Organization: Henry Ford Health System (HFHS)

Project Title: Pneumococcal Disease Prevention Initiative: Integrated Interventions for Improved Adult Immunization Rates.

Overall Goal. The project aims to establish a proactive program for adult immunization that engages key stakeholder groups and improves client-patient and provider knowledge throughout a large, integrated health system. In so doing, we anticipate that this project will lead to sustainably high rates of adult immunization coverage among adults ≥ 65 years of age.

Primary Objectives
1. To establish and evaluate an automated adult immunization reminder-recall function in the Henry Ford Health System (HFHS) electronic health information system that is utilized and accessible by health professionals throughout HFHS.
2. To ascertain potential barriers to acceptance, receipt, coordination and delivery of adult immunizations based on qualitative interviews and focus groups with HFHS health providers, client-patients, and caregivers, and a quantitative web-based survey of HFHS health providers.
3. To develop and integrate an electronic health provider educational program for prevention of pneumonia and invasive pneumococcal disease in adults aged ≥ 65 years.
4. To introduce adult immunizations, including pneumococcal vaccine, for client-patients of the HFHS and measure trends in vaccine coverage in adults aged ≥ 65 years based on analysis of data in the HFHS electronic health information system.

Secondary Objectives
1. To establish comprehensive baseline data on incidence of infection and treatment costs associated with treatment of pneumonia and other adult vaccine-preventable conditions among adults aged ≥ 65 years.
2. To establish baseline rates of health outcomes and vaccine-preventable conditions among adults aged ≥ 65 years.

Technical Approach
How the initiative will meet the goals for the RFP. The HFHS serves as an ideal environment for identifying adult immunization barriers in a diverse provider and patient population. The HFHS is one of the largest integrated health systems in the United States and covers patient populations throughout Southeastern Michigan. At the same time, the robust clinical, patient safety and research infrastructure of HFHS and Wayne State University (WSU) enables the project team to apply a highly multi-disciplinary strategy for identifying systemic-, provider-, patient-based barriers to delivery and ramp up of adult immunizations. For several years, clinicians and managers in the HFHS have shown uncommon leadership in immunizations. In 2010, HFHS instituted a system-wide employee influenza program that encouraged seasonal influenza vaccine or use of alternative barrier precautions for those who opted out of influenza vaccination. Similarly, data (**Appendix, Figure 1**) from older adult client-patients served by the HFHS show that 17,087 doses of adult 23-valent pneumococcal polysaccharide vaccine (PPV-23) were administered from 2009 through mid-2012 (including a total of 4,394 doses in 2009, 5084 doses in 2010, 5,511 in 2011 and 2,098 for the first half of 2012).

Like many urban centers across the United States, the Detroit Metropolitan area (encompassing a tri-county area of Macomb, Oakland and Wayne counties) has contained an ethnically diverse population that experiences varying levels of access to health-care. Recent changes in the U.S. health-care system are leading to dramatic changes in evaluation of health-care quality, methods for health-care delivery and renewed emphasis on preventive health-care. In the context of these healthcare changes, recent census data suggest that the aging of urban populations continues and that HCPs will face increasing challenges to care for an enlarging elderly population over the next several decades. By working within this diverse yet highly representative population, the project team will introduce an innovative, yet sustainable set of immunization tools that are designed to yield improved coordination among immunization providers and lead to significantly increased adult immunization rates.

It is important to note that the project team has an established track record of immunization work in the Detroit area and in collaboration with HFHS clinics.   Currently, Dr. ▮▮▮▮ and colleagues are collaborating on a CDC-funded study via a cooperative agreement with Dr. ▮▮▮▮▮▮▮ (University of Michigan SPH). In this project, clinic patients are surveyed for flu like illness and nasal swabs are collected and tested for influenza. In this observational influenza project, clinic staff are implementing standardized patient enrollment procedures including specimen collection and determination of influenza vaccination histories. This project is part of a multi-center study and will not overlap with but will complement the proposed work for this project. This and other projects, including several projects among hard to reach patient populations in Detroit, underscore the extensive experience of HFHS and collaborating sites for the applied health research projects.

Current Assessment of Need in Target Area

Quantitative baseline data. The HFHS data stores contain one of the largest data repositories available from any integrated health system in the United States. Computerized administrative databases are maintained by the Corporate Data Stores (CDS) and can be accessed through specific data requests that are approved by the Study Management Division, Department of Public Health Sciences of the HFHS. Client-patient discharge records encode demographic, clinical and laboratory characteristics as well as admission and discharge diagnoses using the *International Classification of Diseases*-9th Clinical Modification (*ICD*-9-CM). The HFHS administrative databases undergo routine, rigorous data management protocols and are designed for access by a wide range of clinical, epidemiologic and laboratory research staff through the Study Management Division, Department of Public Health Sciences, HFHS.

Since 1988, the HFHS has retained electronic health records for 100% of client-patients treated at the HFHS inpatient and outpatient facilities. HFHS medical records utilize an electronic platform (CarePlus Next Generation [CPNG], Reliance Software Systems, Farmington Hills, MI) that allows comprehensive recording and tracking of client-patient information including immunization records (**Appendix, Figure 2**). CPNG has been deployed to more than 12,000 users including 1,200 physicians in six hospitals and 120 clinics in the HFHS.

The HFHS has made a major commitment to local communities and has a well-established network of medical centers and clinics that serve a multi-county area including the Detroit Metropolitan area (**Appendix, Figure 3**). For development of this project, we conducted a preliminary review of medical records across 25 HFHS clinics in the greater Detroit

Metropolitan area. These clinics serve over one-half million client-patients (N=557,857) aged ≥65 years (**Appendix, Table 1**). This project will collaborate with the HFHS clinics and their medical staff through the Henry Ford Physicians Group ████████████████████████████ ██. Through Dr. ██████ role as Division Head of Infectious Disease, the effort is fully integrated into the patient care quality improvement initiatives within the institution.

The baseline incidence of pneumococcal disease among older adults (≥ 65 years of age) is high (~37/100,000). In 2004, Michigan adults aged 65 years and over experienced an age-adjusted influenza and pneumonia death rate of 126.8 per 100,000 population (Source: CDC/NCHS, Trends in Health and Aging website, National Vital Statistics System). In the HFHS, from 2009 through 2011, a total of 5,255 hospitalizations and 836 emergency room (ER) visits in the HFHS were associated with pneumonia (**Appendix, Figures 4 and 5**). Additional data for the first half of 2012 showed that 1,005 hospitalizations and 152 ER visits were associated with pneumonia among adults aged ≥ 65 years of age. These data from 2012 suggest that the trajectory for total pneumonia-associated ER visits and hospitalizations for client-patients aged ≥ 65 years of age continues upward. Notably, the highest burden of pneumonia-associated outcomes appears in the age group ≥ 80 years of age. Overall, a slightly greater proportion of ER visits occurred among women (52.4% vs. 47.6%). In contrast, men (51.2%) accounted for a higher proportion of all pneumonia-associated hospitalizations (women, 48.8%).

In recent years, pneumococcal infections continue to be detected through routine microbiologic testing performed in the HFHS patient population (**Appendix, Figure 6**). Among 77 outpatient pneumococcal (*Streptococcus pneumoniae*) strains tested during 2010 and 2011, 34% of isolates were resistant to penicillin, 33% were resistant to erythromycin and 28% were resistant to trimethoprim-sulfamethoxazole (TMP-SMX). Among an additional 58 pneumococcal strains isolated from January through December 2011, 19% of strains were resistant to penicillin based on the non-meningitis breakpoint while 52% of pneumococcal isolates were resistant to penicillin based on the meningitis breakpoint. This ongoing resistance of pneumococcus in the face of routine PCV immunization for children suggests that treatment costs for pneumococcal infections among adults may be an important and preventable burden.

To combat the burden of pneumococcal disease in adults, a vaccine has been available for more than three decades. Yet, achieving targeted goals for pneumococcal immunization, like other adult immunizations, remains challenging (**Appendix, Table 2**). National pneumococcal vaccine coverage estimates (63.2%), like those in Michigan (and other parts of the U.S.) is below current targets (www.cdc.gov/nchs/data/nhis/). While recent data from the National Health Interview Survey (NHIS) suggest that nationally, there has been improvement in pneumococcal vaccine coverage rates, analysis of data by ethnic groups suggests substantial disparities in rates of pneumococcal vaccination. Both crude and age-adjusted rates suggest that coverage among non-Hispanic Blacks (45.1-45.4%) and Hispanic/Latino (38.1-38.7%) populations were significantly lower than rates found among non-Hispanic Whites (63.3-63.6%).

Primary Audience Targeted for this Intervention. In the initial phase and start-up activities of this project, stakeholder mapping will be conducted with key constituents for adult immunizations. A preliminary landscape analysis of stakeholders for adult immunization

suggests that groups may be described by their potential level of interest or influence with regard to uptake, acceptance or use of adult immunizations (**Appendix, Figure 7**). This analysis of key stakeholders for adult immunizations suggests that education among HFHS providers will be a key activity during program roll-out. Our landscape analysis suggests that the proposed intervention will play a critical role by establishing educational resources for adult immunizations that are accessible by a range of HFHS staff, client-patients and their families. In reaching out to these varied stakeholders, the program will enable development and evaluation of a communication model for its a) *effectiveness* in transmitting appropriate messages, b) *sustainability* in an integrated health system context, and c) *completeness* in targeting key stakeholders for receipt of adult immunization focused messages.

Methods to characterize the audience for the intervention. The design and evaluation of audience engagement in this project will be based on a coherent framework (**Appendix, Figure 8**) that identifies and describes stakeholder characteristics including: a) present levels of training, education; b) time constraints in work schedules; c) competing client-patient care and administrative priorities; d) optimal learning methods; e) other sources of professional development and education. For this project, health-care providers (HCP), client-patients, and caregivers and families represent primary audiences for engagement. [1] To ensure maximal understanding of client-patient stakeholders, the project team will describe this group by characteristics including gender, race/ethnicity, socioeconomic status, geographic location and address (e.g., zip code). In the case of an integrated health system such as HFHS, other key secondary audiences for engagement around adult immunizations will include administrative and management personnel and other health-care personnel, particularly pharmacists. [2]

      In this project, qualitative (i.e., formative) research [3] among target audiences will drive a goal-oriented audience engagement plan that incorporates principles for adult immunization programs set forth by the US Centers for Disease Control and Prevention (US CDC) as well as the Agency for Health Care Research and Quality (AHRQ).[4] The CDCynergy is an interactive training and decision-support tool that is designed to help public health professionals systematically plan communication programs within a health context. CDCynergy is an online software system that allows users to assemble the pieces of a health communication plan systematically by answering questions in a specific sequence.[5] CDCynergy will be used in conjunction with HFHS communication technologies and marketing programs to design and implement targeted educational messages organized around specific goals such as increasing awareness among HCP groups, clinic health-care delivery teams and older adults client-patients and caregivers. Effective audience engagement will be evaluated based on a logic model.[6] The logic model process is employed by program managers and evaluators to describe the effectiveness of health programs. In the context of this project, key elements of the logic model for evaluating audience engagement include inputs, activities, outputs, and outcomes (**Appendix, Table 3**). The draft logic model, shown for illustrative purposes, will be reviewed and refined with project stakeholders at HFHS and other organizations at initiation of the project.

