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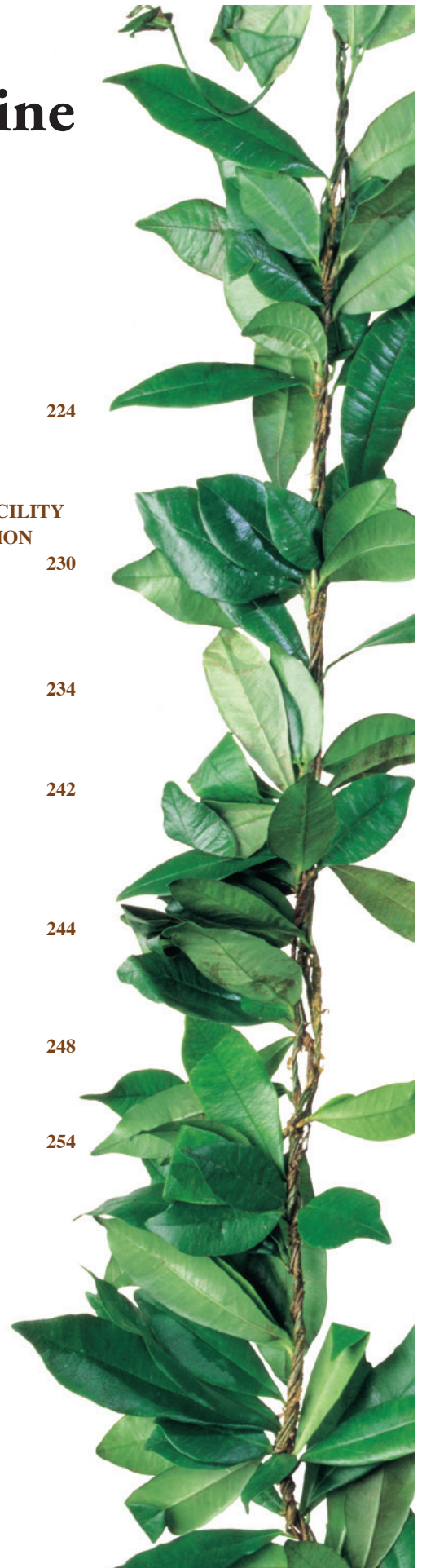
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Using Concept Mapping in the Development of a School of Public Health

Laura J. Hsu DrPH; Misty Y. Pacheco DrPH; Christopher Crabtree DrPH; and Jay E. Maddock PhD

Abstract

Schools of Public Health have a wide variety of essential stakeholders. Broad input in program planning should assist in ensuring well-developed plans and strong community buy-in. The planning of a school can better address the needs of multiple stakeholders from systematic broad-based input from these constituents using concept mapping. In this study, we used concept mapping to prioritize a set of recommendations from diverse stakeholders to assist in the process of planning a school. A set of statements was generated on essential elements for the proposed school from a broad group of stakeholders. The statements were then distilled into unique themes, which were then rated on importance and feasibility. Cluster maps and pattern matches were used to analyze the ratings. Unique themes (N= 147) were identified and grouped into 12 clusters. Cluster themes included leadership, faculty, culture, school, and curriculum. Pattern matches revealed a significant, modest correlation between importance and feasibility ($r=0.27$). A broad range of perspectives was used to identify relevant areas to address in the development of a school.

Keywords

concept mapping, academic program planning, public health

Introduction

Schools of Public Health (SPH) serve a broad array of stakeholders. With a mission of teaching, research, and service as well as an implicit expectation of improving community health, stakeholders include current and potential students, faculty, university administrators, state and local health departments, other public health practitioners, local communities, and the public at large. The development of a SPH to meet the needs of all these constituents, especially in rural areas and in states without other SPH, takes careful planning and preparation.

Over the past decade, there has been a rapid growth in the number of schools of public health (SPH). By December 2012, there were 48 US-based accredited SPH with 16 receiving their initial accreditation since 2000.¹ Building a program or school of public health requires extensive collaboration and resources. However, few published examples exist of broad based participation from faculty, students, staff, alumni, and public health agencies and partners in the development of a SPH.

One method used to obtain systematic contributions from a large group of people for educational development and program planning is concept mapping. Concept mapping was first introduced in 1984 to facilitate learning through a systematic approach.² Concept mapping is an important tool in strategic planning for organizing input from large groups of stakeholders into a coherent conceptual framework.³ Concept mapping is a participatory, mixed methods approach that utilizes a group process of activities consisting of brainstorming, sorting and rating, data analysis, and clustering similar ideas and themes to develop a unique detailed and organized conceptual framework

for change or improvement.

In public health, concept mapping has been used in a variety of strategic planning initiatives. For example, concept mapping has been used to develop a national research agenda for physical activity, environmental and policy research, as well as a logic model for a health agency.^{4,5} Concept mapping techniques have also been used to guide policy directives relating to end of life care.⁶

The process involves the development of a concept map, which is a visual representation of how different ideas are related to each other. Similar ideas are grouped together to form clusters. Like clusters are also visually displayed close to each other. The size of the cluster depends on how closely the ideas are viewed as similar. Clusters are then rated on importance and feasibility to determine priorities. Clusters that are rated with higher levels of importance are depicted with more layers.³

The University of Hawai'i at Manoa had an accredited School of Public Health from 1967 to 1999. However, as a result of its loss of accreditation in 1999, the School was closed and the Office of Public Health Studies (OPHS) was created as part of the John A. Burns School of Medicine. As the only Council on Education in Public health (CEPH) accredited graduate program of public health study in Hawai'i and the US Affiliated Pacific, OPHS is uniquely poised to be a central nexus for the advancement of public health interests for this diverse region. The State of Hawai'i itself is a multifaceted community, with public health needs and priorities that vary between its islands. Significant differences exist between the islands with regard to socioeconomic status, chronic disease burden, education levels, and reliable access to health care. These unique differences present one of the many challenges the OPHS faces as it attempts to rebuild the School of Public Health.

Although concept mapping has been used in various public health projects, we could not find an example where concept mapping was employed to plan an academic public health program. The goal of this study was to use concept mapping to obtain broad input from local, national, and international public health students and professionals to systematically plan for a new University of Hawai'i School of Public Health.

Methods

Concept mapping was used to develop a conceptual model to develop a world-class School of Public Health at the University of Hawai'i that would serve local, regional, and international needs. The process, described in detail below, consists of five phases: planning the primary focus prompt, brainstorming responses to the focus question, structuring and creating clusters

from the brainstormed themes, representing the clusters in a visual map, and interpreting and using the cluster analyses results.

Planning

The research team consisted of graduate students and a faculty advisor. The team developed the focus prompt “To build a world class School of Public Health at UH Manoa that better serves local, regional, and international needs, an essential element is...”. The team then brainstormed a list of potential participants, who were selected based on stakeholder status in public health. The list of participants consisted of the Hawai‘i Department of Health staff, University of Hawai‘i Department of Public Health (faculty, students, and administrative staff), University of Hawai‘i Public Health Nursing program (faculty and students), relevant faculty from various departments at the University of Hawai‘i at Manoa, key faculty from accredited Schools of Public Health, faculty from international University partners, and several nonprofit Public Health organizations.

