstract of each article were evaluated for inclusion according to the definition of a social health surveillance system: the ongoing collection, storage, analysis, and classification of SDH data essential to planning, implementation, and evaluation of interventions designed to integrate social and medical care for improve population health.

Two authors (ZP and IA) independently reviewed each article included to determine if the study met all inclusion criteria. Search results were imported into EndNote Online. In cases where there was disagreement between authors about study inclusion, consensus was achieved by review of a third researcher (NE).

The search yielded 17,598 unique records published in English between January 1, 2008 and December 31, 2018. Of these titles and abstracts, 76 full articles reviewed for eligibility criteria. A final list of 76 studies were selected for inclusion. The full review according to the eligibility text review eliminated 63 articles that lacked the required information regarding social health surveillance systems. The final sample contained 13 unique studies that met all inclusion criteria (Table 2). Articles were excluded for a variety of reasons, as noted in Figure 1 that depicts the PRISMA-P diagram for this study.

Results

Thirteen articles were included in this review, representing 9 different social health surveillance systems. Among articles reviewed in detail, 63 were excluded. Excluded articles only discussed general concepts related to addressing SDH in medical care (24), did not collect SDH data continuously (12), related to systematic reviews of other social and medical care integration topics (6), introduced other studies (5), addressed only the SDH screening mechanisms, (5) included no description of SDH integration with medical care (3), did not address SDH (1), did not discuss how SDH data was stored (1), or other reasons (5).

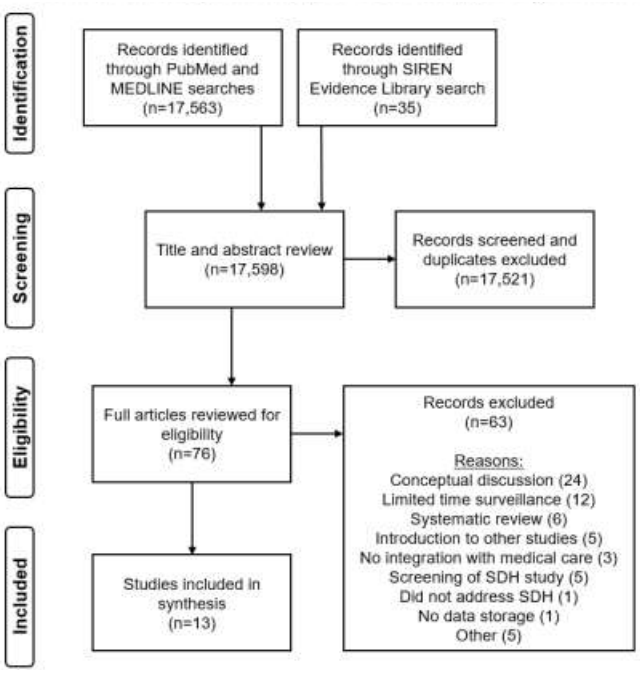

Figure 1. Flowchart of studies included in the Social Health Surveillance Systematic Review

Table 2: Social Health Surveillance Systems.