Qualitative and quantitative formative research to guide development and introduction of the intervention. Our proposed study will use a mixed-methods approach [7] including: 1) focus

group discussions (FGD) with health-care providers (HCPs), adults ≥ 65 years of age and their caregivers [8], 2) individual qualitative interviews with senior HFHS managers and clinic department heads; and, 3) a web-based survey with clinic health-care providers. Qualitative data transcriptions will be analyzed in conjunction with responses to the web-based survey to identify perceptions and knowledge regarding pneumonia, pneumonia vaccines, and barriers to vaccine up-take. These data will be used to determine avenues for communication and content and delivery methods for educational materials for both HCPs and client-patients. After development of adult immunization educational materials, we will conduct focus group discussions with HCPs and client-patients to obtain their feedback prior to deploying field-test versions of the educational materials in HFHS clinic settings. In addition, after the randomized control trial of the intervention materials, we will conduct focus groups with HCPs in those clinics using the materials to assess the implementation process and incorporate suggested changes to improve delivery and content.

Research sites and target population. For conduct of the FGDs, participating (HCPs) and clients will be identified and enrolled at HFHS clinic locations through Southeast Michigan (**Appendix, Figure 9**). At 20 research site clinics, we will recruit HFHS HCPs from a range of professions including physicians, physician assistants, nurses, and pharmacists. All full- or part-time HCPs will be eligible for participation. For interviews with client-patients, Dr. Kaljee and colleagues will work with clinic staff to identify and enroll healthy adults aged ≥ 65 years. Caregivers and family members of client-patients will also be identified through clinics and in consultation with client-patients for participation.

Focus group recruitment. In cooperation with participating clinic administrative staff, informational letters will be provided to potential participants (i.e., HCPs, clients-patients and caregivers) along with invitations to join a focus group discussion. Confirmed focus group participants will be reminded of the FGD day/time/place at least one to two days prior to the FGD via phone, text message, or e-mail.

Focus group sampling strategy. While qualitative data sampling is less stringent than methods employed for surveys, certain measures need to be taken to ensure that participants are categorically representative of significant dimensions of the target population. [9] To ensure adequate sampling and representation of the target patient population, we have identified key dimensions of the target populations including: 1) neighborhood residency in Detroit and surrounding communities (for the client-patient and caregiver FGDs); 2) age (client-patient age groups: 65—69, 70—74, ≥ 75 years of age); and, 3) HCP/professional employment category (healthcare providers). We will conduct two focus groups each with physicians, nurses, pharmacists, and clinic managers (total 8) and 2 focus groups each with populations in the following age groups: 65-69, 70-74, and 75-79 and 80+ years of age. . Among caregivers, we will conduct four FGDs with caregivers of older adult client-patients (total four FGDs). A total of 20 FGDs will be assembled with ~10 participants per focus group (**Appendix, Figure 9**).

Individual interviews. We will also conduct individual qualitative interviews with senior HFHS management and clinic department heads. These interviews will be designed to obtain broader

system-wide issues in relation to disease burden for pneumonia, barriers to vaccination, and implementation of the proposed interventions. We will contact these individuals separately, provide written information about the study, and schedule an individual meeting. We estimate conducting approximately 8 to 12 individual interviews.

Focus group and individual interview guides. Guides for interviews with HCPs, client-patients, caregivers, and senior management/clinic directors will be developed by WSU and HFHS Investigators. Separate but complementary interview guides will be developed for the different participant populations. The guides will include general topics and specific probes to ensure consistency and that all relevant topics are covered in each FGD/interview. The interview guides will be framed on a vaccine uptake model (**Appendix, Figure 10**) which focuses on perceptions of disease (e.g., severity, vulnerability), perceptions and knowledge of adult vaccines and sources of information regarding education about vaccines (providers) and more general health resources (client-patients/caregivers). Utilization of the model will: 1) assist with translation of the data for adaptation/development of the HCP web-based survey; 2) facilitate the triangulation of the qualitative and survey data; and, 3) inform development of the intervention content and delivery. The qualitative process is iterative. As data are collected and reviewed, additional topics may be added to the guides to capture emergent themes.

Qualitative data collection. Experienced facilitators will conduct the FGDs. The facilitators will be trained in the use of the specific interview guides created for this study. FGDs will be observed by Dr. Kaljee and other study team staff and senior administrative/clinic director interviews will be conducted by the project investigators including Drs. Kaljee, Kilgore, and Martin. FGD observers will record observations using computerized word processing and all FGDs will be digitally audio-taped. Individual interviews with senior administrators and clinic directors and project interviewers will record computerized notes during each interview. FGDs will require ~60 minutes and individual interviews ~30 minutes. For both FGD and HCP interviews, through the iterative data collection and analysis process, we will strive to reach the point of "data saturation". Data saturation refers to the point at which no new information or themes are observed in the data. This will be done in order to ensure that we have maximized variability within our data and have sufficient data to fully assess all observed patterns. [9]

Database management and analysis. Recorded qualitative data (FGD and interviews) will be transcribed by qualified health information transcriptionists. Throughout the data collection process, face-to-face or conference calls/webinar project meetings will be held to discuss transcription content and identify emergent issues and to determine the need for modifications to the interview guides. Transcribed data will be coded for analysis using qualitative data management software (Ethnograph v6.0). A coding dictionary will be developed including terms to reflect research objectives, vaccine uptake constructs (e.g., severity/vulnerability) as well as terms grounded in the text. Project investigators will code qualitative data and 20% of interviews will be double-coded to ensure inter-coder reliability. Our analytic strategy will account for the context of interviews and group discussions, the interplay of textual data into single or multiple discourses, as well as relationships between interview texts within and between respondent groups (i.e., providers, caregivers, client-patients) and demographic

groups defined by age, gender, and residency. Additional grouping categories may be identified during the course of analysis. Identifying these discourses will be important for delineating differences between groups in relation to 'knowledge' and perceptions of pneumonia and vaccines for the development of provider and client-patient/caregiver interventions.

Web-based survey. We will develop a brief healthcare provider survey to provide us with more generalizable information regarding providers' perceptions, knowledge and experience with pneumonia in our target populations and current and future use of pneumococcal vaccines. The web-based survey is an excellent means of collecting data for several reasons: 1) the survey can be completed at any time and does not require scheduling a meeting time with busy clinic staff; 2) skip patterns can be built into the program, minimizing time burden for completing the survey; 3) no data entry is required minimizing associated data entry errors; and, 4) greater anonymity and confidentiality. While there is cost associated with programming, these costs are significantly less than hiring and training survey data collectors and data entry staff.

Survey development and programming. The WSU and HFHS investigators will develop the survey based on attitudinal and perceptions items and scales previously used with vaccine uptake research [10-13] and knowledge items specific to pneumonia, client-patient vulnerability, and specific adult vaccine characteristics and indicators for use. All items will be close-ended and the survey will be approximately 10 to 15 minutes in length. To develop and deploy the web-based survey, the project team will work with IDEACore, LLC, a Birmingham, Michigan-based web development and management company (www.ideacore.com). IDEACore has worked with faculty at WSU, including Dr. Kaljee in the development and implementation of a HIV global health research mentoring web-site (www.hivmentornet.wayne.edu). IDEACore will utilize its existing in-house survey development and implementation program. IDEACore's servers are in a secure hosting environment at a Michigan-based data center. IDEACore servers are protected against cyber-attacks using standard security software and other industry-standard features including hardware- and software-based firewalls. The data center has an uninterruptable power supply (UPS), and fully up-to-date environmental and fire protection controls.

Survey target population and sample size. The survey will be conducted with HCPs at the participating HFHS clinics include physicians, physician assistants, nurses, pharmacists. We conservatively estimate that this project will access an average of 10 providers per clinic and our total eligible survey sample will be at least 200 HCPs in a minimum of 20 HFHS clinics. In order to estimate proportions with a precision of no more than ± 10% (i.e. a 99% confidence interval width of ±0.1), a sample size of 166 is needed. To obtain the same precision for a 95% confidence interval, the sample size required is 97 HCPs. Out of 200 potential participants, sample sizes of 97 and 166 will require participation rates of 49% and 83%, respectively.

Survey recruitment. In collaboration with HFHS clinic managers, HCPs will be provided with e-mail invitations for their participation in the survey. Each email will contain instructions for accessing and completing the web-based survey. To ensure timely completion of the survey, reminder e-mails will be sent out to HCPs who did complete the survey at one week, two week

and one month intervals. Since we will be working with these HCPs prior to initiation of the web-based survey in the context of the FGD recruitment and participation, we do not anticipate significant challenges for provider participation in the survey.

Survey data analysis. Variables will be created for scales (e.g., knowledge of adult vaccines). We will compute descriptive statistics and the data will be screened for missing cases, outliers, and normality of distributions. We will identify subgroups of interest by systematically categorizing individuals (e.g., type of providers and specialists). Bivariate analysis including Pearson's chi-square (for categorical variables), and independent t-tests and ANOVA (for continuous variables) will provide information regarding associations between provider characteristics and disease perceptions, vaccine knowledge and perceptions, and past and project use of adult vaccines. Binary and multinomial logistic analysis and linear regression analysis will be used to further refine relationships and control for confounding factors.

Immunization Communications Network. A well-planned and well-executed communications plan will be an essential ingredient to the successful introduction of adult immunizations in the HFHS and other health systems across the United States. While specific approaches to executing this communications plan may vary, there are several key elements and stakeholders to consider (**Appendix, Figure 11**). The staff who are working in primary care clinic settings are likely to play at critical role in educating client-patients and highlighting the value, safety and effectiveness of adult immunizations.