Brainstorming

An anonymous survey with the focus prompt was developed and distributed via the secure online survey tool SurveyMonkey (Palo Alto, CA). Due to confidentiality concerns, an electronic link for the survey was sent to the lead administrators of each agency to distribute on their listservs. For this reason, an exact number of participants could not be determined. Participants were provided a statement of intent for the research, a consent agreement, Institutional Review Board approval, and then asked to complete the prompt. The participants had the option to give up to 9 responses to complete the focus prompt statement. The research team reviewed the compiled list of generated ideas and removed duplicates, yielding a number of unique themes.

Structuring Ideas

Once the unique themes had been identified, the initial survey participants were then given a second survey and asked to rate each of them separately on their importance and feasibility. The survey was again created using SurveyMonkey. Participants were asked to rate each theme on a Likert scale from 1 to 10 based on its importance relative to the other themes and also on the feasibility of implementing the theme in the next 5 years. A score of 1 corresponded to the theme being relatively unimportant/not feasible and a score of 10 corresponded to the theme being extremely important/feasible.

A work group (n=19) consisting of graduate students and faculty then sorted the themes into clusters based on their similarity. The work group participants worked individually to identify themes that belonged together in a cluster. They were instructed to use each theme only once, and that the total number of clusters should be between 1 and the number of themes -1.

Representation

The clustering data and importance and feasibility ratings were entered into Concept Systems (Ithaca, NY), a computer software program that processed the data and performed a cluster analysis and multidimensional scaling. A “cluster map” was

created, providing visual representation of the clusters, with similarly categorized themes clustered close together on the map and themes not similarly categorized placed farther apart. Following the generation of the concept map, each cluster was analyzed by the research group with several considerations, including the range of issues represented, purpose and intended use, and the strength of the clusters. Each cluster was named by the group based on the set of ideas or statements within it. Pattern matches were created to show the concordance between importance and feasibility of the clusters and the correlation between them was calculated.

Interpretation and Use

Students and faculty from the UH Office of Public Health Studies met to review the cluster map and pattern matches. Each cluster was evaluated on its relevance to the UH SPH academic program planning, and how themes identified within the clusters could be used in the UH SPH re-building process.

The Committee on Human Subjects at UH approved this study.

Results

Survey Participant Demographics

The initial survey that generated ideas was completed by 305 participants. The second survey, which rated the themes from the initial survey on their importance and feasibility was completed by 172 participants. For both surveys, the majority (81%) was from the state of Hawai‘i with significant inclusion from the US Mainland (14%) and international participants. Current students, alumni, and other students and faculty comprised the majority of both samples. (See Table 1).

Table 1. Survey Participant Demographics		
	Initial Survey: Completing focus prompt (N=305) %	Ratings Survey: Importance and Feasibility (N=172) %
Where do you work?		
Hawai‘i	81	81
Continental USA	14	14
International	5	5
Are you a ... ?		
UH Manoa Public Health Student	14	20
UH Manoa Public Health Faculty	6	9
UH Manoa Public Health Alumni	32	16
Other UH Manoa Alumni	6	7
Other Public Health Student	1	1
Other Public Health Faculty	4	3
Other Public Health Alumni	4	8
Other Student/Faculty	21	21
International	0.3	1
Other	12	14

Cluster Analysis

From the set of submitted ideas generated in the first survey, a total of 147 unique themes were identified. The themes were plotted on a point map based on their relation to each other. Themes in close proximity to each other represent themes sorted together by the work group for their similarities.

From the point map, cluster analysis using Concept Systems (Ithaca, NY) partitioned the 147 themes into a concept map with 12 distinct clusters, each labeled to encompass the statements within it (Figure 1). Maps with fewer clusters resulted in the clustering of non-related themes, making it difficult to parse out the distinct relationships of the themes in the cluster, and maps with more clusters resulted in the splitting of common themes. Similar to the relationship of the themes in a point map, clusters in close proximity to each other were alike in their content while clusters spaced farther apart were less related.

The number of statements in each cluster ranged from 5 in the Comprehensive Curriculum cluster to 29 in the Class Focus Areas cluster. As indicated by their cluster layers on the cluster map, the Comprehensive Curriculum and Collaboration clusters were rated the most important.

The highest priority statements within each cluster are shown in Table 2. Overall, the Support cluster had the most number of statements ranked as being very important, followed by statements in the Leadership and Faculty clusters. Statements ranked as being very important emphasized strong leadership and support for a SPH, as well as effective faculty and education programs. The top ranked importance statement, "Accreditation" (score=9.42), came from the Academics cluster.

Clusters with statements ranked as very feasible to implement in the next 5 years came primarily from the Collaboration, School and Class Focus, and Internal Infrastructure clusters. Of the top ranked statements for feasibility, three came from the Collaboration cluster, two from each of the Class Focus Areas and Internal Infrastructure clusters, and one each from the School Focus, Class Delivery & Degrees, and Comprehensive Curriculum clusters. The top ranked feasible statement, "Access to library databases to do research" (score=8.42), came from the Internal Infrastructure cluster.

Pattern Match Analysis

The mean values for cluster importance ranged from 7.17 to 8.38, and 6.01 to 7.85 for feasibility (Figure 3). The cluster pattern match showed a weak correlation between importance and feasibility ($r=0.27$), a result of limited relationship between importance and feasibility ratings. This was especially true for items in the Collaboration cluster, where the cluster was rated as the least important of the 12 clusters, but was rated as being highly feasible, compared to the other clusters. Similarly, items in the Support and Faculty clusters were rated to be of relative high importance, but had the lowest feasibility scores. Items in the Comprehensive Curriculum cluster were rated to be the most important, followed by the School Focus cluster. The reverse was true for the feasibility ranking of the two clusters, with items in the School Focus cluster deemed the most feasible, followed by the Comprehensive Curriculum cluster.