Social Health Surveillance System	Article Title	Author(s)	Date	Population Served	Surveil-lance Type	Standardized Data Measurement	Data Collection Approach	Volume of data Collected	Ownership of SDH interventions	Specific SDH variables	Data storage approach	Medical integration approach	Medical care outcomes
Michigan Primary Care Association	Screening for Social Determinants of Health in Michigan Health Centers	Byhoff, E., Cohen, A.J., Hamati, M.C., Tatko, J., Davis, M.M., & Tipirneni, R.	Aug-17	Patients of Michigan Primary Care Association health centers; 70% urban, 26% rural, majority of patients below 200% of FPL	Active	Variation across health centers (a mean of 11 of the 15 core domains (range, 6–15)).	Data collected by clinical staff, such as medical assistants, social workers, physicians, front desk staff, registered nurses before, during, or after the clinical visit. Data were entered into electronic health records (EHR) either directly by the health care provider as reported by the patient or through a paper screening instrument that was then scanned into the EHR.	Collected SDH data for 34% to 52% of the 459,313 total patients receiving care at 167 delivery sites in 2014 (156,000-238,842).	Michigan health centers	15 core domains, including culture, Demographics, Economic Indicators, Education, Employment Status, Family/Living Arrangements, Functional Status, Health Care Access, Health-Related Behaviors, Language, Material Hardship (housing, food, utilities, child care), Mental Health, Social Support, Trauma/Violence, and Veteran Status, and 102 subdomains. However, only only 4 (Demographics, Employment Status, Family and Living Arrangements, Mental Health) collected across all 39 health centers	Entered directly into electronic health record or paper screening instrument scanned into electronic health record.	Social health surveillance supports state-wide social health intervention that create community-based "hubs" to facilitate clinical and community resource linkages. Social care need referrals come into the Community Health Innovation Region hub from community-based organizations and primary care providers that screen for social care needs (Michigan Department of Health and Human Services. State Innovation Model., 2019).	Monitor how health centers and other providers identify needs and take necessary action steps to improve health.
The 2-1-1 System - Missouri	Exploring 2-1-1 service requests as potential markers for cancer control needs	Alcaraz, K.I., Arnold, L.D., Eddens, K.S., Lai, C., Rath, S., Greer, R., & Kreuter, M.W.	Dec-12	Residents of Missouri, primarily low- income, disproportionately female and minorities, and are seeking assistance with basic human needs.	Passive	Collects using terms of the Alliance of Information and Referral Systems taxonomy (<2000 of 9431 terms total) to describe social service needs.	Data from callers were analyzed using logistic regression to tudy correlations betweeen caller demographics, service requests, and cancer prevention needs	166,000 calls in 2011	2-1-1 Missouri	Coded service requests into 6 broad categories: bills, home and family, employment, health, housing, or other	2-1-1 database	Identified associations of social needs with need for cancer control services	Cancer prevention behaviors available for free to low-income and uninsured populations: mammography, colonsocopy, Pap smear, HPV vaccination, smoking cessation.
The 2-1-1 System - Missouri	Proactive screening for health needs in United Way's 2-1-1 information and referral service	Eddens, K.S., Kreuter, M.W., & Archer, K.	Mar-11	Residents of Missouri, primarily low- income, disproportionately female and minorities, and are seeking assistance with basic human needs.	Passive	Collects using terms of the Alliance of Information and Referral Systems taxonomy (<2000 of 9431 terms total) to describe social service needs.	Participants completed questionnaires depending on thieir age, sex, screening history, and whethe they had children. The programs automatically identifies their needs and aach participant received at least one referral	135,352 in 2008	2-1-1 Missouri	Housing, shelter, electricity, heat, food, health insurance	2-1-1 database	Health referrals were related to six cancer prevention behaviors.	Cancer prevention behaviors available for free to low-income and uninsured populations: mammography, colonsocopy, Pap smear, HPV vaccination, smoking cessation.