As in several other health systems similar to the HFHS, first-line staff includes primary care physicians and clinic nursing staff. In collaboration with clinical staff, pharmacists and clinic managers will play an important role in by ensuring continuous access to vaccine supplies as well as ensuring that clinic infrastructure and personnel are both trained and available to administer adult immunizations. In this project, a novel feature of the immunization intervention is the empowerment of an Adult Immunization Champion (AIC). As a regular member of the clinic staff (e.g., a physician assistant), the AIC will receive specialized training in vaccines and represent a focal point for helping clinical staff and other key stakeholders to identify client-patients who need vaccines, assist in tracking client-patients who have been vaccinated, communicate with clinical staff, family members/caregivers and outside organizations (e.g., long-term care facilities, managed care organizations) to ensure that adult client-patients are provided with the highest standard of care and prevention of disease with vaccines.

Intervention Design and Methods
How the planned intervention addresses the established need. Health-care providers and health-care systems experience multiple challenges in the delivery of vaccines for adults. The investigators of this study bring long-term experience in development of clinical and population-based programs for immunization that leverages the skills of a multi-disciplinary team of anthropologists, educators, epidemiologists, infectious disease, and infection prevention specialists to implement a series of activities that gather empiric evidence through qualitative and quantitative methods. These data will be used to inform the design and implementation of provider and client-patient immunization educational programs.

Participating HFHS clinic locations will be randomized to receive the immunization educational intervention or to the control arm of the program that will not implement any targeted educational program. Prior to full-scale implementation, the educational intervention will be pilot-tested to ensure that each component of the intervention is professionally well-suited and culturally-appropriate for the target groups of stakeholders. Full-scale implementation will commence and continue for eight months during which interim surveys with HCPs, managers, and adults client-patients will be conducted to evaluate acceptance of the program and measure adult immunization uptake in the intervention arm and control arm clinics.

How the planned intervention will produce the desired results. The project team is oriented to ensuring high-quality measurable outcomes and results. To this end, the project will use standardized adult immunization quality measures that are consistent with national guidelines as well as national goals set out in Health People 2020 documentation. Results dissemination will be designed to: 1) provide timely information on formative research results to health providers in the HFHS; 2) provide ongoing results (feedback) of immunization coverage to HFHS health providers, clinic staff and senior management; 3) provide regular adult-focused health educational information on prevention of invasive pneumococcal disease and pneumonia; 4) establish conduits for investigator-health provider-adult client-patient population dialogue that will enable regular exchanges of adult immunization information, increase outreach to health providers and adults in the HFHS client-patient population; 5) identify adult immunization champions among the HFHS staff who will serve as future point persons for stimulating and achieving sustained high rates of immunization among older adults and other high-risk persons. Our multidisciplinary team of anthropologists, educators, epidemiologists, infectious disease, and infection prevention specialists will enable the development and implementation of a focused yet comprehensive training program inclusive of biomedical-based knowledge regarding pneumonia in older adults, vaccinology, socio-cultural aspects of health, health-seeking, and vaccine acceptance, and effective strategies for education and intervention. To ensure success and sustainability of the immunization champion model, each champion will be trained and evaluated along the following characteristics: 1) a high degree of knowledge regarding indications and contraindications for each vaccine (e.g., scoring 80% or better on a computer-administered vaccines knowledge test); 2) proven ability to succinctly communicate informative vaccine-specific health messages (e.g., completion of participatory clinic in-service on patient vaccine communication); 3) proven ability to consistently complete loop of communication from patient to nursing and clinic support staff who administer vaccines (e.g., demonstrated understanding in written knowledge test of optimal approaches for in-clinic communication with care team responsible for vaccine administration); 4) high level understanding of potential patient-specific barriers that exist for delivery of adult vaccines and strategies for minimizing impact of barriers on patients. Data from our qualitative formative research phase will be instrumental in preparing the immunization champions to identify and address stakeholder barriers (e.g., demonstrated knowledge and understanding via case studies in a computer administered knowledge test); 5) high degree of willingness to encourage and support use of information technology, immunization registry databases and EMR resources to document vaccine administration (e.g., demonstrated understanding of how to use MCIR and

the CAREPLUS EMR to enter patient vaccination data with follow-up on providers' use of these resources during course of project intervention).

To ensure success in producing the desired results (i.e., increased adult pneumococcal immunization coverage and increased coverage for other adult vaccines), this project will implement a stakeholder/audience engagement plan that systematically works with key target audiences include senior management of HFHS, clinical department leadership, primary care staff physicians, primary care clinic nurses and support staff, pharmacists, HFHS health education program staff, clinic managers and administrators and organizations concerned with the welfare of older aged client-patients and residents in the community (**Appendix, Table 4**). For each target audience, specific communication objectives have been identified as well as the format and means for communication.

Intervention overview. An evidenced-based intervention model for introduction of adult immunizations has been developed based on the published adult immunization literature and takes into account valuable resources within the HFHS infrastructure. Like other health systems that are now moving ahead to meet changing health-care system demands, HFHS has implemented an electronic medical record (EMR). This EMR and its resources provide an excellent opportunity for integration of tools that directly support HCP delivery of vaccines to adults in HFHS clinic settings. In this context, this project will implement a package of interventions that enable clinics to: a) provide accurate, timely and appropriate educational information on vaccines to HCPs, managers and client-patients, b) ensure that vaccine administration, follow-up, and tracking of receipt is integrated in the HFHS EHR and c) sustain immunization efforts with a long-term goal of reaching immunization coverage for adults of 90% or higher.

Intervention bundle. To fully address the challenge of increasing immunization for adults, we considered tools that have been created and tested in clinic and hospital settings. The components of the intervention package include: a) Champions (C) for adult immunization, b) Education (E) for providers and client-patients/family and caregivers, c) Reminders (R) to immunize with adult vaccines, d) Performance (P) feedback to adult immunization providers, e) Standing (S) orders for adult immunizations. Together, the intervention (CERPS) includes tools now used in the HFHS (e.g., electronic reminders to providers) and will incorporate additional components shown to be useful in raising immunization rates (**Appendix, Table 5).**

Immunization champions represent a novel new tool for raising immunization rates. [14] [15] [16] The need for immunization champions has arisen from recognition that peer support can lead to increased focus on the target disease and vaccine. [17] In part, the need for immunization champions has arisen from recognition that other interventions to raise immunization are necessary but not sufficiently effective in allowing providers to reach and sustain high-level immunization coverage. [18]

The Veterans Health Administration (VHA) is notable for having achieved success in the application of CERPS components. [19] Educational programs for providers, clinical reminders to deliver immunizations and performance feedback tools have been recommended for use and are now becoming standard tools for increasing immunization coverage.[20] [21] [22, 23] [24]

[25-27] [28]. A number of institutions, including the HFHS, have utilized standing immunization orders to help ensure vaccine deliver and use of this tool has been recommended for raising pneumococcal vaccine coverage [29] [30] [31]. In addition, client-patient education materials have become standard tools for the HFHS and other institutions. [32] [33] [34] [35] [36]. Providing materials to client-patients during clinic visits, reminders to client-patients by mail or phone have been utilized with success. [37] [38] [39]   [40] [41] [42]

The formative research conducted in the initial phases of this project (described in foregoing sections) will establish a critical foundation on which to design the adult immunization educational tools. In conjunction with Pfizer communication and educational specialists, the project team will leverage existing adult immunization educational tools (e.g., pneumonia education, vaccine efficacy and safety information) to ensure comprehensive yet accessible materials tailored to providers, client-patients and their caregivers/families.

Components of the CERPS will be developed and pilot-tested in selected clinics. Feedback from the pilot-tests will be immediately used to finalize materials in order to maximize acceptability of educational and reminder messages to health-care providers, client-patients and family/caregivers. Once final materials are developed for paper and/or electronic distribution, CERPS will be rolled out to all clinics of the intervention study arm.

Educational program development and pilot-test. The educational program for integration into clinics will incorporate knowledge gained from the formative research conducted in the first phase of this project. Education modules for adult immunization will be modeled after US CDC National Immunization Program educational materials developed for other adult vaccines as well as training modules developed for the American Pharmacists Association (APhA) vaccine certification training program. Educational materials will be pilot-tested through FGDs with HCPs and client-patients/caregivers. These FGDs will follow similar procedures outlined for the formative phase qualitative data collection, management, analysis. During FGDs, immunization strategies for adult client-patients will be presented and discussed to solicit their feedback in order to optimize vaccine uptake throughout participating clinics. These data will be used to finalize the intervention packages for both providers and client-patients/caregivers.

Evaluation Design
How project will determine if practice gap identified was addressed for the target group in terms of the metrics used for the needs assessment. All potential gaps will have baseline evaluation to ascertain performance prior to the project intervention. For example, pneumococcal vaccination rates among adults in the HFHS will be compared against current goals set out Healthy People 2010 and 2020 as well as other adult immunization quality indicator criteria. This baseline status will be shared with project team members, collaborating clinics and HFHS management and patient quality staff to ensure high-level agreement on baseline starting points.   At conclusion of the intervention period, the performance metrics (e.g., specific adult vaccine coverage levels) will be used to assess changes from baseline the post-intervention period.   The magnitude of change both in absolute terms and in relative percentage increase will be ascertained in the analysis phase of the project.

Allocation of clinics to intervention and control arms. Outpatient facilities of the HFHS will be allocated to either the intervention or control arm of the study (**Appendix, Figure 12**). Each arm will consist of ten clinic facilities. All clinic facilities will be offered access to recommended adult vaccines. For patients who receive adult vaccines, the cost of vaccine and its administration will be either charged to their insurance carrier, paid by the patient themselves or supported by the HFHS. Requisite information on adult vaccines will be provided to clinic managers in a manner conducted for previously licensed and distributed adult vaccines in HFHS facilities. Clinic facilities that are allocated to the control arm will continue to apply their current methods for vaccine procurement, storage and handling. Clinics allocated to the intervention study arm will be provided with tailored outreach and education that will introduce the adult vaccines to clinic management staff and HCPs. In this introduction to the range of recommended adult vaccines, clinic staff will be provided with details for each component of the integrated immunization intervention to raise coverage.

Control clinics selection. The control arm of this project will consist of 10 HFHS-affiliated clinic settings that provide ongoing care of client-patients within the Southeastern Michigan region. Control clinics will represent a diverse range of client-patient sub-groups from varying races/ethnic, socioeconomic, employment and educational backgrounds and will be similar in urban versus suburban distribution to intervention clinics through the use of stratified randomization. Following assignment of clinics to the intervention and control arms, clinic characteristics including number of HCP, total clinic staff, pharmacy access and client-patient age distributions will be described to identify any differences between the intervention and control arm clinics.

