



# A LONGITUDINAL STUDY OF POPULATION LEVEL HEALTH PROBLEMS AND INTERVENTIONS

## FINAL REPORT

MARY JO BAISCH, PHD, RN  
SHERYL KELBER, MS  
UNIVERSITY OF WISCONSIN-MILWAUKEE  
COLLEGE OF NURSING  
INSTITUTE FOR URBAN HEALTH PARTNERSHIPS

October 31, 2010

This Quick Strike Study was funded through the Wisconsin Public Health Practice-Based Research Network, a grantee of *Public Health Practice-Based Research Networks*, a national program of the Robert Wood Johnson Foundation.

We would like to acknowledge Emily Shallow, research assistant; Riverwest Health Coalition Partners; the Medical College of Wisconsin Healthier Wisconsin Partnership Program; and the University of Wisconsin Milwaukee College of Nursing Institute for Urban Health Partnerships for their support of this study.



## TABLE OF CONTENTS

<b>Executive Summary .....</b>	<b>4</b>
<b>Introduction .....</b>	<b>6</b>
<b>Methods.....</b>	<b>7</b>
Design – Mixed Methods Case Study Approach .....	7
Development of the Measurement Tool: The Expanded ACHIS Intervention Scheme .....	8
<b>Results.....</b>	<b>11</b>
Comparison of Individual and Population Level Focus/Problem Areas.....	11
Comparison of Individual and Population Level Interventions.....	12
Longitudinal Analysis of Interventions .....	12
Analysis of the Scope and Intensity of Interventions .....	13
Analysis of Nurse Interviews Regarding the Documentation System.....	13
Impact on Clients, Clinical Decision-making, and the Nurses' Workload .....	13
Reliability of the Coding.....	14
Training Support, Functionality and Suitability to the Site.....	14
Model “Pathway for Community Health Improvement” for documenting community health improvement practice .....	14
Meaning and Utility of the Documentation Method.....	15
Measurement of Public Health Activities .....	17
Informatics Considerations.....	18
Limitations .....	18
<b>Conclusions .....</b>	<b>19</b>
Implications for Public Health and Nursing Research, Practice, Education and Policy.....	19
<b>References.....</b>	<b>21</b>
<b>Figures.....</b>	<b>23</b>
<b>Appendices.....</b>	<b>26</b>

## EXECUTIVE SUMMARY

While local health departments routinely collect data about population demographics, problems, and outcomes, few capture data about the population-level interventions that nurses and other public health professionals provide to achieve outcomes. The overall goal of this project was to develop and pilot a method to document population-focused practice in an electronic health system using standard taxonomies, in order to make more visible the contribution of public health nurses and other professionals to community health improvement. The objectives of this study were to determine the utility of the documentation method for recording the processes of community health improvement and to test the ability of the documentation method to capture the scope and intensity of interventions directed toward the health priorities of a local community health improvement initiative designed to serve a diverse community of 7,000 households.

The documentation method was established at the onset of the community health improvement initiative to serve as a more universal and efficient evaluation framework across multiple projects over time in contrast to compiling disparate project-specific evaluation indicators. To develop this innovation, researchers expanded the list of interventions in an existing electronic health system, the Automated Community Health Information System (ACHIS), by adding evidence-based population-level interventions to its existing intervention list. The Omaha System taxonomy (a standard language designed for community home care) forms the underlying structure for documenting nursing practice in ACHIS. Interventions from the Minnesota “Wheel” were used to expand the list.

The local community health improvement initiative was used as a case study. Two nurses, practicing sequentially over five years tracked their practices in the expanded documentation system. A mixed method research design was used to determine if the method for capturing population-level interventions provided sufficient, reliable and valid data for administrative and research purposes. Quantitatively, to determine the ability of the documentation method to capture population-level practice, we analyzed the differences between the problems and interventions coded by the nurses for individual clients (individual-level care) and those coded for community leaders and groups (population-level care). To track the community health improvement process over time, we analyzed these interventions over the five years of the project and across the practices of the two nurses. To determine the intensity of the interventions, we analyzed the differences between actual and potential problems and time spent per visit. Qualitatively, both these nurses were interviewed to determine the meaningful use, feasibility, validity, and reliability of the documentation of their practice using this method.

The findings of this study indicate that using the resultant documentation method, individual and population-level interventions could be distinguished and the scope of interventions used by a community health nurse to impact population-level care can be measured. The differences between the individual and population level problems and interventions are displayed in Figures 1 & 2 and the documentation according to the initiative’s health priorities are included in Figure

3 and Appendix C. Qualitatively, the utility of the documentation method was assessed and the nurses using it found it to be a valid tool that reflected their practice. A draft pathway for coding public health services for population-level problems was then developed from the results to support the reliability of future data collection efforts across initiatives. (See Appendix A.) The study findings support this innovative method for documenting population-level interventions within an electronic health system.

From a public health systems perspective, a method for better capturing population-level interventions in an electronic health system will enable local health departments to link interventions to outcomes. A more complete record of the contribution of public health nurses and other public health professionals to community health improvement efforts will better inform the planning and allocation of resources toward future health initiatives.

## INTRODUCTION

There are many versions of public health information systems, and while many capture public health problems and outcomes, few systematically capture population-level interventions. Consistent with the goals of the Federal Community Health Data Initiative, this study (part of a larger evaluation of a community health improvement initiative) was designed to assess the feasibility of an innovative electronic data systems method to document population-level interventions, the missing link between public health problems and outcomes that could better guide public health practice (US Department of Health and Human Services, 2010).

In 2003, members of community agencies and academic institutions coalesced to form a local initiative in order to improve the health of Milwaukee's Riverwest community, one of Milwaukee's more diverse and vulnerable communities. After conducting a comprehensive community health assessment using a community-based participatory action approach, coalition members and other community partners identified four health priorities: mental health, community safety, food security, and access to health care (Sanders & Baisch, 2008). In 2005, choosing one of the community agencies as a fiscal agent, funding was obtained and a public health nurse was hired to address these four priorities and to expand the community's capacity for health improvement.

As an academic partner of the initiative and to better document the activities of the public health nurse hired to implement the initiative's community health improvement activities, the primary investigator adapted a longstanding electronic information system, the Automated Community Health Information System (ACHIS). This system has been used to document community health nursing care provided in the University of Wisconsin-Milwaukee community nursing centers since 1986 (Hildebrandt, Baisch, Lundeen, Bell-Calvin, & Kelber, 2003). While ACHIS captures social-ecological health concerns, the interventions that could be coded in the system have been largely limited to those provided at an individual and family level.

Public Health Practice-Based Research Network Quick Strike funding was used to analyze data from the documentation method used in the initiative to capture population-focused practice in an electronic health system using standard taxonomies. The goal for the project was to document the contribution of public health nurses and other professionals to community health improvement. The objectives of this study were to determine the utility of the documentation method for recording the processes of community health improvement and to test the ability of the documentation method to capture the scope and intensity of the interventions directed toward the health priorities of the initiative.

From a public health systems perspective, this information will be important for local health departments as they turn to electronic health systems to define their activities and manage resources that address local health priorities. This study may inform future research in which automated data is used to link public health problems, interventions and outcomes.

## METHODS

### DESIGN – MIXED METHODS CASE STUDY APPROACH

In a recent integrative review of the literature, case studies were used as a methodology in studies of different population groups and as part of descriptive and/or mixed method studies, and the methodology was reported in a wide array of peer reviewed journals (Anthony & Jack, 2009). A mixed method design was used to determine if the documentation method developed for capturing population-level interventions provided sufficient, reliable and valid data for administrative and research purposes. Two nurses have served the community health improvement initiative sequentially and each has documented the problems they have addressed and their interventions over the past five years in the expanded ACHIS. For this study, the nurses were considered the cases and data they collected were analyzed quantitatively. Their perceptions of the data collection were captured in qualitative interviews.

The nurses coded their encounters with individual clients and their encounters with community leaders and groups in two separate files, which both included the expanded coding scheme. When the nurses saw a client seeking health care services for themselves or their family, the nurses coded the data in the client's electronic health record in the relational database components of ACHIS. When meeting with community leaders and groups to address community health issues, the nurses coded the data as population-level problems and interventions in a separate spreadsheet.