The 2-1-1 System - Missouri	Promoting Health by Addressing Basic Needs: Effect of Problem Resolution on Contacting Health Referrals	Thompson, T., Kreuter, M.W., & Boyum, S.	Aug-15	Residents of Missouri, primarily low- income, disproportionately female and minorities, and are seeking assistance with basic human needs.	Passive	Collects using terms of the Alliance of Information and Referral Systems taxonomy (<2000 of 9431 terms total) to describe social service needs.	Collected callers' reason(s) for calling 2- 1-1, their health needs, and demographic information. Follow-up measures administered 1 month later assessed whether the reason participants called 2-1-1 had been resolved ("problem resolution") and whether they had contacted any of the health referrals they received.	940 callers in a randomized control trial conducted from 2010 to 2012.	2-1-1 Missouri	Utilities, home and family, rent, food assistance, health, employment, housing , and others	2-1-1 database	Health referrals were related to six cancer prevention behaviors. Evaluated referral uptake success.	Cancer prevention behaviors available for free to low-income and uninsured populations: mammography, colonsocopy, Pap smear, HPV vaccination, smoking cessation.
The 2-1-1 System - San Diego	Healthcare Navigation Service in 2-1-1 San Diego: Guiding individuals to the care they need	Rodgers, J.T., & Purnell, J.Q.	Dec-12	Residents of San Diego County, primarily from low-income households, seeking assistance with transportation, appointment scheduling, child/ elder care, and personal finance.	Passive	2-1-1 San Diego collects demographics, stated and unstated needs, and social care referrals given to clients.	Demographic, social need, and healthcare access data were collected from callers. Participants were referred to the appropiate local social service agencies.	13,313 over 6 months (July and December of 2011)	2-1-1 San Diego Healthcare Navigators, described as a "concierge-based approach."	Health insurance coverage, prescription and food assistance, transportation, appointment scheduling, child/elder care, and personal finance	2-1-1 database	Created Healthcare Navigation Program with partner, Ascension Health, to guide clients to needed services, such as making appointments with health clinics and screening for eligibility for healthcare and food assistance programs. Database of community agencies provides platform for collaboration among healthcare providers.	Patients' percieved ability to manage health needs.
Michigan Primary Care Association	Screening for Social Determinants of Health in Michigan Health Centers	Byhoff, E., Cohen, A.J., Hamati, M.C., Tatko, J., Davis, M.M., & Tipirneni, R.	Aug-17	Patients of Michigan Primary Care Association health centers; 70% urban, 26% rural, majority of patients below 200% of FPL	Active	Variation across health centers (a mean of 11 of the 15 core domains (range, 6–15)).	Data collected by clinical staff, such as medical assistants, social workers, physicians, front desk staff, registered nurses before, during, or after the clinical visit. Data were entered into electronic health records (EHR) either directly by the health care provider as reported by the patient or through a paper screening instrument that was then scanned into the EHR.	Collected SDH data for 34% to 52% of the 459,313 total patients receiving care at 167 delivery sites in 2014 (156,000-238,842).	Michigan health centers	15 core domains, including culture, Demographics, Economic Indicators, Education, Employment Status, Family/Living Arrangements, Functional Status, Health Care Access, Health-Related Behaviors, Language, Material Hardship (housing, food, utilities, child care), Mental Health, Social Support, Trauma/Violence, and Veteran Status, and 102 subdomains. However, only only 4 (Demographics, Employment Status, Family and Living Arrangements, Mental Health) collected across all 39 health centers	Entered directly into electronic health record or paper screening instrument scanned into electronic health record.	Social health surveillance supports state-wide social health intervention that create community-based "hubs" to facilitate clinical and community resource linkages. Social care need referrals come into the Community Health Innovation Region hub from community-based organizations and primary care providers that screen for social care needs (Michigan Department of Health and Human Services. State Innovation Model., 2019).	Monitor how health centers and other providers identify needs and take necessary action steps to improve health.