Sample size estimation. HFHS clinic facilities will be randomized to implement the adult immunization intervention package or to operate their immunization activities using currently utilized standard methods. Since the probabilities of immunization for client-patients using the same clinic are likely to correlated (due to other factors besides the intervention), the effective sample size will be reduced in proportion to the "design effect" which can be expressed as $1+(m-1)\rho$, where m is the number client-patients in a cluster (clinic) and ρ is the intraclass correlation coefficient. In other health services studies, ρ as usually be 0.05 or lower. If we conservatively assume an average of 200 eligible client-patients per clinic during the study period, the design effect will be $1+(200-1)\ \rho = 1+(199)0.05=10.95$. The total number of client-patients per arm would be 200(10)=2000 and the effective sample size would be 2000/10.95 = 182.6. An effective sample size of 182 per group will give 82% power to detect a difference in the proportions immunized of 45% versus 60%. Intra-clinic client-patient heterogeneity by age group could also influence final outcome (note the differences in age group uptake of adult vaccine). However, such differences could be controlled for in the analysis as covariates.

Sources of data. A major advantage of conducting this project with the HFHS is the opportunity to deploy targeted HCP messaging through the HER that is accessible to all HFHS HCPs and managers including those working in both outpatient and inpatient settings. At the same time, the linkage of the HFHS administrative databases to EHR information allows for real-time tracking of progress in adult immunization coverage using programmable database queries. In

this way, the system will also allow for targeted feedback reporting in performance of immunization activities to clinic managers, primary care physicians, nursing staff, other medical staff, clinical department leaders as well as senior managers of the HFHS.

Post-intervention focus group discussions. We will conduct focus group discussions with providers at the clinics randomized to receive the intervention (total 10 FGD). The purpose of these FGDs will be to obtain process evaluation data related to the effectiveness of the delivery mechanisms and challenges/barriers to implementation and utilization of the intervention components. We will use similar data collection, management, and analysis procedures for these FGDs as described for the formative phase. Data from these focus groups will be used to reassess intervention delivery and content prior to wider dissemination and evaluation.

Data collection. Baseline characteristics of participating HFHS clinics will be ascertained from administrative databases containing HFHS personnel listings and client-patient census data. To support additional data analysis, project staff will access automated data files in the Corporate Data Stores of the HFHS. These data will be used to track client-patients in the target age group who present for any reason to the participating HFHS clinic facilities. Data will be accessed at monthly intervals to obtain numbers of client-patients who receive any adult vaccine. Provider- and clinic-specific data will also be obtained to examine adult immunization trends across individual providers, provider specialty area and clinic location. Adult immunization coverage data will also be accessed to permit analysis of trends in overall rates of immunization for adults aged ≥ 65 years and older as well as for specific age groups (65 to 69, 70 to 74, 75 to 79 and ≥ 80 years). To support analysis of trends in adult immunization coverage, underlying medical conditions will be tabulated for client-patients who do and do not receive adult immunizations during the intervention period. Secondary outcomes analysis will be performed to identify incidence of hospitalization due to potentially adult vaccine-preventable conditions including community-acquired pneumonia. Trends in pneumonia and other vaccine-preventable disease-associated healthcare costs will be evaluated using data on patient costs in intervention and control groups, and hospital readmission rates for pneumonia.

Data analysis. The data analysis plan will be driven by the goal of ascertaining impact of the intervention on adult immunization coverage levels. Interim and final analysis will focus on generating outputs that tabulate and graph adult immunization rates. The immunization rate calculations will be based on denominator data that are obtained directly from HFHS electronic clinic records and the computerized data stores. Denominator data will consist of client-patients in the target age groups who are eligible for adult immunizations. To estimate immunization rates, the number of immunized adults will serve as numerator data. Absolute and relative increases in immunization coverage rates (e.g., increase from 70% to 80% yields a 10% absolute % increase in coverage and a 14% relative increase in coverage [80% - 70%]/70%). Crude, mean and median rates will be compared for all clinics in the intervention and control study arms. To inform audiences on the impact of the integrated immunization intervention and to apply existing performance measures from the PCPI (**Appendix, Figure 13**), the project team will also analyze HFHS administrative data with adult immunization coverage data to assess immunization status among client-patients with chronic obstructive pulmonary disease

(COPD), community-acquired bacterial pneumonia and immunodeficiency conditions including HIV/AIDS. Individual HCP performance will also be reported on a weekly basis so HCP will understand the total number of vaccine eligible client-patients under their care, the % of eligible client-patients to whom they offered adult vaccines and the % of client-patients they immunized with adult vaccines (**Appendix, Figure 14**). To formally test for a difference in immunization rates between the intervention and control clinics, generalized estimating equation logistic regression analysis will be used. The logistic regression analysis will include as potential confounding variables, the age of eligible client-patients, client-patient gender, clinic population size and provider years of training. Changes in immunization coverage levels will be compared against existing national targets for pneumococcal vaccination coverage as well as patient quality care indicators used nationally to assess pneumococcal vaccination achievement.

Detailed Workplan and Deliverables Schedule
Narrative workplan. For this project, a detailed activity based workplan will be implemented by project staff in partnership with faculty of Wayne State University, clinical faculty and research staff of HFHS, clinic-based primary care providers and clinic managers of the HFHS. Each activity will have a defined time period, completion date as well as key milestones and deliverables (Refer to New Table below). This detailed workplan constitutes a key project management tool that project leaders will use for guiding activities and sub-activities throughout the 18-month project period. It is anticipated that this workplan will be discussed with project sponsors and additional provisions may be incorporated as recommended or specified by project application reviewers.

Project management and oversight. The project management team led by Dr. ▆▆▆▆▆▆▆ will be convened weekly in Henry Ford Hospital (2799 West Grand Boulevard Detroit, MI) in order to ensure ongoing study progress for each activity. Meeting agenda's will include activity reports by project team members and discussion of milestones and progress toward on-time completion of workplan deliverables. Active engagement of HFHS staff throughout the clinic network will occur on a daily basis and coordinated through the Project Manager who is 100% committed to this project. The project manager will utilize GANTT charting tools, project management software and logic models to actively track progress and report daily on progress to Dr. ▆▆▆▆▆▆▆ to ensure all project tasks are completed as planned. The project manager will be supported by a committed and highly experienced team ▆▆▆▆▆▆▆▆. HFHS has a well established quality infrastructure, in which Dr ▆▆▆▆▆ responsible for immunization efforts.

**Program activities, milestones, deliverables and anticipated completion dates.**

The following activities span an 18-month project period starting January 2013--June 2014.

Table: Timeline and Milestones and Deliverables				
Activities	**Study Month**	**Milestones**	**Deliverables**	**Completion Dates**
Finalize FGD & individual interview guides	-1, +1	-completed interview guides	completed interview guides & protocol manual	Jan. 30, 2013
IRB submission for formative & evaluation research	+1, 2	-completed IRB application	-IRB approval letters	Feb. 28, 2013
Development and programming of web-based HCP survey	+4, 5	-completed programmed web-based HCP survey	-completed programmed web-based HCP survey	May 31, 2013
FGD with HCP, client-patients, caregivers & individual interviews with administrators; qualitative data transcription & analysis	+3 to 6	-completed scheduling & execution of interviews, FGDs -Completed data inspection, cleaning & qualitative mixed methods data analysis	-recorded audio & text transcripts of interviews and FGDs; -qualitative report from FGD & individual interviews	June 30, 2013
Implementation of web-based HCP survey and data analysis	+6 to 8	-completion of data collection for the web-based HCP survey; -preliminary data analysis of the survey; -triangulation of qualitative & survey data	-report on outcomes from the web-based HCP survey; -translation of findings for intervention development	Aug. 31, 2013
HCP & patient educational intervention design	+7 to 8	-development of vaccine educational modules	-vaccine educational modules for HCPs	Aug. 31, 2013
Pilot test of educational interventions	+8	-completed module pilot test with HCP	-final version, vaccine educational training program for HCPs	Aug. 31, 2013
Intervention roll-out and monitoring	+8 to 16	-Vaccine roll out in 20 HFHS clinic sites	-written report of roll out evaluation	Apr. 30, 2014
Adult immunization coverage tracking and interim analysis	+8 to 16	-Vaccine tracking in HFHS health info system (CAREPLUS)	-monthly vaccine coverage reports with age, gender, clinic covariates	Apr. 30, 2014
Audience engagement evaluation	+8, 10, 12, 14, 16	-qualitative and quantitative assessment completed	-report of process & results of audience engagement in HFHS	Apr. 30, 2014
Outcomes, final analysis	+16, 17	-acquisition of HFHS data on vaccine uptake and distribution	-electronic dataset on immunization with covariates	May 31, 2014
Results reporting and dissemination to stakeholders	+18	-aggregation of final vaccination dataset from HFHS data sources	-final project report, peer-reviewed publications	June 30, 2014

Appendix: Tables and Figures to Accompany Technical Approach

Figure 1. Pneumonia Vaccines Administered, Ages ≥ 65 Years, Henry Ford Health System, 2009—2011.
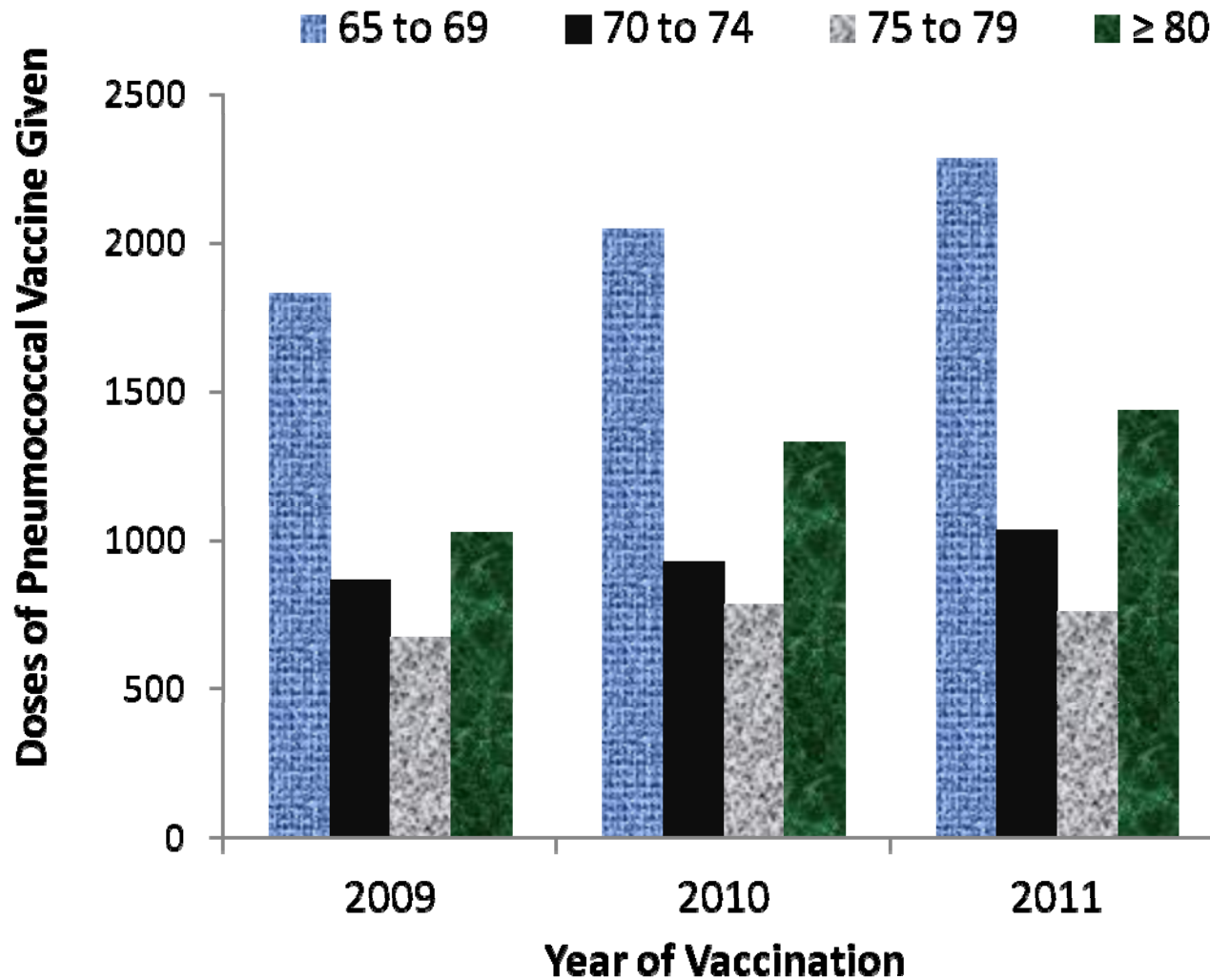
Data Source: Department of Public Health Sciences, Henry Ford Health System.