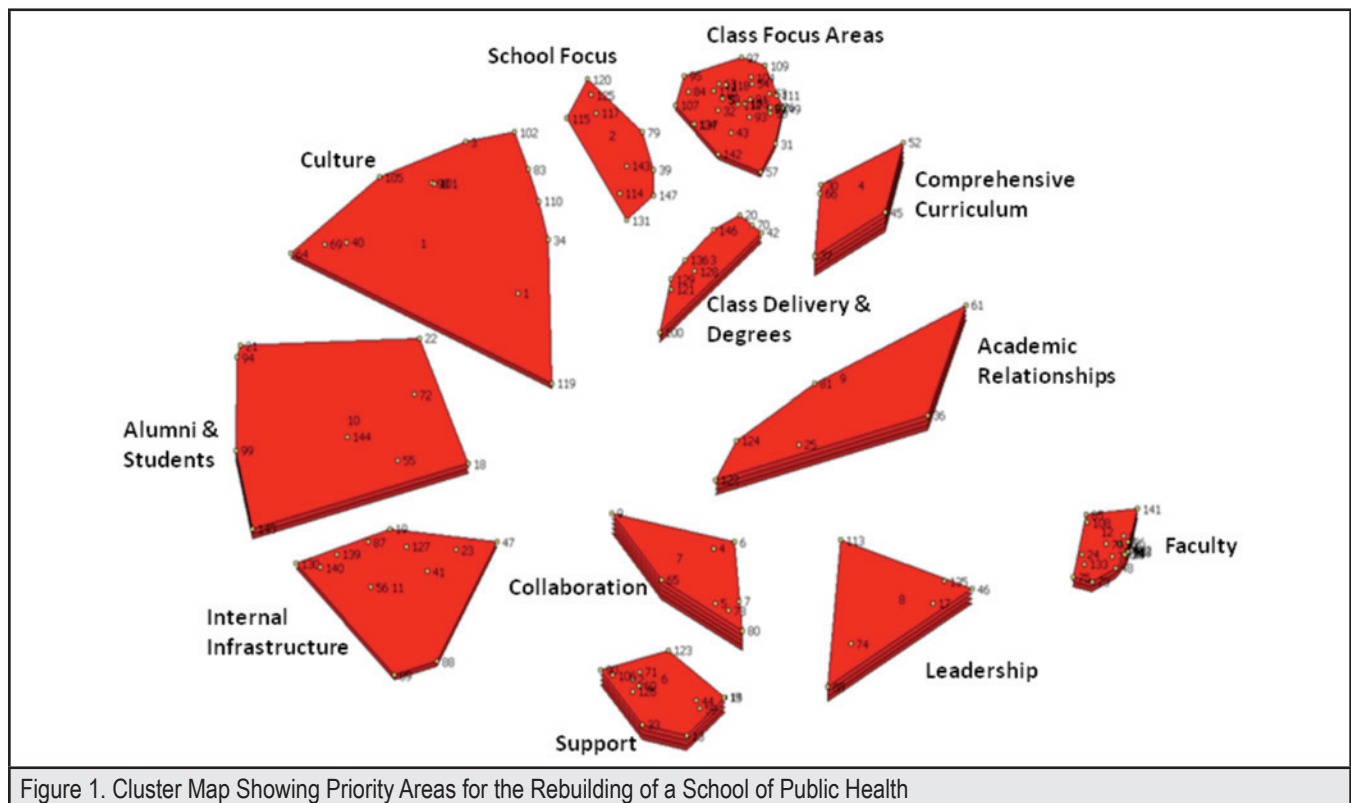


Table 2. Top Importance and Feasibility Statements		
Importance		
Score	Statement	Cluster
9.42	Accreditation	Academic Relationships
9.02	Faculty with good teaching skills	Faculty
8.96	Sufficient funding	Support
8.91	Effective, top-notch leadership that facilitates collaboration within UH departments, state, county, city, and community	Leadership
8.80	Good program disciplines (epidemiology, biostatistics, population health, international health)	Comprehensive Curriculum
8.75	Recruitment and retention of faculty that promotes academic rigor whilst promoting real-world application of skills learned	Faculty
8.71	Commitment from university	Support
8.69	Leadership commitment to growing a School of Public Health	Leadership
8.69	Strong support from the university	Support
8.64	Education and the materials taught to meet national standards	Class Delivery & Degrees
Feasibility		
Score	Statement	Cluster
8.42	Access to library databases to do research	Internal Infrastructure
8.37	Collaboration with community	Collaboration
8.24	Collaboration with local and state health departments	Collaboration
8.22	Collaboration with community-based organizations	Collaboration
8.22	To include world views and research focusing not only on Native Hawaiian	Comprehensive Curriculum
8.12	School of Public Health involvement in community	Internal Infrastructure
8.00	Education and the materials taught to meet national standards	Class Delivery & Degrees
7.95	Offered courses must prepare the students for real positions in Public Health Leadership	Class Focus Areas
7.94	Recognizing that not all PH graduates must/need to continue on to doctoral degrees in order to help lead and build a School of Public Health	School Focus
7.89	Interesting and relevant classes. Things that teach real life skills (ie, strategic planning, grant writing, community mobilizing, and policy advocacy, etc)	Class Focus Areas

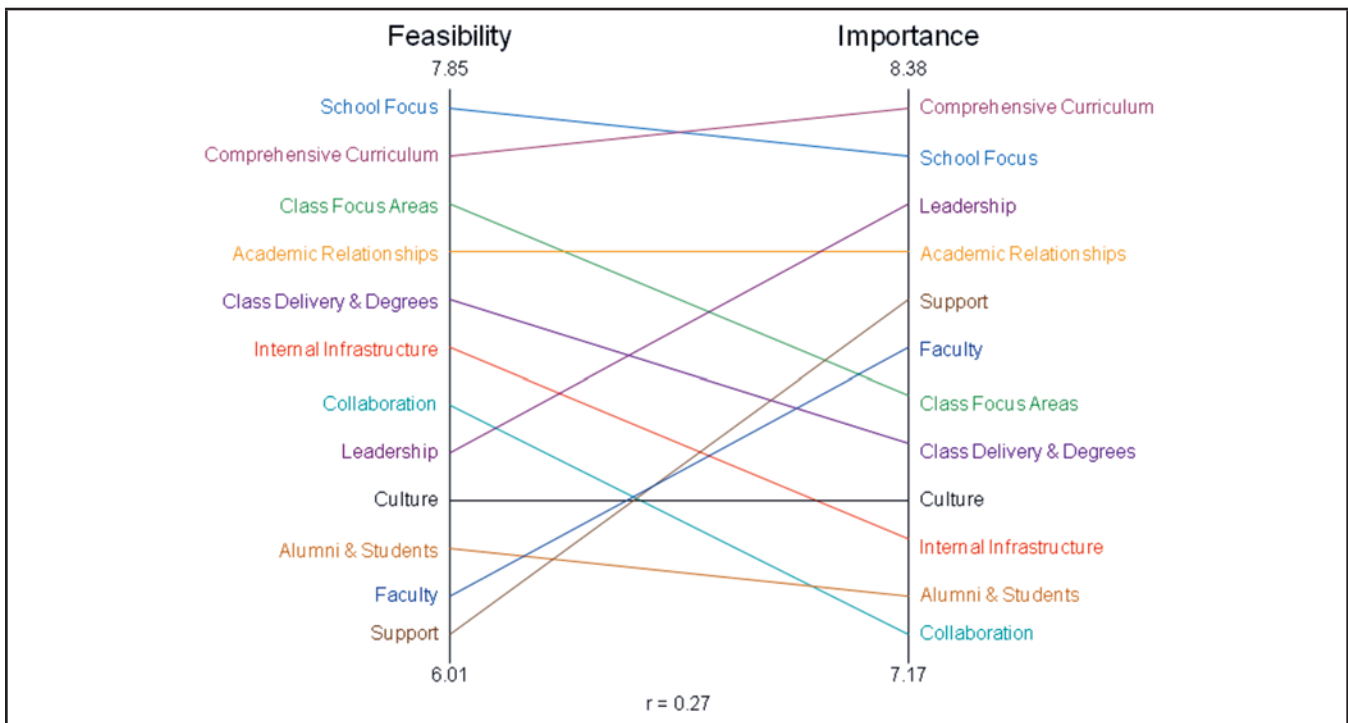


Figure 2. Cluster Pattern Matches for Feasibility and Importance

Discussion

Broad input in program planning should assist in ensuring well-developed plans and strong community buy-in. Concept Mapping is a timely and cost-effective method for getting broad-based input. While Concept Mapping has been applied in public health efforts, our study is the first to use it for the planning of a SPH⁴⁻⁶. In doing so, we were able to build consensus from diverse stakeholder groups and create an organized framework that can be used to guide the school re-building process. Past instances of academic program planning have shown high levels of institutional leadership involvement with limited involvement from other relevant stakeholders.⁷⁻¹⁰ Our concept mapping study demonstrated a broad range of perspectives, including administrators, faculty, students, alumni, community stakeholders, and national and international partners that might not have otherwise been reached were it not for the process. Engaging relevant stakeholders in the program planning process is important, and leads to information crucial to the SPH re-building effort.¹¹⁻¹³ While institutional leadership is important, as evident by the academic program planning examples that demonstrate high levels of leadership input, input from other sources that have stakeholder status is necessary to achieve a wide understanding of a successful SPH. Academic program planning requires input from many different sources, including students for example, as other studies have found.¹³