The 2-1-1 System - Missouri	Exploring 2-1-1 service requests as potential markers for cancer control needs	Alcaraz, K.I., Arnold, L.D., Eddens, K.S., Lai, C., Rath, S., Greer, R., & Kreuter, M.W.	Dec-12	Residents of Missouri, primarily low- income, disproportionately female and minorities, and are seeking assistance with basic human needs.	Passive	Collects using terms of the Alliance of Information and Referral Systems taxonomy (<2000 of 9431 terms total) to describe social service needs.	Data from callers were analyzed using logistic regression to tudy correlations betweeen caller demographics, service requests, and cancer prevention needs	166,000 calls in 2011	2-1-1 Missouri	Coded service requests into 6 broad categories: bills, home and family, employment, health, housing, or other	2-1-1 database	Identified associations of social needs with need for cancer control services	Cancer prevention behaviors available for free to low-income and uninsured populations: mammography, colonsocopy, Pap smear, HPV vaccination, smoking cessation.
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The Online Advocate (now HelpSteps.com)	Improving Social Determinants of Health: Effectiveness of a Web-Based Intervention	Hassan, A., Scherer, E. A., Pikcilingis, A., Krull, E., McNickles, L., Marmon, G., ... & Fleegler, E. W.	Dec-15	Adolescents and young adults age 15 to 25 seeking medical care from an urban hospital-based clinic at Children's Hospital Boston	Active	The Online Advocate (now HelpSteps.com) questionnaire included 90–130 questions developed from validated surveys, including the Youth Risk Behavior Survey, the Growing Up Today Study, and U.S. Department of Agriculture food security scale.	Participant completed the web-based screening survey, which identifies and provides feedbacks about potential issues. Then the participant is referred to a local health and human service agency to address problems.	313 patients over 21 months	The Online Advocate (now HelpSteps.com) clinic resource specialist, a staff member trained to facilitate referrals to social services and to provide more detailed information.	Health-related needs in 9 health-related social domains: nutrition and fitness, education, safety equipment, healthcare access, housing, food security, income security, substance use, interpersonal violence	The Online Advocate survey and referral system, now called HelpSteps.com	Clinical resource specialist addressed urgent issues during the screening process. Acute concerns regarding domestic violence, homelessness, or severe food insecurity were shared with the provider and social worker for urgent intervention.	Smoking cessation, reduced allergies, improved diet and exercise, disease management (based on types of referrals generated)
The Online Advocate (now HelpSteps.com)	Social disparities among youth and the impact on their health	Kreatsoulas, C., Hassan, A., Subramanian, S.V., & Fleegler, E.W.	Mar-15	Adolescents and young adults age 15 to 25 seeking medical care from an urban hospital-based clinic at Children's Hospital Boston	Active	The Online Advocate (now HelpSteps.com) questionnaire consisted of 90–130 questions with branch logic to determine question sequence.	Providers recruited patients for the study. Interested study participants completed a survey on a laptop equipped with a privacy screen. The questionnaire consisted of 90–130 questions.	297 patients over 21 months	The Online Advocate (now HelpSteps.com) clinic resource specialist, a staff member trained to facilitate referrals to social services and to provide more detailed information.	Questions were categorized into 7 social domains: 1) education, 2) health care access, 3) income insecurity, 4) substance use, 5) food insecurity, 6) housing, and 7) interpersonal violence.	The Online Advocate survey and referral system, now called HelpSteps.com	Clinical resource specialist addressed urgent issues during the screening process. Acute concerns regarding domestic violence, homelessness, or severe food insecurity were shared with the provider and social worker for urgent intervention.	Self-rated health
J-CHiP	Case Study: Johns Hopkins Community Health Partnership: A model for transformation	Berkowitz, S.A., Brown, P., Brotman, D.J., Deutschendorf, A., Dunbar, L., Everett, A., Hickman, D., Howell, E., Purnell, L., Sylvester, C. & Zollinger, R.	Sep-16	Medicare and Medicaid beneficiaries receiving primary care in eight outpatient clinics surrounding Johns Hopkins's two primary teaching hospitals in East Baltimore and the approximately 40,000 adult patients admitted annually to 2 Johns Hopkins hospitals.	Active	Structured "barriers to care" assessment.	Assessment administered by community health workers, followed by care management assessment at the clinic with demographic, clinical, health history. Both combined to yield a care plan that was reviewed during team-based rounds.	3035 barriers-to care assessments over 30 months	Johns Hopkins Community Health Partnership (J-CHiP)	Transportation, housing, phone, food availability, finances for medication, finances for doctor, finances for utilities, child and dependent care.	Data stored in a customized care management system along with care management assessment, demographic, clinical, health history, and other related data.	J-CHiP provided low cost bus tokens, cab or shuttle support, provided active social work involvement and a pharmacy assistance program to improve health outcomes.	Provider visit no shows; reductions in the cost of care and other utilization indices such as hospitalizations and emergency department visits

Existing Social Health Surveillance Systems

The 9 identified social health surveillance systems mostly served low-income populations in 20 states. Each used different screening instruments with collection at varying levels of volume and intensity. A variety of approaches for integrating social care and medical care were present.

Michigan Primary Care Association

The 240 primary care community health clinics (CHCs) of Michigan Primary Care Association conducted SDH screenings.[5] SDH data were collected by clinical staff, such as medical assistants, social workers, physicians, front desk staff, and registered nurses. Data were entered into electronic medical record system (EMR) either directly by the health care provider as reported by the patient or through a paper screening instrument that was then scanned into the EMR. The SDH data were used to support state-wide social health intervention programs, such as Michigan's State Innovation Model (SIM) [23] and Michigan Pathways to Better Health, [24] that were coordinated by community-based "hubs" to facilitate clinical and community resource linkages.

The 2-1-1 System

The 2-1-1 system is a collection of call centers that connects individuals with basic social care needs to social services organizations in their communities [25]. While over 200 programs are administered by different entities across the U.S., only two separate 2-1-1 organizations met the inclusion criteria for social health surveillance systems: Missouri [26-28] and San Diego County [29]. These 2-1-1 systems adapted existing social care referral programs to create linkages between social care organizations and health care systems.