Figure 2. CarePlus Screenshot showing immunization fields.

Figure 3. Henry Ford Health System Facilities.
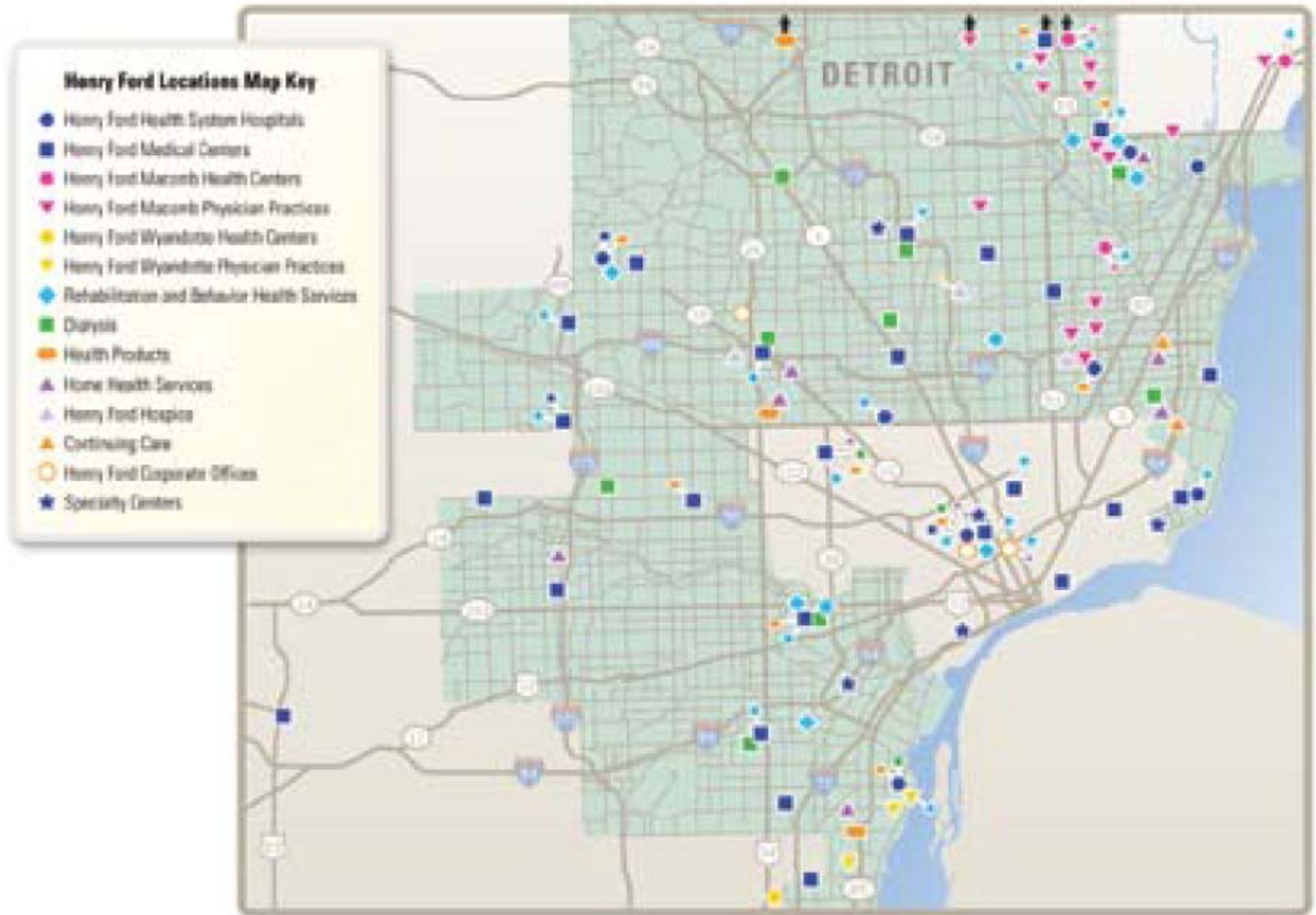
Source: Henry Ford Health System.

Table 1. Age distribution of adults, aged ≥ 65 years, Henry Ford Health System Outpatient Clinics.

Clinic Site	Patient Age Group (yrs)				Total
	65--69	70--74	75--79	≥ 80	
1	2269	462	765	765	277
2	16865	5030	4395	3781	3659
3	45179	15010	12360	9447	8362
4	34267	9566	10291	7789	6621
5	11975	3761	2899	2752	2563
6	46601	16526	10408	8625	11042
7	10982	4343	2206	2219	2214
8	81300	21149	24551	19815	15785
9	18711	5920	5393	3759	3639
10	19950	6951	5327	3804	3868
11	8200	4197	825	1031	2147
12	37791	11576	10021	8726	7468
13	33942	10925	8336	7969	6712
14	1411	614	270	165	362
15	14808	4602	3776	3610	2820
16	6935	2080	1913	1471	1471
17	16091	5339	4371	2870	3511
18	9654	2800	2843	2179	1832
19	10321	2367	3198	2572	2184
20	30644	7259	10614	7668	5103
21	41207	13219	9169	9138	9681
22	14984	4174	4192	4064	2554
23	11412	2599	3743	2724	2346
24	14435	5925	2655	2405	3450
25	17923	5608	4435	3963	3917
Total	**148,956**	**123,311**	**113,588**	**172,002**	**557,857**

Figure 4. Inpatient Hospitalizations for Pneumonia, Ages ≥ 65 Years, Henry Ford Health System, 2009—2011.
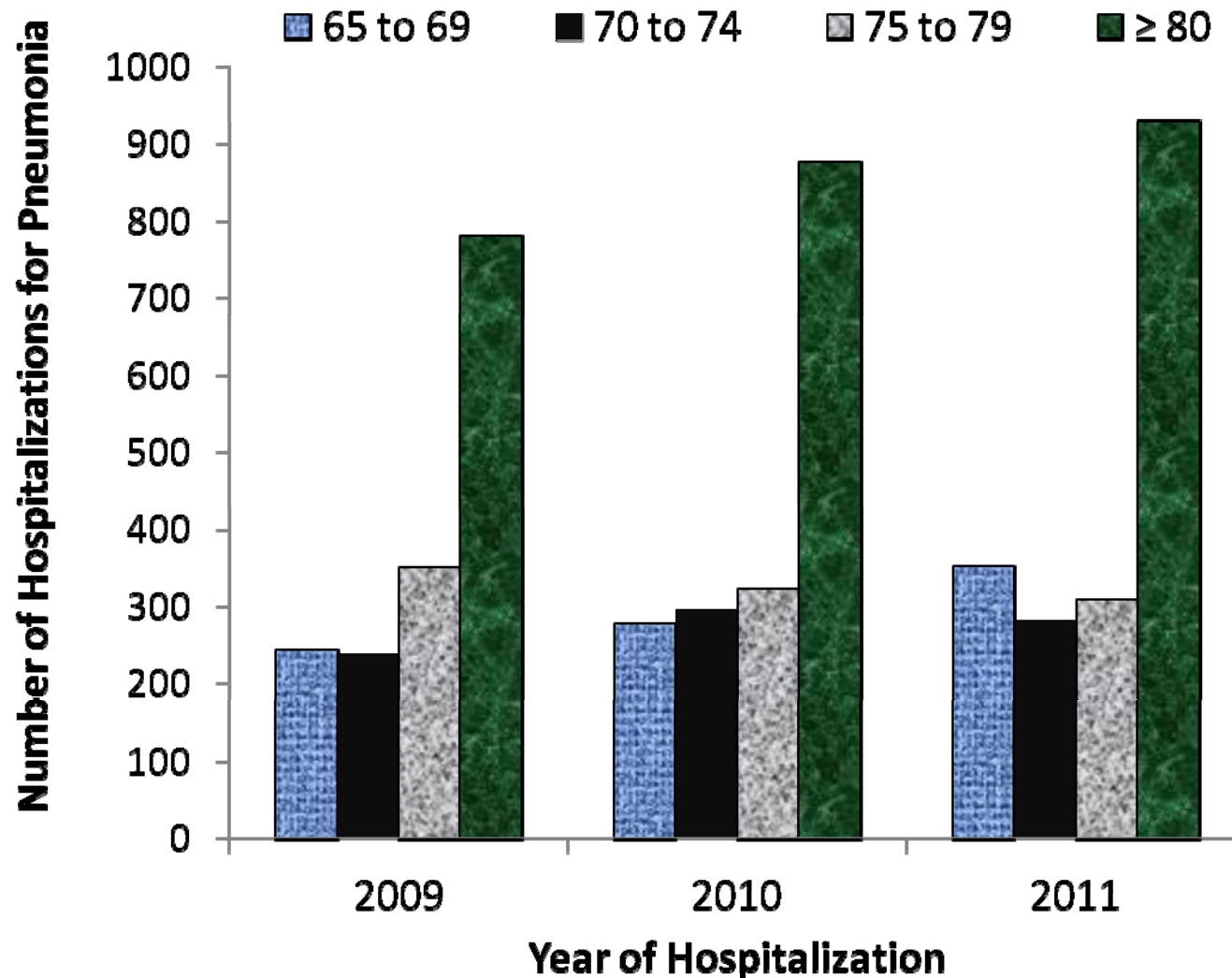
Data Source: Department of Public Health Sciences, Henry Ford Health System.