Quantitatively, the data were downloaded into an SPSS file anonymously and were analyzed using descriptive statistics. To determine the ability of the documentation method to capture population-level practice, we analyzed the differences between the problems and interventions coded by the nurses for individual clients (individual-level care) and those coded for community leaders and groups (population-level care). To track the community health improvement process over time, we analyzed these interventions over the five years of the project. To determine the intensity of the interventions, we analyzed the differences between actual and potential problems and time spent per visit. This dataset included 774 visits with individual clients and 928 encounters with community leaders and groups by the two community health nurses employed by the initiative sequentially over a five-year period, from July 1, 2005 – June 30, 2010.

Qualitatively, the initiative's two community health nurses were interviewed to determine the meaningful use, feasibility, validity, and reliability of their data collection using this documentation method. The qualitative interviews were guided by an evidence-based measure of electronic health system utility designed by the ACHIS research team as a survey for the nursing staff at the university's community nursing centers. Based on a review of the literature, this instrument was designed and implemented to improve the quality of the ACHIS. This survey was adapted for use as a qualitative interview guide to assess the utility of the expanded intervention list in ACHIS. (See Appendix B.) After analysis of the quantitative data, these two nurses were interviewed retrospectively by the investigator to determine their perspectives on the meaningful use of the data, the utility of the electronic health record to capture population-level interventions, the validity and reliability of the coding scheme, and the value of the data in describing their community health nursing practice. In addition, the quantitative results of the study were shared with the nurses to determine the validity of the nurses' coding by eliciting their coding rationale. The nurses' perspective regarding their coding and rationale were

compared to assess the reliability of the pilot data. The results of both the quantitative and qualitative data analyses were applied to the development of the draft “Pathway for Community Health Improvement” in order that it could be used as a template for more reliable coding of public health practices related to initiatives across communities.

#### DEVELOPMENT OF THE MEASUREMENT TOOL: THE EXPANDED ACHIS INTERVENTION SCHEME

ACHIS was adopted by the Rivewest Health Initiative coalition to serve as the electronic health information system for the initiative. ACHIS was designed as a universal tool to collect, store, and retrieve clinical and public health data so as to provide information for clinical, administrative, educational and research applications. ACHIS includes a standard nursing language (the Omaha System) which allows nurses to capture and link client problems, nursing interventions, and outcomes in a way that is not possible in many other clinical information systems. The system was developed by University of Wisconsin-Milwaukee nurse researchers collaborating with computer design specialists and was piloted in 1988. It has served to inform community health nursing practice and research for more than two decades in several local settings (Lundeen, 1994). Through ACHIS, the UWM School of Nursing has created a longitudinal database that now includes more than 150,000 nursing interventions linked to client problems and outcomes. Over the last five years, the ACHIS database has captured data on over 8,000 unduplicated clients, seen in over 17,500 health encounters. Over the years, data collected in ACHIS has been used for both student and faculty research on important community health issues, such as depression, hypertension, health care access, surveillance, and case management (“Omaha System - References,” 2010). From an administrative perspective, analysis of this data has been used for evaluation of programs in the community nursing centers sponsored by the University and to support the development of funding proposals for these centers (Hildebrandt, et al., 2003).

The ACHIS research team has continually modified this electronic health system over the past two decades through a unique collaboration of practitioners, researchers, and informatics experts who specialize in designing clinical information systems for nursing. The principal investigator of this study is part of this team. ACHIS incorporates data elements required by the National Health Services Corps for demographic and provider data with the Omaha Documentation System (Martin, 2005), a healthcare taxonomy recognized by the Library of Congress and SNOMED CT. (SNOMED CT is a comprehensive compilation of clinical healthcare terminology.)

The Omaha System taxonomy (a “standard language” available in the public domain) forms the underlying structure for documenting nursing practice in ACHIS. The Omaha System is used to document problems, interventions and outcomes. While the Omaha System has proven its value in documenting individual-level interventions, including “Teaching, Guidance, and Counseling, Treatments and Procedures, Case Management, and Surveillance” (Martin, 2005); historically, it was not designed to capture the population-level interventions that are recognized today. Although ACHIS has worked well for the University’s community nursing centers, the initiative described in this study was focused on broad community health improvement, rather than more individually-based nursing care.

ACHIS is effective in collecting individual-level interventions, in part because the Omaha System, the underlying nursing taxonomic structure of ACHIS, was derived from home care

nursing practice in the community and addresses broad determinants of health. Because the Omaha System has been carefully developed, tested, and revised, and because ACHIS has carefully adhered to the evolution of the Omaha System taxonomy, an evidence-based community health nursing framework for documenting population-level interventions was needed to guide the expansion of the intervention list in ACHIS so it would continue to be a valid measure. The list of interventions needed to be carefully integrated into ACHIS to maintain the integrity of the Omaha System taxonomic structure underlying ACHIS (Kun, Ray, Merrell, & Kwankam, 2008). ACHIS developers addressed the need to provide more specificity in the database early in its evolution by establishing a rubric for enumerating additions to the Omaha System within the Omaha System's existing structure.

At the onset of the community health improvement initiative described in this study, the investigator reviewed community health frameworks that could be used to guide the expansion of the intervention list in ACHIS to track the processes of community health improvement (National Association of County and City Health Officials APEX/PH Workgroup, 2002; Work Group for Community Health and Development, 2010). Criteria for evaluating frameworks of interventions included having the level of universality and specificity needed to systematically and comprehensively document community health improvement initiatives that involve multiple projects. For the initiative described in this study, a method was needed to not only evaluate the effectiveness of specific interventions at the program level, but to document the community health improvement process overall at the local initiative level.

A review of the literature suggested that the "Wheel of Public Health Interventions" could best meet the need to define and categorize the interventions used for evaluating this initiative and its programs (Linda Olson Keller, Schaffer, Lia-Hoagberg, & Stroschein, 2002). The Wheel is an evidence-based taxonomy of both individual- and population-level interventions that has demonstrated its use in categorizing public/community health interventions over the past decade (Linda Olson Keller, Stroschein, & Briske, 2008). Wheel interventions, such as "Coalition Building," "Collaboration," "Outreach," and "Consultation," capture the community capacity development inherent in the community health improvement process indicating a community's growing capacity for health improvement. The Intervention Wheel is widely recognized for its ability to capture the broad contributions of public health nurses (Linda Olson Keller, Stroschein, & Briske, 2008). Using a grounded theory process, the Intervention Wheel was developed with nurses across the country resulting in a list of 17 actions "common to the work of public health nurses" (p.189).

Because the Omaha System worked well for capturing community health problems and outcomes, it was logical to expand the intervention taxonomy by integrating the population-level taxonomy of the Intervention Wheel. Since both are evidence-based nursing taxonomies, integrating the Wheel taxonomy into the Omaha System taxonomy, made a more reliable and valid tool for community health research and evaluation, and enabled the community health nurse to better document nursing interventions that contribute to community health improvement. Thus, the investigator expanded the Omaha System interventions in ACHIS with nine of the Wheel interventions that did not overlap with the Omaha System interventions semantically and that reflected the nurses' practice as it was planned by the coalition.

A method for coding the expanded list of Wheel interventions electronically was needed that included incorporating the interventions from the Wheel into the existing intervention data-files. First, interventions that were already captured in ACHIS (the interventions in the Omaha System

taxonomy) were maintained. Then the Wheel Interventions were analyzed to identify those that were not already included in the Omaha System. The following were selected to expand the intervention list in ACHIS: "Policy Development," "Social Marketing," "Advocacy," "Community Organizing," "Coalition Building," "Collaboration," "Consultation," "Screening," and "Outreach." For this initiative, the expanded taxonomy would be used to describe the community health improvement process used by the nurses and to evaluate the utility of the data collection method in documenting their ongoing interventions.

One of the benefits of using an electronic health system for both administrative and research purposes is the ability to expand variables to match the growing understanding of health and healthcare delivery. The need to expand the list of interventions in the Omaha System taxonomy to better document population-level nursing practice was evidenced in a recent Omaha System Care Plan where population-level interventions were described in narratives, rather than coded in standard language

([http://omahasystemmn.org/Careplans/community\\_health/WashCo\\_HC\\_Coalition.pdf](http://omahasystemmn.org/Careplans/community_health/WashCo_HC_Coalition.pdf)). The work of the Minnesota Omaha System Users Group to “document community coalition interventions” is further evidence of the need to better capture population-level interventions. In community settings, where traditionally there has been little funding for information systems, there is a critical need for information that informs and maps the care that nurses and other public health professionals provide, particularly in community health care delivery models where the impact of their work may be less recognized. This study was approved by both the University of Wisconsin-Milwaukee and Medical College of Wisconsin Institutional Review Boards for the Protection of Human Subjects.