In Missouri, after 2-1-1 call center representatives provided social care referrals, individuals were asked to complete cancer screening. Based on answers to these questions, a computer program identified needs for cancer control services and generated referrals to local cancer prevention services, such as mammography and smoking cessation programs. The Missouri 2-1-1cancer prevention program then followed-up with patients to assess cancer service utilization rates.

The San Diego 2-1-1 system leveraged their already high-functioning social care referral call center to create healthcare navigation programs to help individuals identify social care needs, make and keep needed medical appointments, and removed the barriers to address health-related needs in the community [29]. Another department helped callers obtain access to health-related public assistance programs.

OCHIN

OCHIN centrally manages an Epic-based EMR system used by more than 440 primary care community health centers (CHCs) [30]. Three CHCs in Washington and Oregon were used as pilot sites to collect, review, and integrate social needs with medical care through referrals. SDH data were collected through three different approaches: (1) SDH modules in the EHR available to front desk staff, clinicians, and community health workers, (2) paper surveys entered by patient then coded into EMR system by staff, and (3) a patient portal questionnaire completed by patient before the visit. Based on identified social care needs, community health workers provided social service referrals. The EMR also enabled social care referral summaries to be accessed during subsequent clinical encounters to support follow-up by the care team [30]. In June 2016, the social health surveillance tools were made available to all OCHIN member clinics (97 sites in 18 states), where preliminary evaluations show variation in screening adoption and data collection and medical care integration workflows [31].

Health Leads

Health Leads staffed help desks with college students at urban medical clinics across the U.S [20, 32]. In the Health Leads model, patients' parents completed a SDH screening survey, providers reviewed screening results and referred patients to Health Leads help desks, and the student "Advocates" utilized the Health Leads database to refer patients and their families to community-based social services. The social needs were captured within the EMR systems and Health Leads's database, which enabled evaluation of social care interventions on individual or population health.

WellCare's Social Service Referral Service

Similar to the 2-1-1 system, the non-clinical call center staff of WellCare Health Plan's social service hotline identified social care needs and referred their Medicare and Medicaid members to social care organizations [33]. The screening results shared with WellCare's case managers who provided direct assistance to individuals with social and medical care needs [34].

WellRx

Three family medicine clinics in Albuquerque, New Mexico piloted a program in collaboration with University of New Mexico and Medicaid managed care plans to collect SDH data through a paper-based survey instrument [35]. For over 3,000 patients over a 3-month period (later expanded to all patients at 9 primary care locations [31]), clinics stored SDH data in the EMR for access by community health workers who sought to improved patient engagement and create better informed primary care clinicians and staff. The program was also utilized for diabetes control quality improvement project.

The Online Advocate (now HelpSteps.com)

For adolescents and young adults seeking medical care from an urban hospital-based clinic at Children's Hospital Boston, the Online Advocate (now HelpSteps.com) conducted a web-based screening survey for social risk, such as food insecurity, healthcare access, and interpersonal violence. Based upon identified social care needs, the system—termed "social epidemiology" by the authors—provided referrals to local social service agency to address the identified social risks [36]. The online assessment system acted as a complement to clinical visits in order to improve attention to patients' social needs [37].

Johns Hopkins Community Health Partnership (J-CHiP)

In 8 primary care outpatient clinics in East Baltimore, Maryland, the Johns Hopkins Community Health Partnership (J-CHiP) community health workers collected SDH data that were combined with care management assessment, demographic, clinical, health

history, and other related data to be reviewed during the clinical encounter [38]. J-CHiP interventions sought to reduce provider visit no shows, cost of care, and other utilization indices, such as hospitalizations and emergency department visits.

Social Health Surveillance Attributes

All 9 social health surveillance systems included in this systematic review collected individual-level SDH data continuously. Each of the social health surveillance systems screened for at least 2 of 17 SDH domains recommended by the Institute of Medicine (IOM), but none screened for all IOM-recommended SDH domains.[18] None of the 9 identified social health system utilized the same data collection approach, except the 2-1-1 systems in Missouri and San Diego. OCHIN utilized the Protocol for Responding to and Assessing Patients' Assets, Risks, and Experiences (PRAPARE) assessment tool developed by the National Association of Community Health Centers that integrates with EMR systems, although each pilot site implemented screenings differently [39].