The organized process of concept mapping allowed us to present the findings in a coherent, credible manner. The findings suggest that a myriad of factors need to be considered in the re-building of the SPH. This is clear in the 12 distinct clusters resulted from the concept mapping process, showing a diverse number of facets that need to be addressed. Clusters such as the Faculty and Support clusters each contained ideas that were closely related to each other, evidenced by the tight proximities of the ideas within the clusters. These clusters may be easier to address in the re-building process, in contrast to clusters such as the Culture and Alumni & Students clusters, which contained diverse ideas as depicted by the large, wide clusters.

Importance and feasibility ratings were discordant. Thus, while clusters such as Support and Leadership were rated as being highly important, implementing ideas within these clusters was not perceived to be feasible. In contrast, clusters such as Class Focus Areas were rated feasible, though they were lower on the importance ladder. The Comprehensive Curriculum and School Focus clusters, however, were rated as being both important and feasible. In creating a framework for re-building the SPH, all such factors need to be taken into consideration.

Academic program planning requires a well-thought out agenda; building an accredited School of Public Health that will align with CEPH standards will require an organized process.¹⁴ The results from the concept mapping process enable identification of areas important to the re-building process of the SPH at UH. This information will be used to develop an agenda that informs the SPH re-building strategic plan. These results can be used to develop faculty-hiring plans and assist

in the development of new degrees. For instance the school focus cluster examined the link to Hawai'i and what makes the school unique. Since the results from the survey were released, the program has focused on the Asia-Pacific region with the development of the Indigenous Health MPH and a focus on recruiting Native Hawaiian and Pacific Islander students.

There are several limitations to the study. While the surveys generated a respectable amount of responses, for confidentiality purposes, surveys were sent out via listservs in which the total number of recipients could not be determined. Due to this, exact response rates could not be calculated.

The sample population was not picked at random, which may have led to certain biases. Survey participants were picked for their stakeholder status in the re-building of the SPH at UH, and therefore biases may exist. However, we chose survey recipients that included not only people directly affected by the re-building of the SPH, but also those that had remote stakes, including students and faculty of other related disciplines.

The initial survey generated a large number of ideas, with over 1000 responses received. From this, duplicates were removed, producing 147 unique themes. In removing the duplicate ideas, the specificity of the ideas may have been lost. However, every effort was made to preserve the intent of the ideas, and only clearly identifiable duplicates were removed from the list.

Conclusions

By using concept mapping to identify essential elements to build a world-class SPH at the University of Hawai'i at Manoa, we attempted to capture multiple perspectives and build consensus among disparate groups. This data can be used to efficiently organize the information into a framework for prioritizing academic program planning activities. The methods we used could prove to be beneficial to other academic departments looking to restructure or plan academic programs using input from an experienced pool of heterogeneous participants.

Conflict of Interest

None of the authors identify a conflict of interest.

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A Case of *Bordetella bronchiseptica* at a Military Medical Facility in Hawai'i: Phenotypic and Molecular Testing of an Uncommon Human Pathogen

Michael A. Washington PhD; Willie A. Agee PhD; Lauren Kajiura MS;
Joshua S. Hawley-Molloy MD; Catherine M. Staeger BS; and Jason C. Barnhill PhD

Abstract

Bordetella bronchiseptica (*B. bronchiseptica*) is rarely implicated in human disease. Human infections typically occur in the context of immunosuppression and while human infection has been sporadically reported in the literature, the majority of these reports are largely descriptive and do not explore the molecular and phenotypic properties of the isolates in question. Here we report the isolation and characterization of a *B. bronchiseptica* isolate derived from an HIV positive patient at Tripler Army Medical Center on O'ahu. This case represents the first published report of human infection of *B. bronchiseptica* in the state of Hawai'i and the most detailed description of the biochemical and molecular features of a Hawaiian isolate to date.

Case Report

A 58-year-old man with a history of acquired immunodeficiency syndrome (AIDS) presented to the emergency department with three months of progressive dyspnea. He had been HIV positive for 24 years and had decided to discontinue his antiretroviral therapy (ART) three years earlier. His CD4 count was 62 (3%) two months prior to presentation. During the week prior to admission, he was no longer able to get out of bed due to shortness of breath. He had fatigue and a non-productive cough as well as a weight loss of forty pounds over the previous three months.

Evaluation in the emergency department revealed a thin male in mild respiratory distress with blood pressure 113/84 mm Hg, heart rate 100 beats per minute, respiratory rate 23 breaths per minute, and a temperature of 97.9 degrees Fahrenheit. His oxygen saturation was 94% at 5 liters per minute via nasal cannula. Physical exam was notable for normal breath sounds, normal heart exam, no skin lesions, normal neurologic exam, and was otherwise non-revealing. The patient's CD4 count upon admission was 63 (3%). A chest X-ray was normal, but chest CT (computed tomography) showed bilateral peripheral patchy ground-glass opacities and mild upper lobe bronchiectasis. The patient was treated empirically for community acquired pneumonia with ceftriaxone and azithromycin and for *Pneumocystis jiroveci* pneumonia with trimethoprim-sulfamethoxazole.

About twelve hours after admission, a bronchoscopic alveolar lavage (BAL) was performed. A Grocot's methenamine silver (GMS) stain of the BAL fluid demonstrated organisms consistent with *Pneumocystis jiroveci*. A Gram stain of the BAL fluid demonstrated Gram negative rods, and respiratory cultures obtained from this procedure yielded more than 100,000 colony forming units (CFU) of an aerobic Gram negative coccobacillus. Blood cultures yielded no growth, and acid-fast and fungal respiratory cultures of BAL fluid also yielded no growth.