## RESULTS

### COMPARISON OF INDIVIDUAL AND POPULATION LEVEL FOCUS/PROBLEM AREAS

The two community health nurses, practicing sequentially (Nurse 1: July 1, 2005 – June 30, 2008 and Nurse 2: October 1, 2008 – June 30, 2010) coded a total of 1,702 encounters. Data about population-level interventions coded in electronic health records for community leaders and groups addressing community health issues and data about individual level interventions coded in the electronic health records of individual clients were displayed graphically. Within these encounters, the nurses identified and coded a total of 4,103 focus areas of the encounters. (Although the Omaha System includes client concerns as “problems,” in ACHIS the term “focus area” is used rather than “problem” as it can be construed as either a “strength” or a “problem”.) Of these, 59% of focus areas were identified and coded at a population-level among their work with community leaders and groups and 41% were coded as focus areas identified at an individual-level for their work with individual clients. The most common focus areas for the nurses’ work at a population-level with community leaders and groups included “Communication with community resources” (52%). Within this focus area, the nurses coded their work in helping connect community leaders and groups to promote the capacity of the community for health improvement. The various focus areas the nurses identified and coded for community leaders and groups and individual clients are displayed graphically in Figure 1.

The focus areas were also grouped according to the health priorities. To determine the relationship of the focus areas the nurses coded with the health priorities of the community health improvement initiative, the focus areas were categorized according to the priorities. The categorization is included in Appendix C. For example, the health priority of food security was linked with the Omaha System coding categories of Neighborhood/workplace safety, Residence, Sanitation, and Other environmental health issues. When there were questions about the categorization, the nurses were queried to determine the category of best fit. For example, while “Oral health” could be categorized as an “Other health issue”, access to dental care was a specific project of the initiative and after consulting with one of the nurses, this focus area was categorized as “Access to care”. To be more conservative in the categorization, the category, “Other health issue” was chosen for more specific health concerns, such as “Pain” or “Neuro-muscular-skeletal.” Because the nurse was instructed to code as many focus areas as she identified in an encounter, she often coded multiple focus areas for one visit to address the multiple health issues of individuals and community groups. For example, when addressing asthma or immunization issues with community groups, nurses may have coded “Respiration” as well as “Health care supervision” and “Communication with community resources”.

When coding focus areas for community leaders and groups (population-level), nurses most often coded “Communication with community resources” which is a focus area that indicates support for the community’s “capacity for health improvement”. The remaining focus areas were closely linked to the health priorities: Access to care (14% of the focus areas); Neighborhood safety (13% of the focus areas); Mental health (11% of the focus areas); and Food security (6% of the focus areas). Three focus areas: Income, Formal education, and Legal system (now included in the Omaha System as “Symptoms” of “Communication with community resources” (Martin, 2005)) were categorized as “Social determinants of health” and were coded as 11% of

the focus areas. Interestingly, the nurses coded “Other health issues” only 5% of the time, suggesting that their work was aligned to the health priorities.

#### COMPARISON OF INDIVIDUAL AND POPULATION LEVEL INTERVENTIONS

Within the total encounters, the nurses coded 4,467 interventions. These were almost equally split between population-level (50.8%) and individual-level (49.2 %) interventions. Within the 50.8% of encounters that were coded as population-level interventions, the most frequent interventions were Case management (23%), Collaboration (18%), Teaching, Guidance, and Counseling (12%) and Community Organizing (10%). The array of interventions the nurses coded is illustrated in Figure 2.

When coding individual- or population-level interventions, the nurse had the option of coding the encounter with the additional nine “Wheel” interventions as well as the four Omaha System interventions already included in ACHIS. Although all four Omaha System interventions were coded by the nurses to describe population-level interventions, they reflected only 44% of the total.

Within the 49.2% of encounters that were coded as individual-level interventions, the most frequent interventions were Case Management (48%), followed by Teaching, Guidance, and Counseling (30%), and Surveillance (17%). Four out of the nine Wheel interventions were coded by the nurses to describe individual-level interventions reflecting about 5.5% of the total individual-level encounters. These data are also illustrated in Figure 2.

#### LONGITUDINAL ANALYSIS OF INTERVENTIONS

The data about the nurses' interventions were also analyzed longitudinally. To track the community health improvement process over time, we analyzed the interventions the nurses provided with the community leaders and groups over the five years of the project and across the practices of the two nurses (nurse 1: quarter 3, 2005 – quarter 2, 2008 and nurse 2: quarter 3, 2008 – quarter 2, 2010). (See Appendix D. Interventions with community leaders and groups by quarter year.) Both nurses frequently coded "Case Management" early in their practice, but the number of times this intervention was coded diminished over time (even though the first nurse coded "Case Management" more often than the second). "Collaboration" was coded in 19 of 22 quarters of the year. As the second nurse described in her later interview: "You are always collaborating. It is part of the practice." In reviewing the data, she also noted the pattern of her practice: “When you begin [a community/public health nursing practice], you are out [in the community] building coalitions. . . Later, you are outreaching to bring in more people to those coalitions." She also said that when the nurse first begins, "It is all about relationships, and then you work on projects." The process was less evident in the first nurse's coding. The second nurse also noted that she coded "Consultation" when she was seeking information from others, and "Teaching, Guidance & Counseling" was coded when she was providing information to others.

## ANALYSIS OF THE SCOPE AND INTENSITY OF INTERVENTIONS

To determine the intensity of the interventions, the nurses were able to code the focus areas as a health promotion issue, a potential problem, or an actual problem. Two issues affected the coding related to the acuity of the problems and the intensity of the interventions. It was found that the nurses did not use the full scope of the electronic data system to describe all of the aspects of their practices. Thus the focus areas were tagged as a health promotion issue, or a potential or actual problem in only 7% of the encounters. Furthermore, the nurses saw the clients (both at an individual-level and at a population-level) only once or twice, making it not possible to measure the intensity of the interventions because of the lack of data.

## ANALYSIS OF NURSE INTERVIEWS REGARDING THE DOCUMENTATION SYSTEM

The interview guide was structured to assess the meaning and relevance of the data to the coder, the ease of use of the coding scheme, its functionality, its suitability to the setting, the training and knowledge needed by the coders, the amount of time it took to code the data concerning their practice, and its potential impact on clients. The first nurse was hired by the initiative in late spring 2005 and left the project in mid-summer 2008. The second nurse was hired in fall 2008 and is still working with the initiative. The content of the interviews was analyzed regarding the questions in the interview guide and for general themes. The nurses were also shown data tables to assess their rationale for coding and to allow them an opportunity to reflect on the patterns in the data. Both nurses used the Omaha System in previous employment settings, so both were experienced coders in that system prior to this pilot.

## IMPACT ON CLIENTS, CLINICAL DECISION-MAKING, AND THE NURSES' WORKLOAD

The nurses both reported that they perceived that coding had little impact on their encounters with their clients for several reasons. As Nurse 1 reported, "It's something I did later in the day, so I don't think it disrupted my care." Both reported not being concerned about the time it took to document their care. Nurse 1 said, "It's not a significant part of my workload, but it does take time. . . less than thirty minutes each day, but I didn't document every day." The second nurse said that it takes about five minutes to code each client, noting "It's valid time. I understand the benefits, so it doesn't bother me."

The commitment of both nurses to their coding provided some evidence of its meaningfulness to them. Nurse 1 noted its importance for "project evaluation purposes" and as previously stated, Nurse 2 noted that it was "valid" time. When queried about the ability of the coding system to "capture" their practice, Nurse 1 discussed the issues of reliability: "There are times the definitions could have different meanings depending on the population." Nurse 2 noted that while the documentation system "Did a good job of capturing the process and the focus of a visit," she reported that some situations were harder to code. For example, she said that she found coding the focus areas related to the urban garden plots more difficult and coded them as "mental health," "neighborhood safety," and "nutrition" because they addressed the improved emotional health of residents, food security issues, and the promotion of the safety of the neighborhood as community residents worked together on the gardens.