Figure 5. Emergency Room Visits for Pneumonia, Ages ≥ 65 Years, Henry Ford Health System, 2009—2011.
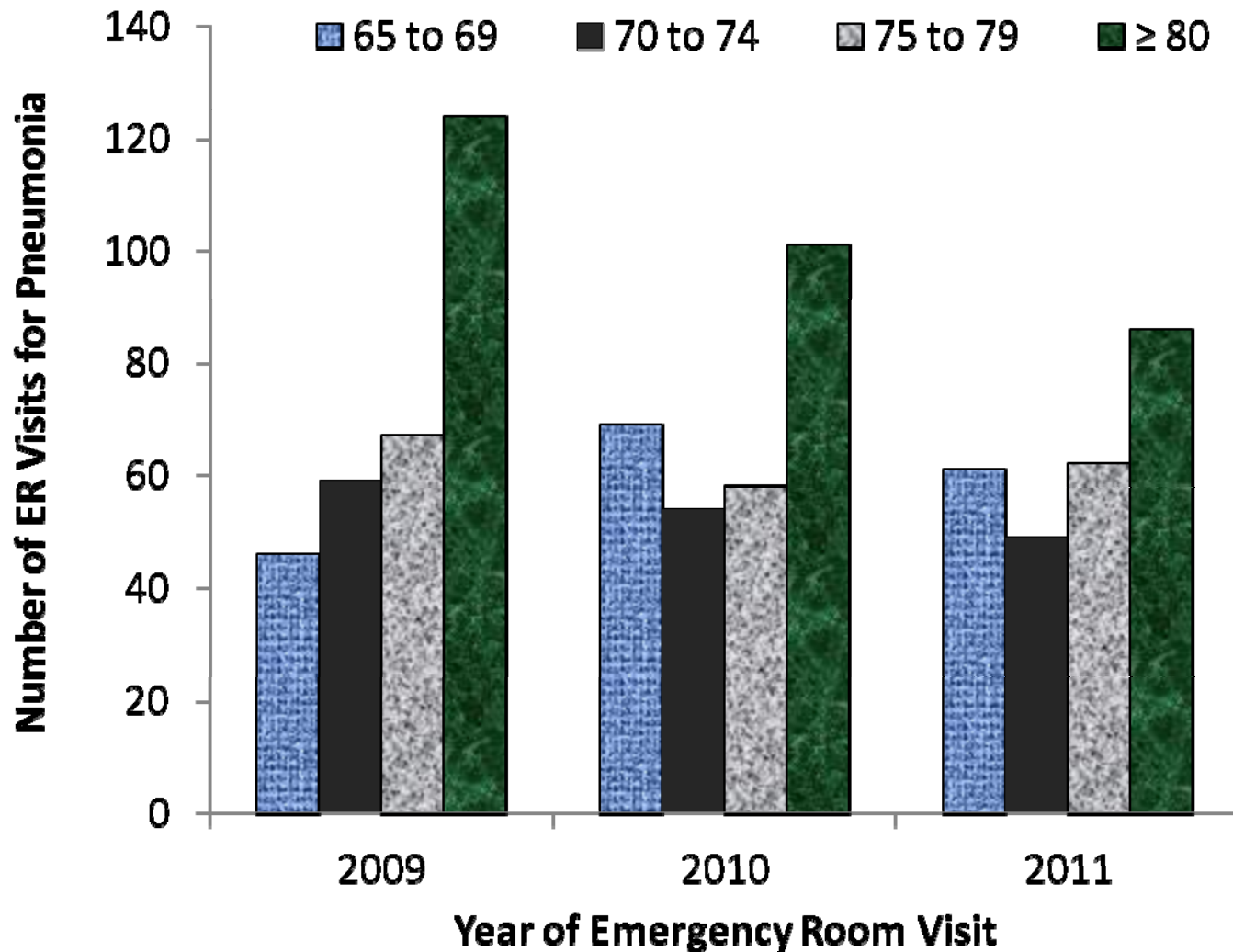
Figure 6. Antibiotic Susceptibility Reports for Isolated Pneumococcal Strains, Henry Ford Health System, 2010—2011.

OUTPATIENTS % Susceptible Jan – Dec 2010/2011	Total Strains (N)	PCN	CTX	TET	VANCO	E-MYCIN	TMP-SMX
Streptococcus pneumoniae (non-meningitis breakpoints)	77	**66**/18 100/0	99/99	75/77	100/100	**67/70**	72/73
Streptococcus pneumoniae (meningitis breakpoints)	77	66/18 68/0	91/93	75/77	100/100	**67/70**	72/73

INPATIENTS % Susceptible Jan-Dec 2011	Total Strains (N)	PCN	CTX	MOXI	E-MYCIN	TMP-SMX
Streptococcus pneumoniae (non-meningitis breakpoints)	58	**81/0**	99	100	100	**67**
Streptococcus pneumoniae (meningitis breakpoints	58	**48/0**	86	100	100	**67**

NOTE. PCN, penicillin; CTX, ceftriaxone; MOXI, moxifloxacin; TET, tetracycline (doxycycline); VANCO, vancomycin; E-MYCIN, erythromycin; TMP-SMX, trimethroprim-sulfamethoxazole. Figures represent percent fully susceptible/Percent with intermediate susceptibility.

Table 2. Percentage of adults aged 65 years and over who had ever received a pneumococcal vaccination, by race/ethnicity: United States, 2010

Race/ethnicity	Crude[1] percent (95% confidence interval)	Age-adjusted[2] percent (95% confidence interval)
Hispanic or Latino	38.1 (33.15-42.95)	38.7 (33.83-43.52)
Not Hispanic or Latino, single race, white	63.3 (61.38-65.29)	63.6 (61.64-65.49)
Not Hispanic or Latino, single race, black	45.1 (40.34-49.79)	45.4 (40.78-50.04)

[1]Crude estimates are presented in the figure.
[2]Estimates for this Healthy People 2010 Leading Health Indicator are age adjusted using the projected 2000 U.S. population as the standard population and using two age groups: 65–74 and 75 and over.

DATA SOURCE: CDC/NCHS, National Health Interview Survey, 2010, Sample Adult Core component. Data are based on household interviews of a sample of the civilian noninstitutionalized population.

Figure 7. Adult Immunization Stakeholder Preliminary Landscape Analysis.

High Interest Level

Keep Satisfied

-Family, relatives and friends of patient
-Faith-based community organizations
-Ancillary health providers
-Hospital administrators and quality officers
-Vaccine procurement organizations
-Professional societies

Manage Closely

-Primary health care providers
-Immunization program managers and staff
-Government organizations with interest in immunization delivery and safety
-Donors (research sponsors)
-Managed care organizations

Low Influence Level

High influence Level

Monitor & Keep Informed

-Adult & Aging-associated community organizations
-General public
-State medicare & medicaid officers
-Peer-review & quality improvement organizations
-Non-medical, non-health business community

Keep Informed, Maintain 2-Way Communication

-Adult infectious disease clinicians
-Infectious disease research community
-Health care insurance programs
-Pharmacists
-Vaccine suppliers
-Health insurance organizations

Low Interest Level

Figure 8. Framework for audience engagement in adult immunization.

1. Plan from the outset for promotion and dissemination.

2. Identify your HCP and patient audience as early as possible.

3. Engage those who can help you learn about and reach your audience.

4. Use the insights of social marketing.

5. Be strategic about timing audience engagement activities.

6. Be strategic about positioning of educational resources.

7. Actively work with HFHS communications and PR departments.

8. Use advertising to promote educational materials.

9. Use outreach to promote educational resources and facilitate its use.

10. Gather and analyze feedback on educational materials.

Table 3. Draft logic model table for audience engagement.

Inputs	Activities	Outputs	Short-Term Outcomes	Mid-Term Outcomes	Long-Term Outcomes
What resources will be use to support the project?	What are the main things the project will do/provide?	How many and what sort of observable/ tangible results will be achieved?	What will occur as a direct result of the activities & outputs? (typically, changes in knowledge, skills, attitudes)	What results should follow from the initial outcomes? (typically changes in behavior, policies, practice)	What results should follow from the initial outcomes (typically, changes in broader conditions)

NOTE. KOL, key opinion leaders; FGD, focus group discussion; CSO, community service organizations.

Inputs	Activities	Outputs	Short-Term Outcomes	Mid-Term Outcomes	Long-Term Outcomes
Project funding & contract	Initiate project plan; conduct formative research	Step-by-step plans for healthcare provider (HCP) meetings	Coalescence of project team focused on primary project goals	Optimized coordination of project team with key stakeholders in HFHS and other org.	Securing sustained funding to support broadened HCP and other stakeholder engagement
Project team expertise	Review of team member roles/responsibilities	Experts meet with HCP, Healthcare managers	High degree of team coordination and building of awareness of vaccine introduction	Acceleration of HCP engagement with marketing staff	Establishment of a highly informed cadre of immunization champions
HFHS Marketing & Communications Team	Meeting to introduce role of immunization; build awareness among non-medical, business staff	Organizational commitment for sustained immunization advocacy	Discussion and development of plan for targeted client-patient engagement relevant for vaccines	Optimized plan for establishing vaccine demand among eligible client-patients	Leadership by example to show other health systems optimal approaches for vaccine advocacy
Professional organization network	Meeting with KOL to identify key concerns, issues for further discussion	Background and briefing documents to prepare FGD facilitators	Optimized strategy for efficient and effective conduct of FGDs.	Increased awareness of vaccines among primary care providers and others	Partnerships focused on reaching HP 2020 goals for pneumonia immunization
Community service organization network	Identification of key patient advocacy groups that can support adult vaccine introduction	Report to document knowledge gaps regarding relevant diseases and adult vaccines	Prioritization of CSOs with regard to their potential influence to advocate for adult vaccines	CSO-specific engagement plan of action designed to maximize overall community advocacy	Increased integration of adult immunization into personal wellness plans for adults

Figure 9. Health-care provider and patient-client focus groups.