Phenotypic analyses of the Gram negative coccobacillus isolate revealed that it was catalase, oxidase, and urease positive.¹ Subsequent screening with the Vitek 2 (bioMerieux, Durham, NC) system identified this isolate as *B. bronchiseptica*.^{2,3} However, due to the historical infrequency of isolating this organism from the human respiratory tract and the strong correspondence between the phenotypic properties of this isolate and the phenotypic properties of *Brucella* species (which is a highly infectious Category-B biothreat agent), a detailed biochemical and molecular characterization was undertaken.⁴⁻⁸

Polymerase chain reaction (PCR) was performed using the ABI 7500 (Life Technologies, Grand Island, NY) thermocycler and a set of primers designed to identify *Bordetella* species via the detection of insertion sequences 481 (IS481), 1001 (IS1001) and a stable region of the pertussis toxin promoter.^{9,10} Of note, all PCR reactions utilizing these primers yielded negative results. This indicated that either the isolate in question was not a *Bordetella* species or that it represented a unique strain, which lacked the above-mentioned insertion sequences in addition to maintaining a sequence divergent pertussis toxin promoter. The isolate was later confirmed to be a member of the *Bordetella* genus by 16S ribosomal RNA sequence analysis using the Microseq identification system by Life Technologies.^{11,12}

The results obtained from an exhaustive set of biochemical analyses (Table 1) were consistent with the identification of *B. bronchiseptica*.¹³⁻¹⁶ The isolate was found to be capable of growth at 25°C and 35°C but not at 42°C in tryptone glucose yeast extract agar. It was found to have peritrichous flagella and to be capable of growth as a non-lactose fermenter on MacConkey agar. Inoculation of the organism into a triple sugar iron agar slant yielded an alkaline over alkaline reaction (K/K) and no hydrogen sulfide (H₂S) production. However, the organism was able to produce small quantities of H₂S that could be detected with lead acetate paper, a result which was also consistent with previous reports.^{13,16} The organism was incapable of carbohydrate fermentation for all carbohydrates tested but was capable of utilizing citrate as a carbon source. It was negative for all amino acid decarboxylases tested, and was unable to utilize acetamide as a carbon source. It produced an alkaline reaction on litmus milk, was found to be motile, capable of reducing nitrates to nitrites and capable of limited growth in media containing 6% sodium chloride.¹³

Table 1. Summary of biochemical reactions for the isolate derived from the BAL fluid of an immunocompromised patient. All biochemical reactions are consistent with <i>B. bronchiseptica</i> .	
Biochemical Test	Result
TSI Reaction	K/K no H2S Production
Flagella	Peritrichous
Oxidase	Positive
H2S Production (Lead acetate Paper)	Positive
Carbohydrate Utilization (Glucose, xylose, mannitol, lactose, sucrose, maltose, fructose, ethanol, methanol)	Negative K/K for all carbohydrates tested
S. Citrate Utilization	Positive
Urease Production	Positive
Cetrimide Agar Growth	Negative
Nitrate Reduction	Positive
Nitrite Reduction	Negative
Indole Production	Negative
Motility	Positive
Gelatin hydrolysis	Negative
Growth in 0% NaCL	Positive
Growth in 6% NaCL	Positive
LOA Decarboxylase Production	Negative
Acetamide	Negative
Litmus Milk	No reaction, K

The phenotypic characteristics of this putative *B. bronchiseptica* isolate were replicated with the aid of the API 20NE system (bioMerieux, Durham, NC). The API system consists of a series of 20 microtubes containing the dehydrated substrates necessary to perform microscale biochemical assays.¹⁷ Each positive reaction is assigned a numerical value and the pattern of values resulting from analysis of the entire series is used to derive a unique numerical profile for each isolate. This numerical profile is then used to query an automated profile recognition system. Analysis of the BAL-derived putative *B. bronchiseptica* isolate with this system yielded identical biochemical reactions to those obtained by the conventional biochemical methods and subsequently yielded a numerical profile that was a 100% match for *B. bronchiseptica* via the automated profile recognition software. Although the API 20NE system is not a confirmatory assay, the replication of the results obtained with conventional biochemical and molecular testing support the genus and species identification of this isolate as *B. bronchiseptica*.

Because conventional biochemical testing, API 20NE analysis, and Microseq are unable to accurately discriminate among the various members of the *B. bronchiseptica* complex (per manufacturer), we sought to determine whether the combination of PCR and mass spectrometry may serve as a useful adjunct to conventional analyses since this recent technology has been demonstrated to successfully identify a wide range of bacteria viruses and fungi from clinical samples.¹⁸⁻²⁷ The PLEX-ID system

(Abbott Molecular Diagnostics, Des Plaines, IL) utilizes PCR to amplify 16 separate regions of the bacterial genome. The resulting amplicons are then analyzed by electrospray ionization mass spectrometry. This leads to the determination of the exact numbers of each nucleotide base in the amplicon. These base counts are used to construct a base count signature for the organism.²²⁻²⁴ The base count signature is then used to query a database for matching profiles.²¹ When the BAL-derived isolate was analyzed by this method, it was found to closely match the profile for *B. bronchiseptica* in general and strain M0149 in particular. Strain M0149 (also known as D444 and B2594) belongs to the *B. bronchiseptica* complex IV which is closely related to *B. pertussis* and may represent a recent ancestor to this organism.²⁸ Strain M0149 was originally isolated from a human host, and interestingly, the majority of complex IV isolates have been derived from human clinical material, suggesting this complex may be uniquely adapted to growth in an environmental niche provided by the human respiratory tract.²⁸

The patient was diagnosed with pneumonia due to *B. bronchiseptica* and *P. jiroveci*. He was treated with trimethoprim-sulfamethoxazole and prednisone for *Pneumocystis* and with levofloxacin for *Bordetella* based upon susceptibility results. Ceftriaxone and azithromycin were discontinued and ART was restarted a few days after admission. Upon further questioning he stated that he owned a dog which was not ill, but which had not been receiving routine veterinary care. The patient's pneumonia and hypoxemia improved, and he was discharged after a 15-day hospitalization.

Discussion

Bordetella bronchiseptica is a small, non-fermentative Gram negative aerobic coccobacillus which is capable of growth on simple media.²⁹ It has a high guanine and cytosine (GC) content and has historically been classified with the betaproteobacteria.³⁰ *B. bronchiseptica* is currently recognized as the causative agent of acute and chronic respiratory disease in non-human mammals.³¹⁻³⁵ It is also infrequently associated with zoonotic infection and is sporadically isolated from immunocompromised human hosts.^{36,37} However, the role *B. bronchiseptica* plays in human disease is not well defined.^{14,30} As a member of the genus *Bordetella*, it shares several biochemical characteristics with the *Alcaligines* species and the various members of the genus *Ralstonia*. These similarities tend to complicate traditional phenotypic identification and underscore the need for accurate diagnostic methods to enable the identification of this agent and the resolution of individual strains.^{14,30}

Seven species of *Bordetella* are currently recognized.³ However, only three of these have been found to be consistently capable of colonizing and infecting human hosts. These are *Bordetella pertussis*, *Bordetella bronchiseptica*, and *Bordetella parapertussis*. *Bordetella pertussis* was the first member of the genus *Bordetella* to be described; it was initially isolated in 1906 by Bordet and Gengou.³⁴ *Bordetella bronchiseptica* was first isolated by Ferry from cases of canine distemper in 1910, and the phenotypic distinction between *Bordetella pertussis*

and *Bordetella parapertussis* was made in 1938.³⁴ *Bordetella pertussis* is the causative agent of whooping cough or pertussis, *Bordetella parapertussis* is associated with a mild variant of pertussis, and *B. bronchiseptica* is the causative agent of tracheobronchitis or “kennel cough” in dogs, atrophic rhinitis in swine and sporadic cases of a pertussis-like illness in immunocompromised humans.³⁷ The process of infection displayed by *B. bronchiseptica* in mammalian hosts is a stereotyped and multifactorial process similar to that which is displayed by other members of the genus *Bordetella*. This process begins with exposure of the host to the organism (typically through aerosol contact), attachment of the organism to the ciliated cells lining the respiratory tract, and replication of the organism within the structures of respiratory tract.³ Virulent strains of *B. bronchiseptica* express a series of virulence factors that aid in the process of infection. Attachment to ciliated epithelial cells is mediated by at least two protein adhesins known as pertactin and filamentous hemagglutinin. These adhesins facilitate the interaction of the organism with the sulfated glycoprotein integrin present on the surface of ciliated epithelial cells. They also interact with a glycoprotein receptor known as complement receptor-3 (CR3) on the surface of macrophages. These interactions allow the organism to be phagocytized into macrophages without the production of a reactive oxidative burst.³ This allows the organism to survive and proliferate within the cytoplasm of the macrophage in a state of relative isolation from both the humoral and cell mediated immune systems.