## RELIABILITY OF THE CODING

In regards to the reliability of the coding, Nurse 2 stated: "I try to stay consistent, and code the same domain, focus, and intervention the same way [for similar situations]." Both nurses kept a list of "common codes" to improve the consistency of their coding of similar situations. Nurse 1 said she would "go back and cross reference previous cases or write herself a note" to promote the consistency of her coding. Both nurses also periodically looked up the published definitions for the specific focus areas and/or interventions when they were unsure how to code a situation. During the interview, the second nurse reflected on her promotion of policy changes regarding access to care as an example of the difficulty in choosing the appropriate codes. She said that she could have coded those interventions as "advocacy," but did not always think of that as a possible code during the process of coding her practice. She further stated, "I've used the system now for awhile, so I get a little complacent. I should go back and look at the definitions in the book more often. This nurse was previously employed in one of the university's community nursing centers and has periodically met with the community nursing center nurses to discuss coding issues. These meetings promote coding that is more consistent with those using the Omaha System locally. The nurses in the community nursing centers periodically consult with others using the Omaha System internationally, sharing these discussions with the nurse in this initiative/study.

## TRAINING SUPPORT, FUNCTIONALITY AND SUITABILITY TO THE SITE

Both nurses felt that the training they received about coding was adequate. Nurse 1 discussed the additional intervention codes stating that it is difficult to anticipate the codes that you need until your start the process of coding. Nurse 1 reported that there was not a need for more training, while Nurse 2 reported that she liked the "peer support" available from the nurses in the community nursing centers. She also reported that she appreciated seeing the reports of the data analysis which emphasized the important reasons for documenting their practices.

Both nurses reported that the documentation system was fairly easy to use. Nurse 1 rated it an "8" on a scale of 10 as the highest score for ease of use. Both noted that while the coding system was not difficult, ACHIS as a data system was sometimes challenging, making it sometimes less functional than optimally needed. When there were problems, it was important to have information technologists available. They both suggested integrating the individual and group files into the database and eliminating the use of the spreadsheets for groups.

## MODEL "PATHWAY FOR COMMUNITY HEALTH IMPROVEMENT" FOR DOCUMENTING COMMUNITY HEALTH IMPROVEMENT PRACTICE

The relationships between the focus areas and interventions, as well as interventions and the targets of the interventions were analyzed to provide an evidence-based framework for consistent coding of community health improvement activities (Watkins et al., 2009). The coding template was established by determining the most frequent population-level coding and is included in Appendix A. This template was reviewed by a key informant to assess its relevance and applicability to public health practice.

## DISCUSSION

Critical developments in the evolution of the discipline of public health necessitate new research on methods to measure public health services that impact health improvement. These developments include the widening use of electronic health records, the growing fluency of informatics to capture the nature of public health services across information systems, and the expanding interest and funding in public health and public health services and systems research shown by private foundations such as the Robert Wood Johnson Foundation, and federal agencies such as AHRQ. The emergence of practice-based research networks offer researchers in the field of Public Health Service and Systems Research (PHSSR) an opportunity to share measurement tools which can facilitate collaboration, accelerate discovery, and build public health research capacity. Funding from the Public Health Practice-Based Research Network (PH-PBRN) supported this study to systematically document population-level interventions used in community health settings that support the capacity development needed for health improvement.

The investigator in this study developed an innovative method to electronically document public health interventions that are often not captured in public health systems research but are an important component of public health services and germane to public health informatics. In public health research, it is more common to link problems with outcomes than to define the interventions that link problems with their outcomes. It is even more difficult to define the dose of the interventions needed to impact an outcome. The findings of this study indicate that using the resultant documentation method, individual and population-level interventions could be distinguished and the scope of interventions used by a community health nurse to impact population-level care can be measured. Qualitatively, the utility of the documentation method was assessed and the nurses using it found it to be a valid tool that reflected their practice.

This longitudinal study was made possible by the informatics infrastructure that the College of Nursing at the University of Wisconsin-Milwaukee put in place over 20 years ago to capture community health services at their community nursing centers. The goal of this study was to integrate population level interventions into the existing community health taxonomy to document the contribution of public health nurses and other professionals to community health improvement. The future use of the resultant measurement method across public health settings could inform the taxonomic development describing the work of public health (Jacqueline Merrill, Jonathan Keeling, & Kristine Gebbie, 2009) and its value (Jacobson & Neumann, 2009).

## MEANING AND UTILITY OF THE DOCUMENTATION METHOD

The first objective of this study was to determine the utility of the documentation method for recording the processes of community health improvement. Over the five years of this study, the two nurses (sequentially) captured information about 1,702 encounters with both individual clients and community leaders and groups. Using the documentation system the nurses were able to distinguish between their work at a population-level and at an individual-level. Furthermore, when examining focus areas of the encounters and the interventions captured by the nurses, at the population-level and individual-level the results were substantially different. These differences in individual and population level care, and the diversity of the focus areas and

interventions in the encounters provided evidence that the documentation method captured a broad scope of the nurses' community health practice using evidence-based taxonomies.

In assessing the ability of the documentation method to describe community health improvement (as defined by the health priorities of the initiative), the data revealed that 84% of the focus areas that the nurses coded could be categorized according to those priorities. Based on this information, using the documentation method the nurses were able to discriminate between individual- and population-level focus areas of the encounters and different types of interventions, and supported the documentation of community health improvement activities.

Although not conclusive due to the small sample of nurses, patterns of community health improvement were evident to the nurses when they reviewed the data. For example, when reviewing data by quarter year, the intervention "collaboration" was coded in 86% of the quarters, and as one nurse noted, it is a constant thread in population-based practice. When interpreting the data describing her practice, she also noted, that when initiating a community nursing practice you first build coalitions and then outreach to expand the coalitions. This progression was evident in the data (Appendix D).

Due to the amount of data collected by the two nurses in this study, we were not able to assess the levels of intensity of the interventions at this time. This is an aspect of the study that will be addressed as the initiative continues building on the results of this pilot. Over the five years of the study, the data were reported for administrative and funding purposes, but a comprehensive analysis of the data system's utility and feasibility was not conducted until this study. This is an important finding and speaks to the need for a periodic and more comprehensive analysis of data reported from the multiple layers of any electronic data system, in addition to the analysis of data reported on a more regular basis for ongoing administrative and/or funding purposes.

This study also points to the need for periodic and regular analyses of health care providers' coding to promote the quality of clinical data and to reduce the signal to noise ratio of the data. By sharing the data reports with the nurses in this study, we were able to view the data from the coders' perspectives and to assess the validity and reliability of the coding. Sharing the data with the staff is consistent with the participatory philosophy of community (Baisch, 2009). The coders' interpretation of the coding scheme definitions and the consistency across providers in coding must be considered when analyzing any coded data. In most instances, the nurses coded similarly, yet there were some differences. Regular assessment of the coding and training would improve inter-rater reliability. When coding any activity, decisions are made regarding which codes to choose based on the perception of the coder. Using a coding scheme that was grounded in community and public health work, the coding decisions of the nurses were more likely to reflect the reality of their practice.

The meaning and relevance of the documentation system, its functionality and suitability for the community health nurses' practice, and the needed support for use of the documentation method within ACHIS were assessed through interviews with the community health nurses. The nurses reported that they appreciated the value of the data collection for project evaluation purposes and found the demands of coding were not unreasonable. They usually coded their encounters with clients at the end of the day, not entering data at point of service. This is an area to be explored and although the nurses used a laptop computer for capturing data about their encounters, they

may find it easier to code on a smaller unit. The nurses sought coding support when they had questions about definitions and coding decisions and each kept a list of “common codes” that they used to assist in making their coding more efficient and reliable. As both of these nurses had used the Omaha System previously, their need for training in the taxonomy was reduced. A more extensive orientation to the documentation system would be required if the staff had less familiarity. On the other hand, students who rotate through the university’s community nursing centers become adept at coding in ACHIS each semester. Finally, not only did the nurses report that they understood the value of documenting their work, they did not find the documentation process overly burdensome. Their reports of the time they spent on documenting their practice (generally between five and thirty minutes per day) provides an initial understanding of the time cost of using the system.

A key feature of this documentation system is its adaptability to various types of public health services and settings. Derived from home care, the four domains of the Omaha System reflect community health practice. This system has been used not only by nurses, but has been used in a variety of community health and social service settings, e.g. capturing police department activities. Documentation from the system including a list of coding definitions has been used as evidence in court for cases of abuse. The goal of the expansion of the list of interventions was to capture population-level services that are more inherent in the processes of community health improvement. The results of this study indicate that using a broader list of interventions supported the documentation of population-level community health improvement activities.