Health-care Provider Focus Groups

N=2	N=2	N=2	N=2
Physicians	Managers	Nurses	Pharmacists

Family Members/Caregivers of 65-74 year olds N=2

Family/Caregiver Focus Groups

Family Members/Caregivers of 75+ year olds N=2

65—69 yrs	70—74 yrs	75-79	80+
N=2	N=2	N=2	N=2

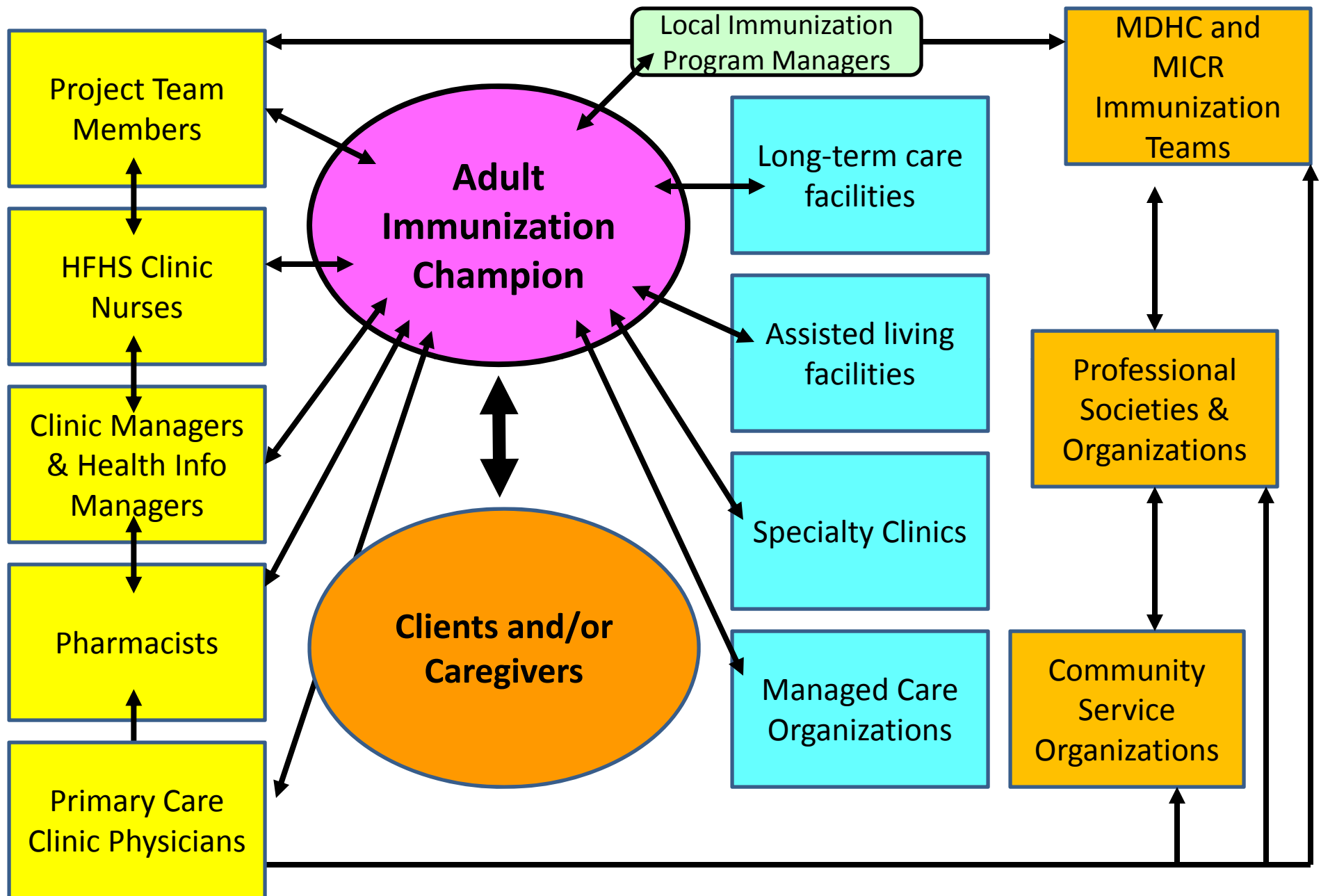**HFHS Patient-Client Focus Groups**
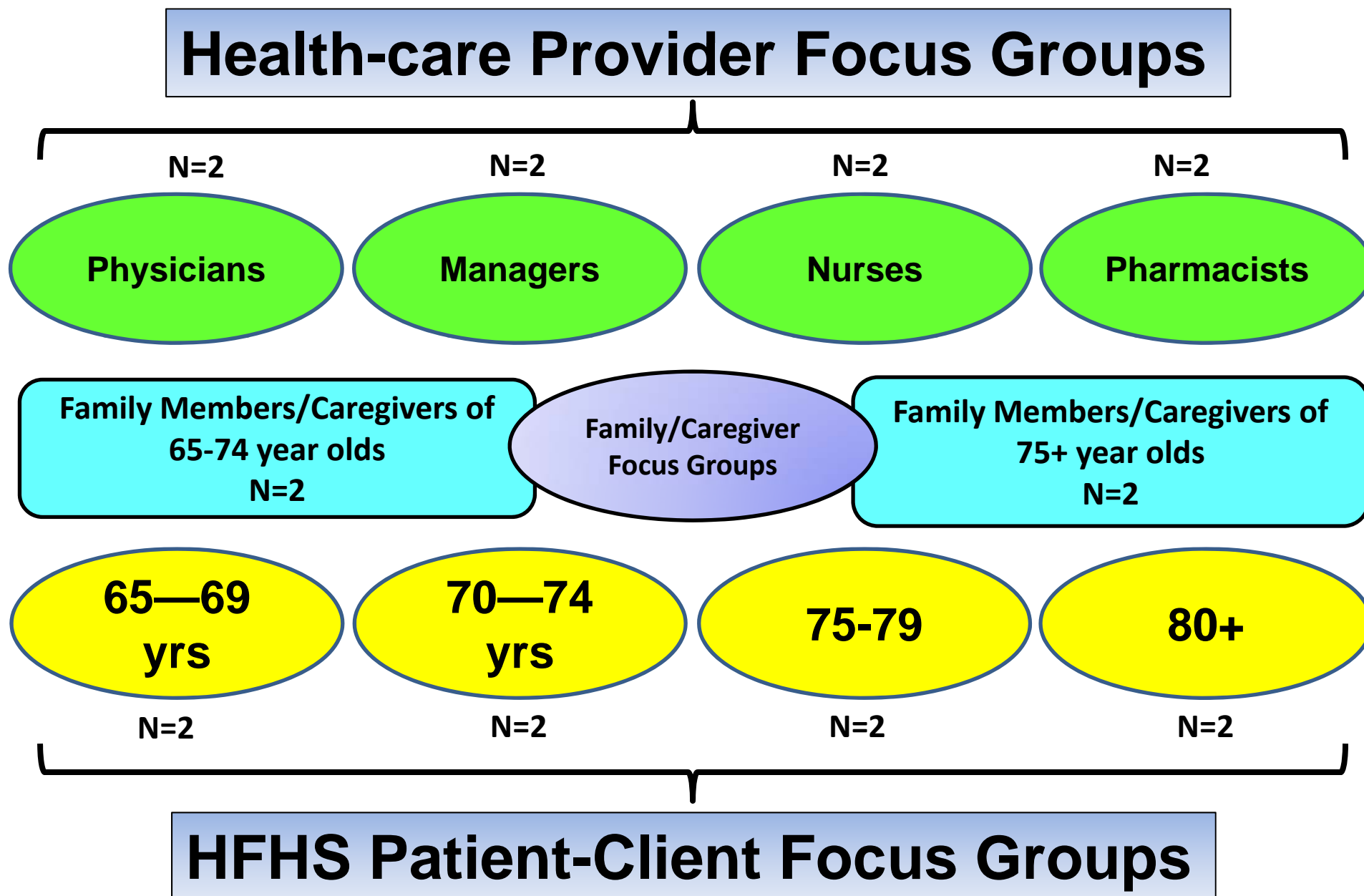
Figure 10. Adult vaccine uptake framework.
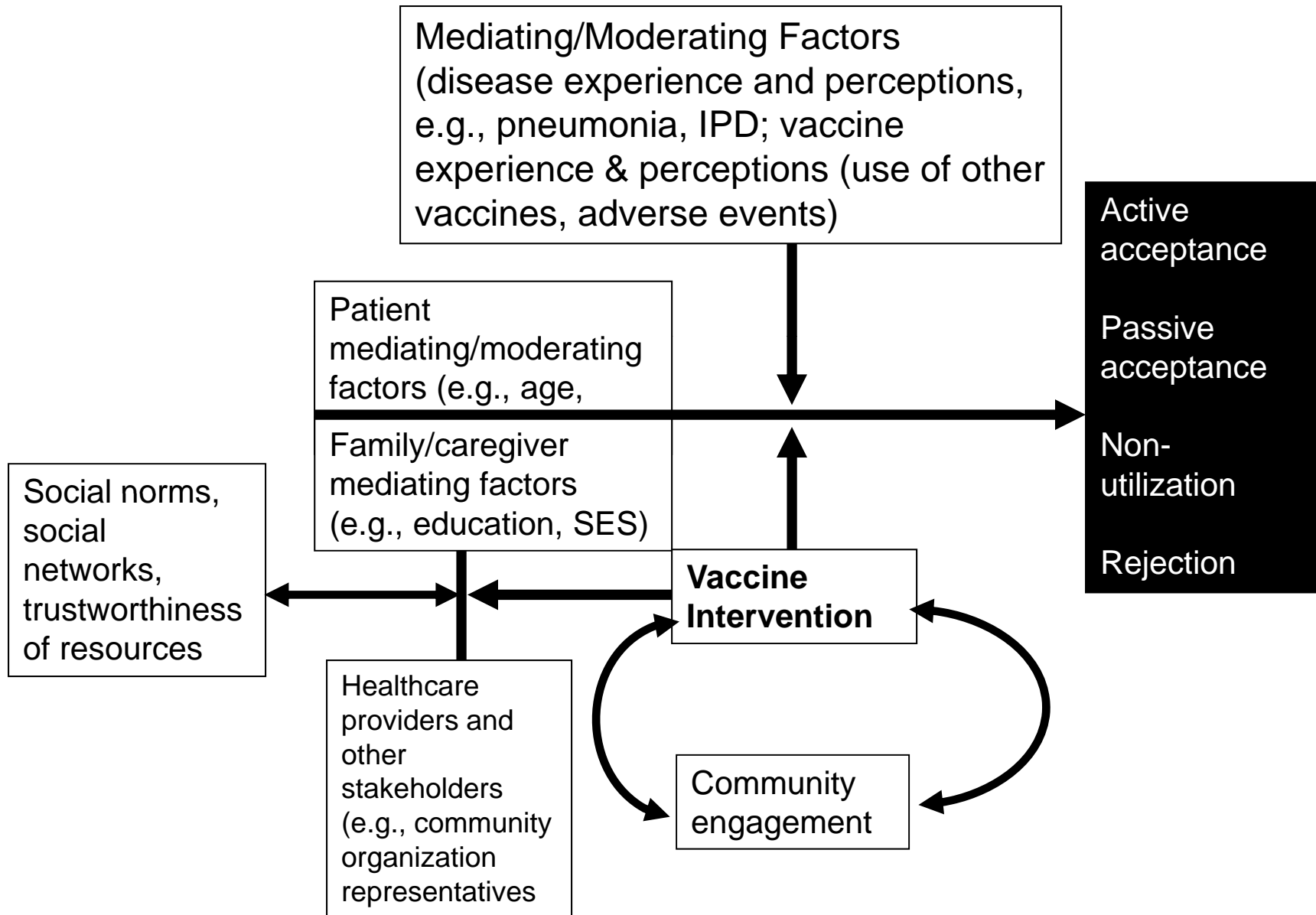
Figure 11. Communications Network.