Although most members of the genus *Bordetella* express some form of pertussis toxin, this protein is not elaborated by any known strain of *B. bronchiseptica*. Local tissue damage and systemic toxicity are both mediated by alternate toxins. Primarily these consist of the adenylate cyclase hemolysin and the dermonecrotic toxin.^{31,38} The adenylate cyclase hemolysin is essential for the initiation of infection but dispensable for the maintenance of the organism within the host.^{32,38} To date, an adaptive role for dermonecrotic toxin has not been conclusively demonstrated.

B. bronchiseptica can be identified via microscopy, culture, or nucleic acid amplification.⁷ However, it is most often identified in clinical laboratories with the aid of automated biochemical identification systems such as the Vitek 2.² However, the algorithms utilized by these systems are primarily based upon the enumeration of phenotypic characters and are not capable of resolving individual strains. In addition, many commercial phenotypic identification systems have been shown to have low diagnostic accuracy where non-fermenting organisms are concerned. The genus *Bordetella* is a closely related group of organisms, consequently the individual members of this genus tend to differ in a relatively small number of genotypic and phenotypic characters.¹⁴ Thus, individual members of this genus (particularly at the strain level) are difficult to discriminate. The combination of the PCR with mass spectrometry is a relatively recent development that may enable the rapid and specific detection of non-fermenting organisms and allow strain resolution.¹⁸⁻²⁷

Although several cases of human infection with *B. bronchiseptica* have been reported in the literature, very few of the reports identify the precise strains responsible for infection.³⁴ In addition, few laboratories confirm the identification of *B. bronchiseptica* with the use of multiple independent assays.³⁴ Therefore, the true incidence of human infection has probably been underestimated, resulting in a paucity of data concerning the prevalence of individual strains. Human infection with this organism has only been rarely documented, yet information regarding the phenotypic and molecular characterization of the specimens has not been publicly available. Here we report the isolation, identification and phenotypic characterization of *B. bronchiseptica* from the bronchial fluid of an immunocompromised patient at Tripler Army Medical Center on O‘ahu. Based upon our review of the literature this report represents one of the most complete molecular and phenotypic descriptions of a case of human infection with this organism.

The views expressed in this publication/presentation are those of the authors and do not reflect the official policy or position of the Department of the Army, Department of Defense, or the United States Government.

Conflict of Interest

None of the authors identify a conflict of interest.

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A Survey of Physicians' Attitudes and Practices about the Human Papillomavirus (HPV) Vaccine in Hawai'i

Reni Soon MD, MPH; May Rose I. Dela Cruz DrPH; JoAnn U. Tsark MPH; John J. Chen PhD; and Kathryn L. Braun DrPH

Abstract

The human papillomavirus (HPV) vaccine has the potential to decrease the incidence of several cancers that affect women and men. Despite recommendations by the medical and public health community, and the incorporation of the vaccine into the adolescent immunization schedule, uptake of the vaccine remains well below target goals. To understand potential physician barriers to recommendation and provision of the vaccine, a cross-sectional survey was administered to Hawai'i pediatricians and family physicians from July 2012 to September 2012 on their attitudes, practices, and perceived barriers regarding HPV vaccination. Surveys were mailed to 465 members of the local pediatrics and family medicine professional chapters, and 87 responses were received for a response rate of 19%. After excluding 14 responses, 73 surveys were included in the analysis. Although almost all of the respondents reported stocking and administering the HPV vaccine in their offices, only 71% reported strongly recommending the HPV vaccine to girls 11-12 years, and only 57% strongly recommend the vaccine to boys 11-12 years old. Lack of insurance coverage and other financial considerations were barriers to provision of the vaccine by physicians. Physicians who felt it is necessary to discuss sexuality with patients prior to recommending the vaccine were significantly less likely to strongly recommend the vaccine to boys 11-12 years old. Public health efforts should focus on addressing the financial barriers and encouraging physicians to recommend the HPV vaccine according to the guidelines.

Keywords

Human papillomavirus, HPV, HPV vaccine, providers, attitudes, practices, Hawai'i

Introduction

Each year the human papillomavirus (HPV) causes approximately 18,000 new cases of cancer in women and 8,000 new cases of cancer in men in the United States (US).¹ Oncogenic HPV accounts for the majority of cases of cervical cancer and is associated with many other anogenital and oropharyngeal cancers in men and women.¹ The morbidity caused by HPV extends beyond these diagnoses of cancer. Treatments for cervical dysplasia, the precursor to cervical cancer, can be emotionally difficult and invasive for women, and have been associated with pregnancy complications, such as cervical stenosis and preterm labor.^{2,3} One study calculated the yearly direct medical costs of preventing and treating HPV-related diseases to be \$8 billion.⁴

The US Food and Drug Administration approved the first HPV vaccine in 2006. Gardasil© is a quadrivalent vaccine with efficacy against four subtypes of HPV: types 16 and 18, which account for 70% of cervical cancers, and types 6 and 11, which cause genital warts.⁵ In phase 3 studies, Gardasil© was found to be 98-100% effective in preventing high-grade cervical dysplasia, the precursor to cervical cancer.⁶⁻⁸ Long-term follow-up studies established the safety of the vaccine, with its most common side effects being fainting (syncope), redness or swelling at the site of the injection, dizziness, and nausea.^{9,10}

In 2007, the Advisory Committee on Immunization Practices (ACIP) of the Centers for Disease Control and Prevention (CDC) recommended the HPV vaccine for girls and women, ages 11-26 years.¹¹ Subsequently, the American Academy of Pediatrics (AAP) integrated the HPV vaccine into the standard immunization schedule for all girls at age 11-12 years and extended that recommendation to all boys at age 11-12 years in March 2012.¹²

Despite the safety and efficacy of the HPV vaccine, and the recommendation by medical societies for vaccination, many eligible children are not getting vaccinated. A recent analysis from the CDC shows that, in 2013, only 57.3% of girls age 13-17 nationwide had received at least one dose of the vaccine and 37.6% had received all three doses.¹³ This represented an increase from 2012 when 53.8% of girls age 13-17 had received one dose of the vaccine and 33.4% had received all three doses.¹⁴ While nationwide HPV vaccination coverage increased, the proportion of girls age 13-17 in Hawai'i who were vaccinated during this same time period decreased. In 2012, vaccination coverage in Hawai'i among girls age 13-17 was 64.6% for one dose and 43.4% for all three doses,¹⁴ and in 2013 these numbers decreased to 52.7% and 34.4% respectively.¹³ Coverage both locally and nationwide is still far below the Healthy People 2020 goal of 80% uptake of all three doses of the HPV vaccine among girls 13-15 years old.¹⁵ The National Health Interview Survey, an in-person survey also conducted by the CDC, found that over half of the parents of girls who were not vaccinated indicated that they were not planning to vaccinate their daughters. The most common reasons for this refusal were feeling that their daughters did not need the vaccine and concerns about the safety of the vaccine.¹⁶ In this 2010 study, parents reported that 28.9% of their daughters age 11-17 years old had received one or more doses of the vaccine, and only 14.2% received all three doses of the vaccine.¹⁶