## MEASUREMENT OF PUBLIC HEALTH ACTIVITIES

There is a need in PHSSR for documentation systems that yield valid and reliable data. Although the units of analysis in this study (individual clients in the electronic health records and group data in spreadsheets) were somewhat different precluding statistical comparisons of the data, the descriptive data reflected both convergent and discriminant validity. In this study, the links between the initiative’s health priorities and the focus areas coded by the nurses provide evidence of the convergence of the data. The substantial difference between individual-level and population-level interventions provides evidence for the discriminant validity of the data. Future research with more encounters will provide opportunities to test these types of validity. The theoretical work to develop both the Omaha System and the Wheel helps to verify the content validity of the data. The inclusion of the categorization of the focus areas in relation to the initiative’s health priorities also provides evidence of the content validity. Continued research on constructs of “capacity development” will strengthen the validity of the data regarding this concept. In this study, the Omaha System “problem” of “Communication with community resources” served as the indicator of “capacity development.”

The nurses discussed their efforts to reliably code their encounters. The data system itself was an aid in this process as the electronic records included fixed lists in drop-down menus. While there was the potential for errors in coding related to the interpretation of definitions or the frame of mind of the coder, such as the “complacency” described by one of the nurses, the size of the dataset served to ameliorate the potential for coding inconsistencies. The interviews with the nurses also served to verify the quantitative findings by comparing the coding they completed for different types of encounters.

## INFORMATICS CONSIDERATIONS

The assumptions for this innovation were that any additions to the electronic health system should be evidence-based and congruent with the standard taxonomy that forms its underlying structure. This would enable more reliable comparisons of community and public health problems, interventions, and outcomes across initiatives and projects nationally and internationally and support its interoperability with other systems using this standard taxonomy. The structure of the already existing data system (ACHIS) lent itself to easier integration of the additional Wheel interventions into the existing Omaha System. The relational aspects of the Omaha System worked well and aspects of the system that were not used fully for this initial study will be explored more in the ongoing work of the initiative. The current nurse will begin to code her encounters with clients by expanding her use of the Omaha System modifiers that indicate the intensity of the focus areas and interventions required to achieve improved outcomes. She will include the time she spends during encounters to more fully indicate the dose of the intervention provided. This will provide additional data about the intensity of the interactions with clients. The nurse will also begin to code her perception of changes in the client's knowledge, behavior and status in the Omaha System Outcome Rating Scales.

Expanding the list of interventions in the document method provided a necessary level of specificity as 58 % of the encounters would have been unrecognized as population-level services without the Wheel interventions added to the list. Some of the interventions that were added were used very little, i.e. "Advocacy" and "Policy Development" and this finding will require more investigation: it may indicate the need for more training about the definitions of the codes or it may be that these interventions do not reflect this particular community health improvement initiative. It also may be that these interventions are used more by other members of the coalition indicating a need to explore which members of community health improvement coalitions should track their work toward health priorities. The nurses in the initiative indicated a need for a code that reflected their planning for activities that support their projects. A review of additional taxonomies may inform this finding and future expansions of the intervention list.

## LIMITATIONS

The primary limitation of this study was the sample consisted of only two nurses. Without a larger sample, there was insufficient statistical power to measure relationships among the various data elements. Furthermore, as the data concerning individual clients and community leaders and groups were collected in different formats (database and spreadsheet), the units of analysis were different. As the initiative progresses the data will be collected in one format allowing more powerful analyses. Additionally, future studies, not conducted retrospectively, should include a training session including inter-rater reliability analysis. With this pilot, the nurses did not use all the available components of ACHIS and in subsequent studies the nurses will use all of the aspects of the database including the Omaha System Outcome Rating Scale to provide additional evaluation data for the initiative.

## CONCLUSIONS

When compared to recommended competencies in Public Health Master's Programs and in a survey of academicians of graduate programs in public health across the United States, all agreed that informatics concepts were important to public health practice (Richards, 2007). In order to have the information needed for public health practice, data must be organized in standard formats and be easily retrievable. In comparison with medical informatics, public health informatics as a field is less well established. The results of this study inform the expanding intersection of public health and informatics by using standard languages/taxonomies to describe public health problems and interventions in an electronic health system. As the interoperability of public health data files improve, interventions recorded digitally will help fill the missing link between results of community health assessments and public health outcomes.

The findings of this study are important at a local community level as they can be shared with the community coalition to not only educate the community partners about the public health practices of the nurse in relation to the community health improvement initiative, but can be used for future planning and allocation of resources. Reports elicited from this documentation system can be shared with community partners, such as the local hospital, schools, social service and recreational agencies, faith-based organizations, and others. On a more global level, the documentation method using frameworks available in the public domain (both the "Intervention Wheel" and the Omaha System offers great potential for standardization of future public health documentation systems. Use of this documentation method to measure public health interventions will allow for the design of future causal studies in which a dose-response effect can be quantified across various public health practices and settings.

## IMPLICATIONS FOR PUBLIC HEALTH AND NURSING RESEARCH, PRACTICE, EDUCATION AND POLICY

This study informs several areas for future research. The focus of this study was on population-level interventions. The next step is to link interventions with problems and outcomes. The data system used in this study, ACHIS, is poised to continue this work with other community and public health agencies. The integration of the Intervention Wheel into the Omaha System can be done with other software programs as well. Both CareFacts® and CHAMP Software® (proprietary systems) have incorporated the Omaha System into their programs and are used by many health departments to record their daily activities. The "Intervention Wheel" could be integrated into the software of both systems while maintaining the structure of the underlying Omaha System taxonomy. Many health departments in Wisconsin, including members of the Wisconsin Public Health Practice-Based Research Network, use these software data-systems and could serve as partners in a broader study of both individual- and population-level public health practices. The analysis of outcomes could be positioned as a future study once measurement properties are further established and, ideally, once the information system is deployed in a larger number of settings.

These settings could include nurse-managed health centers. The University of Wisconsin-Milwaukee College of Nursing served as the founding coordinating center for the National Nursing Center Practice-Based Research Network (Anderko, Lundeen, & Bartz, 2006). Many nurse-managed health centers/community nursing centers use the Omaha System to

document their nursing care. This Practice-Based Research Network offers another set of health care delivery sites that can serve as sites for future research.

The conceptual framework for this study is based on the Omaha System and the Wheel Interventions. The principal investigator in this study has worked with the developers of the Wheel and Omaha System experts to map the two systems. At the University of Wisconsin-Milwaukee, initial steps have been taken to map these languages with the International Classification of Nursing Practice. This work is consistent with the mapping of semantic terms that has taken place with other standard languages cited in the Unified Medical Language System and SNOMED CT. This study and the work of Merrill, Keeling and Gebbie (2009) and others helps to strengthen the foundation for public health informatics systems and future studies. Additional research is needed to identify the specific attributes of the concept “capacity development for health improvement,” one of the foundational activities of community health improvement.

From an academic perspective, it is critical that public health professionals understand the rudiments of informatics systems. As methods have been developed to map and link standard languages, it is less important that students learn to code in a specific language, than to understand the rationale for documentation overall. In this new world of electronic coding and documentation, it is critical that students at both undergraduate and graduate levels understand the meaning of validity and reliability. In addition, it is important that students who will practice in public and community health understand the distinctions between individual- and population-level care.

From a practice and policy perspective, the report of this study will arm public health administrators and health services researchers with an additional data collection strategy to document population-level care and specifically public health problems with outcomes. This data collection strategy allows for tracking progress toward achieving health priorities, information that can be shared with community at large and can contribute to broader investigations of community health improvement. Additional research is needed to identify the issues that may affect the feasibility of the use of this or like data systems in other practice settings and for its use on a much broader scale. The ability to link intervention data with data in other systems such as those used for tracking communicable diseases and vital statistics will allow for powerful evaluations of health improvement initiatives in local health agencies. These data can be used for quality improvement, funding proposals and reports, and to provide evidence for policy decisions. Through ongoing development of public health informatics systems, local health departments and other agencies will be able to better define their activities as they allocate appropriate staff and other resources to address local health priorities. This information will help to make the population-level activities of public health agencies more explicit and visible, revealing to those not familiar with these capacity development strategies a better understanding of their importance.