The intensity of public health surveillance systems can be classified as active or passive [40]. Correspondingly, active social health surveillance utilizes screening tools to directly identify patient social needs at medical care facilities. A passive social health surveillance system relies on social needs identified and reported by individuals or their caregivers. Among the 9 social health surveillance systems identified in this review, 6 were active (Michigan Primary Care Association, OCHIN, Health Leads, WellRx, The Online Advocate, and J-CHiP) and 3 were passive (WellCare, Missouri 2-1-1, and San Diego 2-1-1).

The passive social health surveillance systems (WellCare and the 2-1-1 Systems) use custom technology platforms to track social services referrals and to store SDH data. The Michigan Primary Care Association, OCHIN, and WellRx stored SDH data in their respective EMR systems. Health Leads in Baltimore stored SDH data both in a database of social service referrals and in the EMR social history. J-CHiP SDH data are stored in a customized care management system. The Online Advocate (HelpSteps.com) survey and referral system stored the SDH data for analysis.

A fundamental component of social health surveillance systems is the ability to analyze these data. Although all 9 social health surveillance systems screened for social care needs for the purposes of integrating social care with medical care practices, our review shows a wide variation in capabilities to plan, implement, evaluate interventions designed to integrate social and medical care. For example, at the Michigan Primary Care Association, the lack of standard screening practices across de-centralized referral "hubs" limited the ability to plan, implement, and evaluate interventions to those SDH domains reliably collected, such as homelessness [5].

Two social health surveillance systems effectively analyzed the relationship between social care interventions and health outcomes and published those results in peer-reviewed literature. The Missouri 2-1-1 System cancer control program successfully planned, implemented, and evaluated their cancer control referral uptake rates [27]. The WellCare program published detailed evaluation of the social and medical care integration efforts, including the association of social risk factors to inpatient readmissions[41] and the relationship of social care utilization to overall health care spending [33].

For other social health surveillance systems, although capacity for evaluation exists, the results of the influence of social health interventions on medical care outcomes are less clear. For example, Health Leads papers stated that the program could evaluate how resource interventions can impact "individual or population health over time" [20] and "promote greater health equity," [32] but these results were not yet published. OCHIN [30] and J-CHiP [38] also described capabilities to evaluate the impact of social care interventions on health outcomes, but the results were not published. Other social health surveillance systems relied on health measures collected as a part of the social health surveillance system, such as patients' perceived ability to manage health needs (San Diego 2-1-1 [29]), diabetes control (WellRx [35]) and self-rated health (The Online Advocate/ HelpSteps.com [37, 42]).

Discussion

Public health surveillance provides the model for a national, individual-level social health surveillance system specifically designed to support the integration of social and medical care. The public health system obtains large quantities of data from widely-recognized data sources, such as reportable diseases, vital statistics, registries, surveys, and from administrative sources, such as hospital and emergency department discharges data, insurance billing claims, laboratory test results, and poison control hotline data [8, 43]. Critically important, public health transforms this data into actionable information on the health needs and risks of the community served in order to create interventions designed to improve public health [44]. The public health system currently conducts national surveys that include SDH, such as Behavioral Risk Factor Surveillance System (BRFSS), to develop community-level representations of social health risk, but community-level data may not enough detail to develop effective interventions seeking to integrate medical and social care systems [45]. When it comes to creating an effective social health surveillance, the tenets of epidemiological surveillance should be upheld but require adaptation.

The NASEM Committee recommended 5 complementary activities needed to strengthen social care integration: awareness, assistance, adjustment, alignment, and advocacy [1]. The 9 existing social health surveillance systems described in this systematic review support these activities directly. First, all 9 social health surveillance systems conduct awareness activities by identifying the social risks. However, the variability in how these SDH data are collected present a challenge to developing a fully-realized national surveillance system. A more effective social health surveillance system would incorporate national data standards for EMRs and other data systems and utilize and interoperable technology infrastructure for sharing between and among organizations [1, 18, 21].

According to the NASEM Committee, assistance entails connecting individuals to community-based social service assets. Without assistance, the effort to "medicalize" social care needs into medical

care rather than investing in upstream community interventions may add to the costs with negligible impacts on health outcomes [46]. Such "collection without connection" negates the benefits of screening for social risk factors and may cause unintended consequences, such as undue burden on providers or distress to patients [47]. All 9 social health surveillance systems provided assistance activities through similar processes – identify a social care need, make social care referral, and follow-up to assess the health-related outcomes. Some organizations assist individuals through a "concierge-based approach" where "navigators" (San Diego 2-1-1 [29]) or "advocates" (Health Leads [20, 32]) assist members with social care needs throughout a defined process.