Another common reason that parents report not vaccinating their children with the HPV vaccine is lack of physician recommendation.¹⁷⁻¹⁹ Physicians can play a large role in efforts to increase the uptake of the HPV vaccine, as studies have consistently shown that one of the strongest factors associated with acceptance of the vaccine is physician recommendation.^{17,20-24} One recent study found that adolescent females age 12-17 whose parents reported their provider recommended the HPV vaccine were eighteen times more likely to have initiated the HPV vaccine series than girls whose parents did not report receiving a provider recommendation.²⁵ In addition, while most physicians agree with the HPV immunization recommendations,^{26,27} many do not provide the HPV vaccine in their offices.²⁶ Physicians

most commonly cite financial reasons for not administering the HPV vaccine, including lack of insurance coverage and the cost of the vaccine.^{26,28}

The objectives of this study were to gather detailed information about Hawai'i physicians' practices and attitudes toward HPV vaccination with a particular focus on whether they recommend and/or administer the vaccine in their offices. Because physician recommendation is a powerful predictor of HPV vaccination, this study also sought to identify the factors associated with physician recommendation. Identifying these factors and other perceived barriers could inform practices and programs on ways to increase the uptake of the HPV vaccine series among Hawai'i's girls and boys.

Methods

Study Population

A cross sectional survey of practicing Hawai'i physicians specializing in either pediatrics or family medicine was conducted from July 2012 to September 2012. Local chapters of two relevant professional societies, the American Academy of Pediatrics and the American Academy of Family Physicians, agreed to e-mail the survey to their members. To optimize survey response rates, the e-mail message contained an introduction and personalized message from the principal investigator, a practicing obstetrician-gynecologist, and an endorsement of the survey by the local chapter. The survey was disseminated through e-mail to 298 family physician members and 167 pediatrician members. A follow-up e-mail was sent out four weeks later, with instructions to abstain from participation if the survey had already been completed. Because the objective of this survey was to ascertain practices and beliefs of physicians who make medical decisions impacting today's adolescents, resident physician members, medical student members, retired physician members, and any members who did not see adolescents in their practices were excluded.

Survey Design

The questionnaire for this study was adapted from a validated survey instrument that assessed the attitudes and behaviors regarding HPV vaccination of pediatricians and family physicians in a nationwide network.²⁶ The survey included provider demographics, specialization, years in practice, and the number of patients age 11-30 years seen in an average week. Provider attitudes and behaviors were assessed via 4-point Likert type scales (eg, strongly agree to strongly disagree), as were barriers to providing HPV vaccination (eg, definitely a barrier, somewhat of a barrier, a minor barrier, and definitely not a barrier). Physicians were also asked whether they recommend the HPV vaccine to girls and/or boys in various age groups, with possible answers being strongly recommend, recommend but not strongly, or do not recommend. This study was approved by the University of Hawai'i Institutional Review Board.

Data Analysis

Characteristics of the respondents were summarized by frequen-

cies and percentages, and compared between the two medical specialties using Fisher's exact tests. Because of the limited sample size, for each survey question regarding the attitudes and perceived barriers, answers were dichotomized into strongly/somewhat agree and strongly/somewhat disagree (for attitude questions) and definitely/somewhat a barrier and minor/not a barrier (for barrier questions). Because physician recommendation is a strong determinant in whether a patient receives the HPV vaccine, whether or not the physician strongly recommends the HPV vaccine and the factors that affect this was one of the study's primary interests. As a result, responses for physician HPV vaccine recommendation were dichotomized into strongly recommend and do not strongly recommend. Associations between "whether or not a physician strongly recommends the HPV vaccine for children ages 11-12 years" and each of the demographic and practice characteristics, attitudes and perceived barriers were evaluated using Fisher's exact tests separately for boys and girls. For each gender, variables that reached a P -value $< .15$ were identified as indicative and entered into the multivariate logistic model. To make the models for boys and girls comparable, any relevant independent variables identified for either boys or girls were included in both models. For "number of patients age 11-30 years seen in an average week", the variable was dichotomized into >20 and ≤ 20 ; for "parent/patient concern about the efficacy of the HPV vaccine", due to the problem of complete separation, the variable was recoded into "Definitely" and "Others" in the multivariable analysis. As the physician specialty was a variable of interest, it was kept in the multivariable model even though it did not reach the P -value cutoff. Unadjusted and adjusted odds ratios (ORs) and 95% confidence intervals (CIs) were calculated separately for boys and girls. Statistical analyses were performed using SPSS version 20.0 (IBM Corp: Armonk, NY).

Results

Of the 465 surveys sent, 87 responses were received for a response rate of 19%. Of these, 14 individuals did not meet the study criteria and were excluded, leaving a total of 73 surveys for analysis. Reasons for exclusions were: 3 respondents were medical residents, 4 were physicians not currently in practice, 3 did not consent to the survey, and 2 gave consent, but did not answer any part of the survey. Additionally, two of the respondents who completed portions of the survey stated they do not see patients between the ages of 11-30 years, therefore their responses were not included in the analysis.

The respondents were almost equally split between pediatricians (52%) and family physicians (48%). There were equal numbers of men and women among the pediatricians, while 60% (21/35) of the family physician respondents were women. The pediatricians were significantly older than family physician respondents ($P = .002$) and in practice significantly longer ($P = .009$), with the majority of pediatricians in the 45-60 year age group and in practice for over 20 years. Overall, 40% (29/73) of respondents and 51% (18/35) of the family physicians stated they see more than 20 patients age 11-30 years in an average