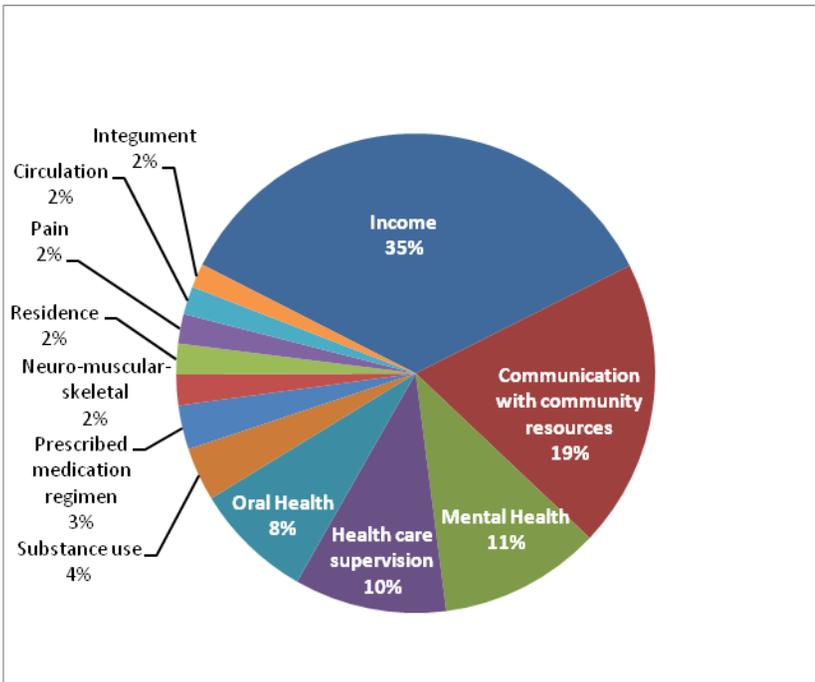
## REFERENCES

- Anderko, L., Lundeen, S. P., & Bartz, C. (2006). The Midwest Nursing Centers Consortium Research Network: Translating research into practice. *Policy, Politics, and Nursing Practice*, 7(2), 101-109.
- Anthony, S., & Jack, S. (2009). Qualitative case study methodology in nursing research: an integrative review. *Journal of Advanced Nursing*, 65(6), 1171-1181.
- Baisch, M. J. (2009). Community health: an evolutionary concept analysis. *Journal of Advanced Nursing*, 65. (11), 2464-2476.
- Hildebrandt, E., Baisch, M. J., Lundeen, S. P., Bell-Calvin, J., & Kelber, S. (2003). Eleven years of primary health care delivery in an academic nursing center. [Research]. *Journal of Professional Nursing*, 10(5), 279-288.
- Jacobson, P. J., & Neumann, P. J. (2009). A framework to measure the value of public health services. *Health Systems Research*, 44(5), 1880-1896.
- Keller, L. O., Schaffer, M. A., Lia-Hoagberg, B., & Strohschein, S. (2002). Assessment, Program Planning, and Evaluation in Population-Based Public Health Practice. [Article]. *Journal of Public Health Management & Practice*, 8(5), 30.
- Keller, L. O., Strohschein, S., & Briske, L. (2008). Population-based public health nursing practice: The Intervention Wheel. In M. Stanhope & J. Lancaster (Eds.), *Public Health Nursing: Population-Centered Health Care in the Community* (7 ed., pp. 186-204). St. Louis, MO: Mosby Elsevier.
- Keller, L. O., Strohschein, S., & Briske, L. (2008). Population-based public health nursing practice: The Intervention Wheel. In M. Stanhope & J. Lancaster (Eds.), *Public Health Nursing: Population-Centered Health Care in the Community* (7th ed., pp. 199-204). St. Louis, MO: Mosby Elsevier.
- Kun, L., Ray, P., Merrell, R., & Kwankam, S. Y. (2008). Improving the health care and public health critical infrastructure. *IEEE Engineering in Medicine and Biology*, 27(6), 21-25.
- Lundeen, S. P. (1994). The automated community health information system (ACHIS): A relational database application of the Omaha System in a community nursing center. In S. J. a. P.-W. Grobe, E.S.P. (Ed.), *Nursing Informatics: An international overview for nursing in a technological era*: Elsevier Science B.V.
- Martin, K. S. (2005). *The OMAHA System: A Key to Practice, Documentation, and Information Management* (2nd ed.). Omaha, Nebraska: Elsevier Saunders.
- Merrill, J., Keeling, J., & Gebbie, K. (2009). Toward standardized, comparable public health systems data: A taxonomic description of essential public health work. *Health Systems Research*, 44(5, Part II), 1818-1841.
- Merrill, J., Keeling, J., & Gebbie, K. (2009). Toward standardized, comparable public health systems data: A taxonomic description of essential public health work. *Public Health Services and System Research*, 44(5, Part II), 1818-1841.
- National Association of County and City Health Officials APEX/PH Workgroup. (2002). MAPP: Mobilizing for Action through Planning and Partnerships: Achieving Healthier Communities through MAPP. A User's Handbook. , from Retrieved from [www.naccho.org/topics/infrastructure/mapp/upload/MAPP\\_Handbook\\_fnl.pdf](http://www.naccho.org/topics/infrastructure/mapp/upload/MAPP_Handbook_fnl.pdf) on October 5, 2005.
- . Omaha System - References. (2010, 9/27/2010), from <http://www.omahasystem.org/references.html>

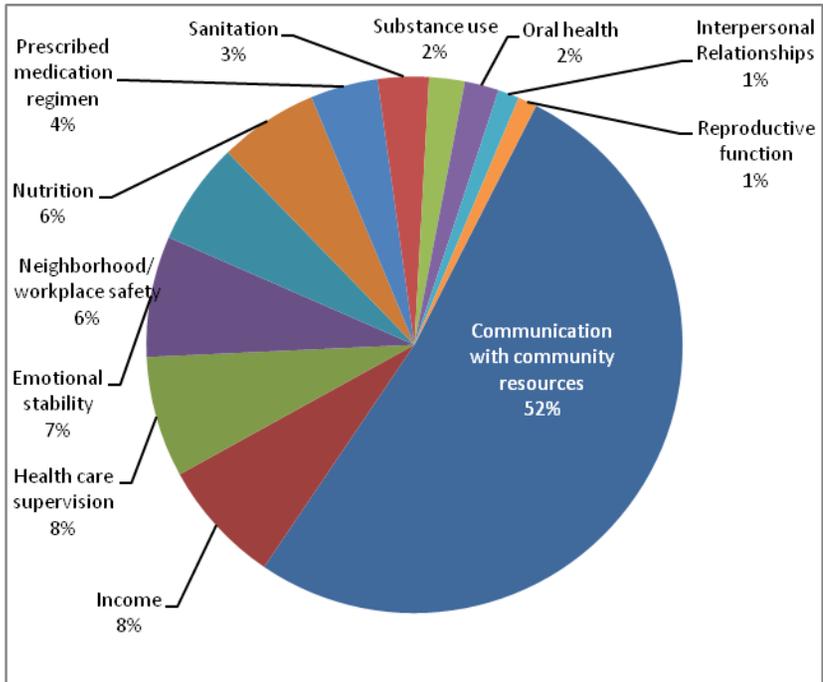
- Richards, J. (2007). Importance of public health informatics: A survey of public health graduate programs in the United States. *MEDINFO: Proceedings of the 12th World Congress on Health (Medical) Informatics*, 129(Part 2), 1410-1413.
- Sanders, J., & Baisch, M. J. (2008). Implementing the community health improvement process at the neighborhood level. *Progress in Community Health Partnerships*, 2(1), 7-15.
- US Department of Health and Human Services. (2010). *Community Health Data Initiative*. Washington, DC: Retrieved from <http://www.hhs.gov/open/plan/opengovernmentplan/initiatives/initiative.html>.
- Watkins, T. J., Haskell, R. E., Lundberg, C. B., Brokel, J. M., Wilson, M. L., & Hardiker, N. (2009). Terminology use in electronic health records: Basic principles. *Urologic Nursing*, 29(5), 321-326.
- Work Group for Community Health and Development. (2010). Chapter 37. Some Operations in Evaluating Community Interventions. *Community Toolbox - Bringing Solutions to Light*. Retrieved from <http://ctb.ku.edu/en/default.aspx>