All social health systems identified in this review altered their clinical approaches to accommodate social health issues, described as adjustment activities by the NASEM Committee [1]. For example, WellCare Health Plans utilized SDH data in their health plan case management processes, [33] the Missouri 2-1-1 System asked additional cancer prevention questions, [26-28] and health care providers at clinics with Health Leads help desks refer patients to students advocates for detailed social service guidance [20, 32].

Finally, according to the NASEM Committee, alignment and advocacy relate to investments and support of the social care services by health systems in their communities, and this systematic review found evidence of alignment and advocacy activities [1]. For example, evidence from the WellCare Health Plans SDH data showed that utilization of social services was associated with greater reduction in healthcare costs reinforcing the organization's commitment to align social care with medical care by issuing microgrants to community-based organizations to support the exchange of additional social care utilization data [33, 48]. Advocacy was demonstrated by the collaboration between the New Mexico Medicaid agency, health plans, and federally qualified health centers to expand the scope of the effort of the WellRx pilot program to address SDH [35].

In public health, active surveillance involves the health department directly conducting research or reaching out to providers and laboratories for data collection, and passive surveillance relies on reporting by clinicians. These public health surveillance components contain social health surveillance analogs. Active social health surveillance utilizes screening tools to directly identify patient social needs at medical care facilities. A passive social health surveillance relies on social needs identified and reported by individuals or their caregivers.

Six of the identified social health surveillance systems use an active approach, which has the advantage of proximate integration of between identification of patients' priority social care needs and relevant medical issues.[4] However, there are drawbacks to active social health surveillance, including the costs to clinicians who may lack the time to address social health risks [1, 49]. In addition, active surveillance may identify social risks but lack the time to obtain social care services. Finally, patients may not be receptive to social needs screening or have general privacy and stigma concerns related to non-clinical social health surveillance systems [50, 52].

A vast majority of public health surveillance systems are passive [53]. Only 3 social health surveillance systems were passive [34, 54]. Social service referral experts free-up clinical resources to conduct their specialized roles [37]. However, privacy and security concerns may be associated with non-clinical sites collecting SDH which may require an increased capacity to comply with privacy and security standards related to the sharing of protected health information [1].

Limitations

Though the search was exhaustive, some social health surveillance systems may not be included. The review includes published studies only so there may be other qualified social health surveillance systems. For example, Kaiser Permanente in California launched Thrive Local by partnering with social care referral system platform called Unite Us to connect social and medical care for patients, but peer-reviewed literature on the program was not yet available [55]. Finally, some social health surveillance systems may have been excluded because some defining aspect, such as identification of health outcomes, may be present in the system but not fully explained the published literature.

In conclusion, the social health surveillance system of the 21st century will utilize a steady stream of SDH data to permit benchmarking, goal setting, coordinated interventions, and description of results of integrating social care and medical care [43]. The 9 social health surveillance systems described in this systematic review fulfill this vision, but further work is needed.

Public Health 3.0 seeks to build on extraordinary public health successes of the 19th and 20th centuries to work across sectors to address SDH to improve population health [56]. Using this new perspective, public health leaders should expand epidemiological surveillance systems into a robust, nation-wide social health surveillance system through a multi-disciplinary collaboration with medicine, public health, social work, and others. To build a 21st century social health surveillance system beyond the programs identified in this review, policymakers should marshal the necessary resources [1, 8]. Without a social health surveillance system that supports the development of effective interventions that address SDH, the downstream clinical encounter will continue to be overwhelmed [1, 9].

Implications for Policy and Practice

- A social health surveillance system can be defined as the ongoing collection, storage, analysis, and classification of social determinants of health data essential to the planning, implementation, and evaluation of social care need interventions.
- Each of 9 identified social health surveillance systems implemented different approaches to continuous SDH data collection, but all used the information to integrate social and medical care.
- The social health surveillance systems were specifically designed for the purposes of addressing social care needs in order to improve health outcomes, such as reducing inpatient readmissions or emergency department visits.

- Public health leaders should expand the epidemiological surveillance systems into a robust, nation-wide social health surveillance system through a multi-disciplinary collaboration with medicine, public health, social work, and others.

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