Table 4. Plan for results dissemination.

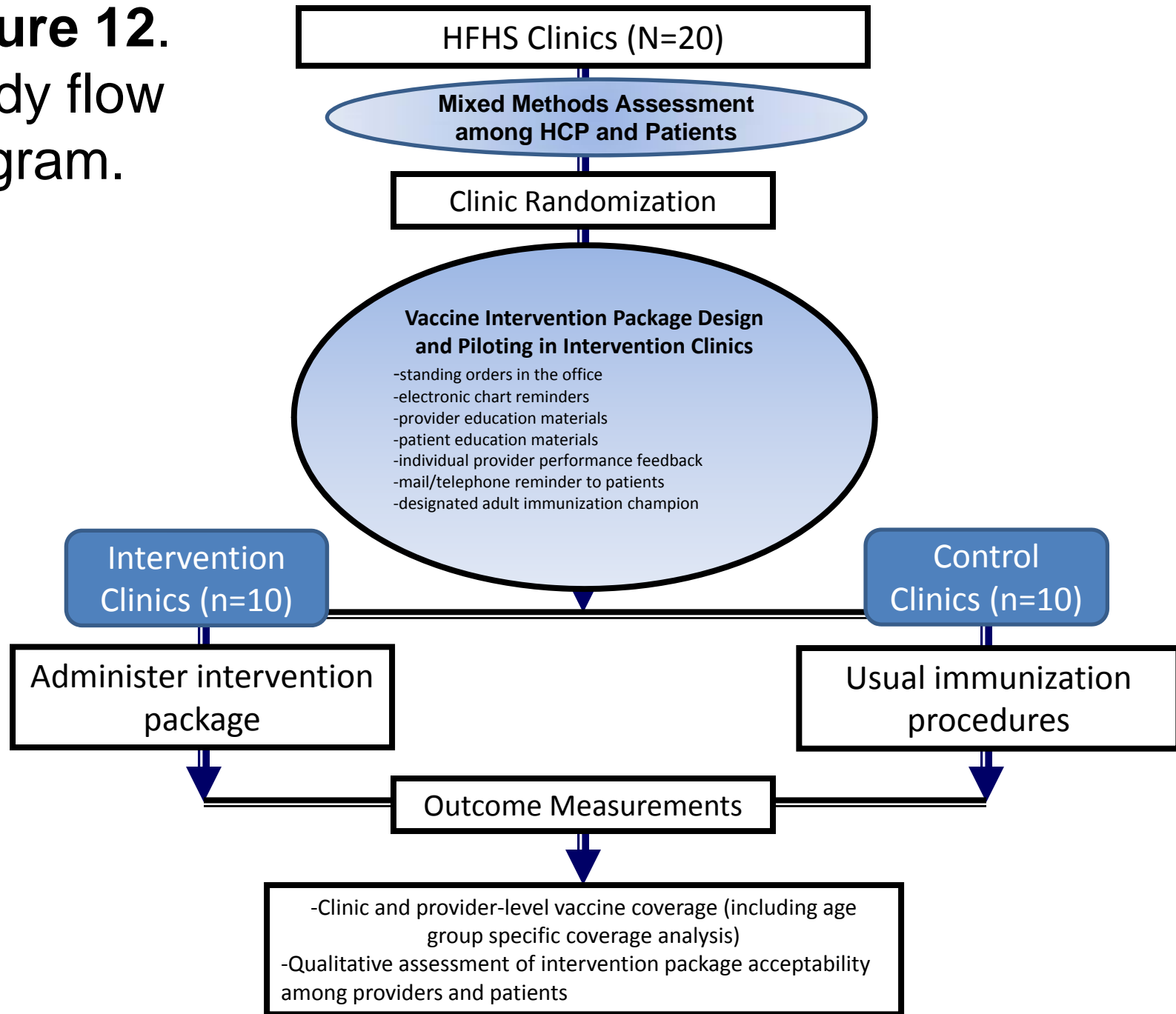| Audience	Communication Objective(s)	Format of Information	Means of Dissemination
Clinic HCPs & Managers	-provide evidence-based messaging around safety and effectiveness of adult vaccines	-E-mail and/or phone text messaging	-HFHS online info management system
Dept lead HCPs & Managers	-provide current and accurate information on target groups for vaccine -provide regular feedback on performance for vaccine coverage (provider-, clinic-specific)	-brief summary written reports (pdf and hard copy)	-E-mail and HFHS mail system distribution
HFHS Sr. Management	-provide rationale for adult vaccine program and expected short- and long-term benefits -provide semi-annual reports containing adult vaccine coverage estimates	-verbal briefings with oral presentations -summary written reports	-in person presentations and HFHS mail system distribution
Local & State Health Departments	-share process and decision-making behind educational intervention design and deployment -promote sharing of program with clinical and public health reps at state and national levels	-presentation of interim and final results to local, state, national mtgs	-Abstracts, poster and oral presentations; Published reports
Community Service Organizations (CSO)	-share results of patient qualitative interviews and/or FGDs -provide messaging for media that provide current information regarding adult pneumonia and vaccine prevention of disease	-summary, lay person reports in clinic waiting rooms, websites and direct distribution to CSOs.	-printed reports distributed to clinic facilities and CSO administrators

NOTE. FGD, focus group discussion; HCP, health-care provider; HFHS, Henry Ford Health System.

Table 5. Champion, Education, Reminder, Performance Feedback and Standing Orders.

CERPS Component	Target Audience	Training & Education Tools	Technologies	Implementation in intervention clinics
Champion (C) for Immunization	Primary Care Providers, including MDs, nurses, others	-disease and vaccine info content; -interpersonal communication skill building	-one-on-one and group staff interactions -electronic & written communications	-pilot test among providers at 2 clinics followed by full rollout to all clinics
Education (E) for Disease and vaccines	Primary Care Providers	-clinical, lab, epi disease update -vaccine efficacy, safety data, herd protection	-paper and web-based educational modules	-medical staff newsletter intro -pilot test and full rollout to all clinic staff
	Patients, Family Members & Caregivers	-info on high-risk groups, disease sequelae -vaccine safety, effectiveness, herd protection	-paper pamphlets, vaccine information sheets	-pilot test selected clinics over 2-week period followed by full rollout to all clinics
Reminder (R) to immunize with adult vaccine	Primary Care Providers	-HFHS health information system electronic messaging	-electronic messaging	-pilot test among providers at 2 clinics followed by full rollout to all clinics
	Patients, Family Members & Caregivers	-Automated phone messaging; reminder when patients are in clinic appt.	-telephonic communications; paper reminder in clinics	-pilot test among providers at 2 clinics followed by full rollout to all clinics
Performance (P) *feedback* to Providers of adult vaccine	Primary Care Providers, including MDs, nurses, others	-History, experience from provider feedback used elsewhere for vaccines	-individualized electronic education	-pilot test among providers at 2 clinics followed by full rollout to all clinics
Standing orders (S) for adult immunization	Nursing staff, other healthcare providers, Pharmacists	-In-service education focused on MD and non-MD care provider education	-paper and web-based educational modules	-IT modification to existing screen followed by full rollout system-wide

Figure 12.
Study flow
diagram.

HFHS Clinics (N=20)

Mixed Methods Assessment
among HCP and Patients

Clinic Randomization

**Vaccine Intervention Package Design
and Piloting in Intervention Clinics**

-standing orders in the office
-electronic chart reminders
-provider education materials
-patient education materials
-individual provider performance feedback
-mail/telephone reminder to patients
-designated adult immunization champion

Intervention
Clinics (n=10)

Control
Clinics (n=10)

Administer intervention
package

Usual immunization
procedures

Outcome Measurements

-Clinic and provider-level vaccine coverage (including age
group specific coverage analysis)
-Qualitative assessment of intervention package acceptability
among providers and patients

Figure 13. Examples of performance metrics from the Physician Consortium for Performance Improvement (PCPI).

1. <u>Patients with COPD</u>.
   -assessment of pneumococcal immunization status
   -pneumococcus vaccine administered

2. <u>Patients with community-acquired bacterial pneumonia</u>.
   -assessment of pneumococcal immunization status

3. <u>Patients with HIV/AIDS</u>.
   -pneumococcal immunization

Figure 14. Evaluation of Vaccine Introduction in HFHS facilities.

1. Identify Denominators

Weekly # clinic visits for patients in target age group
-Total # patients
-# patients/clinic
-# patients/HCP

2. Ascertain numerators

Weekly # vaccine doses administered in target age group
-Total # vaccine doses
-# vaccine doses/clinic
-# vaccine doses/HCP

NOTE. HCP, healthcare provider; EMR, electronic medical record

3. Calculate % immunized

% coverage = (numerator /denominator) * 100
-Total # vaccine doses/total # patients
-Total # vaccome doses/total # patients/clinic
-Total # vaccine doses/total # patients/HCP

4. Evaluate process measures

Patient age and risk factor evaluation for adult immunization
-% of patient EMRs with documentation that age, risk factors were evaluated for vaccine administration
-% of patients in target age group who were offered vaccine
-% of patients whose vaccine status is up-to-date

5. Weekly and monthly performance measures reporting

HFHS Facility (Clinic)	Total vaccine eligible pts., target ages	Total vaccine doses given	% Patients offered vaccine	% Patients vaccine immunized	Median vaccine coverage, per HCP	Range vaccine coverage among HCP
Total, Intervention Arm Clinics						
Total, Control Arm Clinics						
Clinic-specific measures						

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