**Figure 1. Areas of Focus/ Problems Addressed by the Community Health Nurse**

**Individual Clients - 2005 – 2010 (N=1,662)**



**Community Leaders and Groups - 2005 – 2010 (N=2,441)**



**Figure 2. Interventions Provided by the Community Health Nurse**

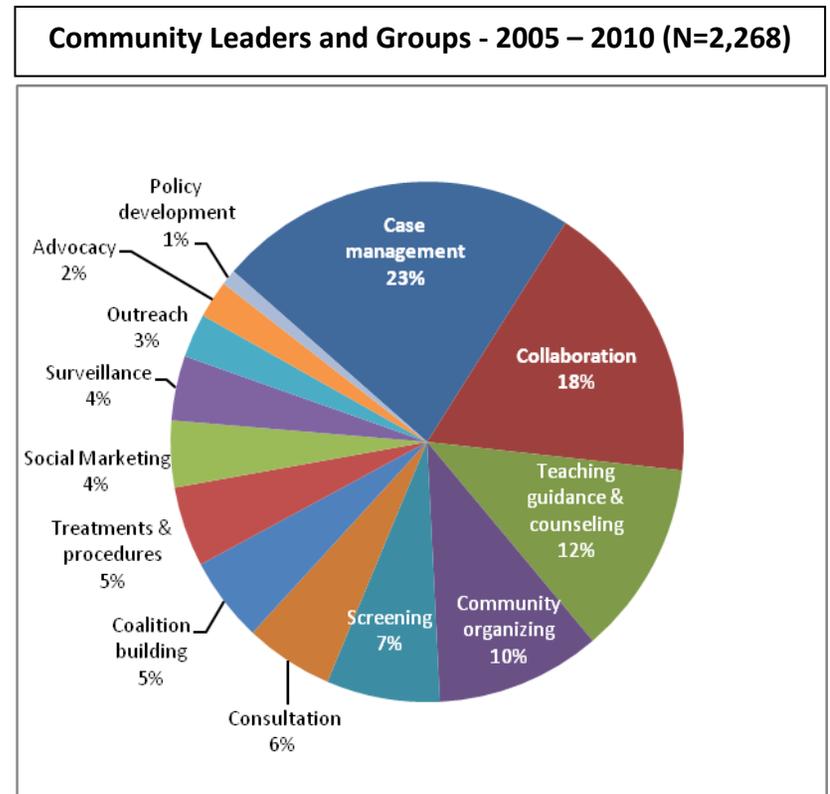
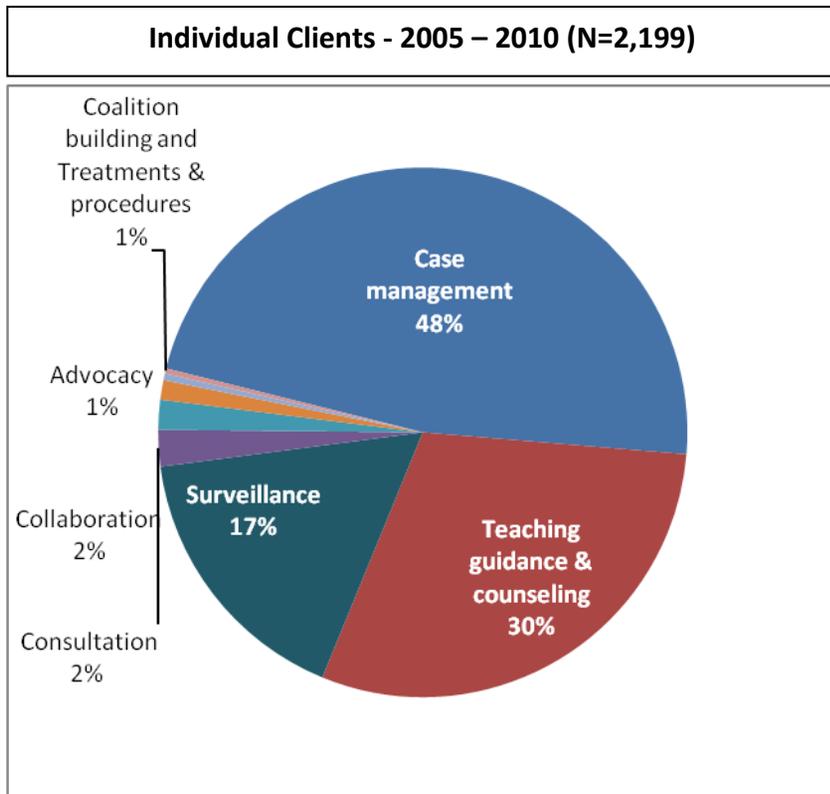
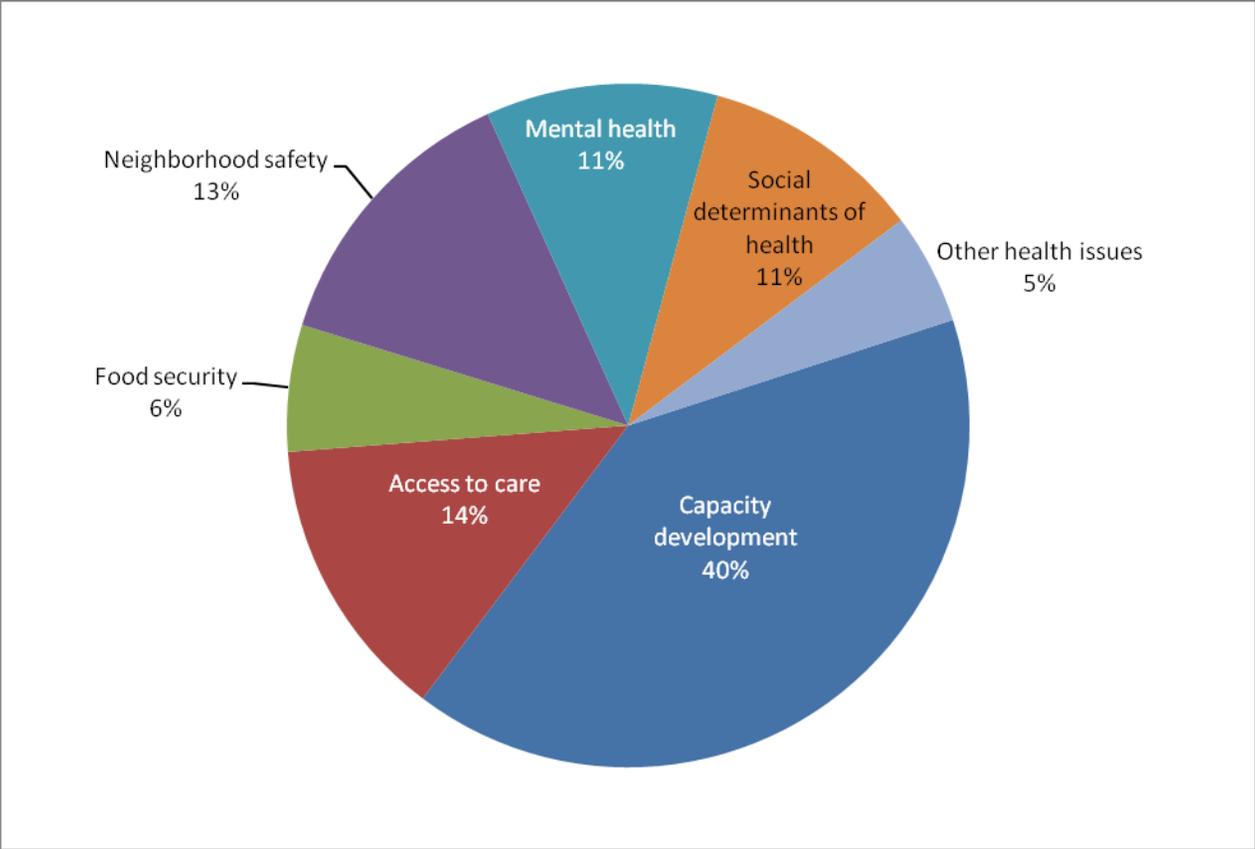


Figure 3. Percentage of coded focus areas/problems related to community health priority categories for community leaders and groups



## Appendix A. Draft Pathway for Community Health Improvement

Client Care Plan: Coded in Omaha System with Wheel Intervention List Expansion

Client: Community organization or leader

Level of care: Community

Client ID #

Admission Date:

Plans are dependent upon the socio-cultural context and the community health priorities. This example is for the period 2005-2010 with the health priorities: Access to health care, food security, mental health, neighborhood safety. (Percentages indicate the numbers of times the focus area, intervention or target were coded within the focus area totals in the study.)

### 06 Communication with community resources (42.4%)

Category	Wheel Interventions	Targets	Care Description
	Collaboration (14.9%)	Communication	
	Community organizing (14.9%)	Medication administration	
	Coalition building (10.1%)	Medical dental/care	

### 01 Income (10.2%)

Category	Wheel Interventions	Targets	Care Description
Case management (33.3%)		Medical/dental care	
Teaching, guidance and counseling (23.3%)		Other community resources	
	Advocacy (10.0%)		
	Community organizing (10.0%)		

### 12 Mental Health (9.0%)

Category	Wheel Interventions	Targets	Care Description
	Collaboration (33.3%)	Support system	
Case management (19.8%)		Signs and symptoms/emotional	
Teaching, guidance and counseling (15.3%)			
	Outreach (10.8%)		

### 41 Health care supervision (7.3%)

Category	Wheel Interventions	Targets	Care Description
Case management (28.9%)		Medical/dental care	
	Collaboration (20.1%)	Screening	
Teaching, guidance & counseling (15.4%)		Communication	
Surveillance (10.7%)			

35. Nutrition (5.4%)

Category	Wheel Interventions	Targets	Care Description
	Collaboration (40.0%)	Communication	
Teaching, guidance & counseling (17.5%)		Other community resource	
Case management (15.8%)		Wellness	

04. Neighborhood/workplace safety (5.0%)

Category	Wheel Interventions	Targets	Care Description
	Community organizing (35.0%)	Wellness	
	Collaboration (21.1%)	Safety	
Teaching, guidance & counseling (12.2%)		Screening	
Case management (10.6%)		Communication	

## Appendix B. Interview Guide to Assess Data Collection in Expanded ACHIS

1. Meaning and relevance:
  - a. How does your data collection impact existing clinical care process (assessment, treatment, evaluation)?
  - b. Do you think the data you have collected is important for clinical decision making and for evaluating the project?
  - c. Do you think documenting your practice disrupts your care?
  - d. How does your data collection impact your work load?
  - e. How long did it generally take you?
  - f. What kinds of actions were captured or not captured by the system?
  - g. How did you know if you were coding the same way each time?
  - h. If the purpose of the community health improvement process is to improve population health, how well do you think this data system captures health improvement?
2. Ease of Use: How easy or difficult did you find the data collection in the ACHIS system?
3. Functionality: How difficult did you find working with the IT support that you had?
4. Suitability to the Site: Did you find that the database suited your needs for data collection? If not, what would have helped?
5. Training Support: How would you improve the training support?
6. Knowledge of Users: Do you think you understood the data collection scheme enough to adequately code the data? What would have helped?
7. Time: How much time did you devote to the data collection?
8. Format of ACHIS: How would you improve the format of ACHIS screens and spreadsheets?
9. Impact on patients & families: Do you think your data collection had an impact on the individuals and families you saw?
10. Other: Is there anything else that you would like to say about your use of the ACHIS to collect data about your clients?

### Interview guide adapted from:

Androwich, I. M., Bickford, C. J., Button, P. S., Hunter, K. M., Murphy, J., & Sensmeier, J. (2003). *Clinical Information Systems: A Framework for Reaching the Vision*. Washington, DC.

Lundeen SP, Friedbacher BE. Chapter 9, *Academic Nursing Centers and Community-Based Nursing Information Systems. Nurse Case Management in the 21st Century*. St. Louis: Mosby; 1996.

Polgar, JM, Reg OT, Barlow I (2005) Measuring the clinical utility of an assessment: the example of the Canadian Occupational Performance Measure. Retrieved April 12, 2005, from <http://www.seatingandmobility.ca>

Smart, A. (2006). A multi-dimensional model of clinical utility. *International Journal for Quality in Health Care* vol. 18 no. 377-382 Published by Oxford University Press on behalf of International Society for Quality in Health Care

**Appendix C. 1. Categories of coded focus areas/problems by community health improvement priorities**

<b>Health Priority of Initiative</b>	<b>Omaha System Focus/Problem Area</b>	<b>N</b>
Capacity development	Communication with community resources	914
	Total	914
Access to care	Health care supervision	166
	Prescribed medication regimen	93
	Oral health	47
	Total	306
Food security	Nutrition	136
	Total	136
Neighborhood safety	Neighborhood/workplace safety	141
	Residence	90
	Sanitation	70
	Other environmental health issues	5
	Total	306
Mental health	Mental health	166
	Substance use	49
	Interpersonal relationships	29
	Social contact	3
	Grief	2
	Total	249
Social determinants of health	Income	171
	Formal education	48
	Legal system	20
	Total	239
Other health issues	Human sexuality	21
	Caretaking- parenting	15
	Growth and Development	18
	Hearing/ Ears	4
	Vision/ Eyes	13
	Dentition/ Mouth	1
	Pain	8
	Integument	6
	Neuro-Muscular- Skeletal	1
	Respiration	15
	Circulation	3
	Digestion/ Hydration	1
	Bowel Function	1
	Physical Activity	4
	Personal hygiene	3
	Family Planning	2
	Other health related behaviors	2
	Pregnancy	1
	Total	119

**Appendix D. Frequency of nurses' coding of population-level interventions (with community leaders and groups) by quarter year**

	#	%			
	2005				Q3
					Case management
					33
					38.37
					Collaboration
					26
					30.23
					Community organizing
					8
					9.30
					Screening
					7
					8.14
					Teaching, guidance & counseling
					6
					6.98
					Coalition Building
					6
					6.98
					86
					100.00
					Q4
					Case management
					12
					27.91
					Screening
					9
					20.93
					Teaching, guidance & counseling
					8
					18.60
					Advocacy
					8
					18.60
					Community organizing
					6
					13.95
					43
					100.00
					2007
					Q1
					Case management
					21
					45.65
					Community organizing
					12
					26.09
					Screening
					5
					10.87
					Collaboration
					4
					8.70
					Coalition Building
					4
					8.70
					46
					100.00
					Q2
					Teaching and Guidance
					10
					28.57
					Case Management
					6
					17.14
					Social Marketing
					4
					11.43
					Community Organizing
					8
					22.86
					Collaboration
					7
					20.00
					35
					100.00
					Q3
					Collaboration
					12
					48.00
					Social Marketing
					4
					16.00
					Case Management
					2
					8.00
					Advocacy
					3
					12.00
					Screening
					2
					8.00
					Coalition Building
					2
					8.00
					25
					100.00
					Q4
					Screening
					7
					25.93
					Collaboration
					7
					25.93
					Teaching and Guidance
					5
					18.52
					2006
					Q1
					Case management
					139
					41.87
					Teaching, guidance & counseling
					68
					20.48
					Community organizing
					65
					19.58
					Screening
					36
					10.84
					Collaboration
					24
					7.23
					332
					100.00
					Q2
					Case management
					68
					46.90
					Community organizing
					22
					15.17
					Screening
					15
					10.34
					Social marketing
					14
					9.66
					Teaching, guidance & counseling
					13
					8.97
					Collaboration
					13
					8.97
					145
					100.00

Case Management	4	14.81
Social Marketing	4	14.81
	27	100.00
2008		
Q1		
Case Management	20	62.50
Social Marketing	5	15.63
Policy Development	2	6.25
Screening	3	9.38
Coalition building	2	6.25
	32	100.00
Q2		
Teaching and Guidance	4	36.36
Case Management	3	27.27
Collaboration	2	18.18
Social Marketing	1	9.09
Advocacy	1	9.09
	11	100.00
Q3		
Collaboration	21	35.59
Consultation	12	20.34
Teaching and Guidance	10	16.95
Coalition building	9	15.25
Outreach	7	11.86
	59	100.00
Q4		
Collaboration	18	38.30
Coalition building	9	19.15
Treatments and Procedures	9	19.15
Consultation	7	14.89
Outreach	4	8.51
	47	100.00
2009		
Q1		
Collaboration	30	34.48
Consultation	16	18.39
Outreach	16	18.39
Treatments and procedures	13	14.94
Coalition building	12	13.79
	87	100.00
Q2		
Collaboration	48	41.38
Coalition building	20	17.24
Consultation	17	14.66
Teaching, guidance & counseling	16	13.79
Treatments and procedures	15	12.93
	116	100.00

Q3

Collaboration	27	38.03
Treatments and procedures	15	21.13
Outreach	11	15.49
Coalition building	10	14.08
Teaching, guidance & counseling	8	11.27
	71	100.00
Q4		
Collaboration	23	33.33
Treatments and procedures	18	26.09
Teaching, guidance & counseling	15	21.74
Outreach	7	10.14
Consultation	6	8.70
	69	100.00
2010		
Q1		
Collaboration	26	38.24
Treatments and procedures	18	26.47
Teaching, guidance & counseling	14	20.59
Consultation	5	7.35
Social marketing	5	7.35
	68	100.00
Q2		
Teaching, guidance & counseling	23	28.75
Collaboration	18	22.50
Treatments and procedures	14	17.50
Consultation	9	11.25
Outreach	8	10.00
Coalition building	8	10.00
	80	100.00