Table 1. Characteristics of Respondents by Specialty			
	Pediatricians (n=38) n (%) ⁺	Family physicians (n=35) n (%) ⁺	P-value*
Sex			
Male	19 (50)	14 (40)	.49
Female	19 (50)	21 (60)	
Age (years)			
Less than 30	1 (3)	1 (3)	.002
30-44	9 (24)	23 (66)	
45-60	20 (54)	9 (25)	
Over 60	8 (21)	2 (6)	
Number of years in practice			
Less than 5	2 (5)	3 (8)	.009
5-10	6 (16)	9 (26)	
11-20	8 (21)	16 (46)	
More than 20	22 (58)	7 (20)	
Number of patients age 11-30 years seen in an average week			
1-5	1 (3)	2 (6)	.18
5-10	15 (39)	8 (23)	
11-20	11 (29)	7 (20)	
More than 20	11 (29)	18 (51)	
How often physician discusses sexual health/sexuality with her/his patients			
Rarely	2 (5)	4 (11)	.077
Sometimes	11 (29)	17 (49)	
Often	25 (66)	14 (40)	
How often physician discusses immunizations or vaccination status with her/his patients			
Rarely	0 (0)	4 (11)	< .001
Sometimes	1 (3)	9 (26)	
Often	37 (97)	22 (63)	
Strongly recommending HPV vaccination for girls of 11 – 12 (years)			
Yes	26 (70)	24 (73)	1.00
No	11 (30)	9 (27)	
Strongly recommending HPV vaccination for girls of 13 – 18 (years)			
Yes	38 (100)	31 (94)	.43
No	0 (0)	2 (6)	
Strongly recommending HPV vaccination for girls of 19 (years) & above			
Yes	23 (96)	29 (83)	.27
No	1 (4)	6 (7)	
Strongly recommending HPV vaccination for boys of 11 – 12 (years)			
Yes	23 (64)	16 (50)	.37
No	13 (36)	16 (50)	
Strongly recommending HPV vaccination for boys of 13 – 18 (years)			
Yes	35 (95)	19 (61)	.002
No	2 (5)	12 (39)	
Strongly recommending HPV vaccination for boys of 19 (years) & above			
Yes	19 (83)	11 (32)	< .001
No	4 (7)	23 (68)	

*P-values were based on Fisher's exact tests. +Percentages were based on numbers of non-missing responses.

week. More pediatricians (66%) than family physicians (40%) indicated that they discuss sexual health with their patients, but this was not significantly different between the two groups (Table 1).

Overall, 71% (50/70) of the physicians reported they strongly recommend the HPV vaccine for girls 11-12 years old, with minimal difference between the pediatricians and family physicians. For boys age 11-12, only 57% (39/68) of physicians strongly recommend the HPV vaccine; 64% (23/36) of pediatricians and 50% (16/32) of family physicians (Table 1). The proportion of physicians in both specialties who strongly

recommend the vaccine for older girls and boys increased. Almost all the respondents (97% of the pediatricians and 94% of the family physicians) said they stock and administer the HPV vaccine to female patients in their offices, while slightly fewer (95% of pediatricians and 86% of family physicians) said they stock and administer the HPV vaccine to male patients in their offices (data not shown).

Tables 2, 3, and 4 show which physician characteristics, attitudes and perceived barriers were significantly associated with whether a physician strongly recommends the HPV vaccine to patients age 11-12. None of the physician characteristics

Table 2. Strongly Recommending HPV Vaccine to Children Age 11 – 12 Years: Physicians' Characteristics				
	Girls: 11 – 12 years n (%)	P-value*	Boys: 11 – 12 years n (%) ⁺	P-value*
Specialty Pediatrician (n=35) Family physician (n=38)	24 (69) 26 (68)	1.00	16 (46) 23 (61)	.16
Gender Male (n=33) Female (n=40)	24 (73) 26 (65)	.62	21 (64) 18 (45)	.088
Age (years) Less than 30 (n=2) 30-44 (n=32) 45-60 (n=29) Over 60 (n=10)	2 (100) 23 (72) 19 (66) 6 (60)	.85	2 (100) 15 (47) 16 (55) 6 (60)	.63
Number of years in practice Less than 5 (n=5) 5-10 (n=15) 11-20 (n=24) More than 20 (n=29)	4 (80) 10 (67) 16 (67) 20 (69)	1.00	3 (60) 7 (47) 10 (42) 19 (66)	.32
Number of patients age 11-30 years seen in an average week 1-5 (n=3) 5-10 (n=23) 11-20 (n=18) More than 20 (n=29)	3 (100) 15 (65) 16 (89) 16 (55)	.056	3 (100) 12 (52) 12 (67) 12 (41)	.15
How often physician discusses sexual health/sexuality with her/his patients Rarely (n=6) Sometimes (n=28) Often (n=39)	6 (100) 20 (71) 24 (62)	.18	5 (83) 13 (46) 21 (54)	.28
How often physician discusses immunizations or vaccination status with her/his patients Rarely (n=4) Sometimes (n=10) Often (n=59)	2 (50) 7 (70) 41 (70)	.70	1 (25) 4 (40) 34 (58)	.31

*P-values were based on Fisher's exact tests.

Table 3. Strongly Recommending HPV Vaccine to Children Age 11 – 12 Years: Physicians' Attitudes				
	Girls: 11 – 12 years n (%)	P-value*	Boys: 11 – 12 years n (%) ⁺	P-value*
It is necessary to discuss issues of sexuality before recommending HPV vaccine to patients Strongly/somewhat agree (n=50) Strongly/somewhat disagree (n=23)	31 (62) 19 (83)	.11	21 (42) 18 (78)	.005
Other vaccination recommendations have made it easier to introduce the HPV vaccine in my practice Strongly/somewhat agree (n=42) Strongly/somewhat disagree (n=31)	29 (69) 21 (68)	1.00	25 (60) 14 (45)	.25
Vaccination against a sexually transmitted infection encourages early initiation of sexual activity Strongly/somewhat agree (n=2) Strongly/somewhat disagree (n=71)	1 (50) 49 (69)	.54	1 (50) 38 (54)	1.00
HPV causes too few cancers in males to justify vaccination for them Strongly/somewhat agree (n=2) Strongly/somewhat disagree (n=71)	1 (50) 49 (69)	.54	1 (50) 38 (54)	1.00
It is more important for females to get the HPV vaccine than males Strongly/somewhat agree (n=32) Strongly/somewhat disagree (n=41)	20 (63) 30 (73)	.45	15 (47) 24 (59)	.36
Parents worry that HPV vaccination encourages early initiation of sexual activity Strongly/somewhat agree (n=35) Strongly/somewhat disagree (n=36)	25 (71) 23 (64)	.62	21 (60) 16 (44)	.24
Parents of my 11-12 year old patients get upset that I'm offering HPV vaccination Strongly/somewhat agree (n=14) Strongly/somewhat disagree (n=59)	9 (64) 41 (70)	.76	8 (57) 31 (53)	1.00
Parents of 11-12 year old patients refuse HPV vaccination more than parents of 16-18 year olds Strongly/somewhat agree (n=45) Strongly/somewhat disagree (n=28)	27 (60) 23 (82)	.07	22 (49) 17 (61)	.35
I don't have confidence in the safety of new vaccines Strongly/somewhat agree (n=10) Strongly/somewhat disagree (n=62)	5 (50) 45 (73)	.27	4 (40) 35 (57)	.50

*P-values were based on Fisher's exact tests.

Table 4. Strongly Recommending HPV Vaccine to Children Age 11 – 12 years: Physicians' Perception of Barriers to Providing HPV Vaccination in the Office				
	Girls: 11 – 12 years n (%)	P-value*	Boys: 11 – 12 years n (%) ⁺	P-value*
Lack of reimbursement Definitely/somewhat a barrier (n=21) Minor/Not a barrier (n=52)	16 (76) 34 (65)	.42	11 (52) 28 (54)	1.00
Up-front costs of providing the vaccine Definitely/somewhat a barrier (n=16) Minor/Not a barrier (n=57)	12 (75) 38 (67)	.77	8 (50) 31 (54)	.79
Failure of insurance companies to cover the vaccine Definitely/somewhat a barrier (n=31) Minor/Not a barrier (n=42)	21 (68) 29 (69)	1.00	16 (52) 23 (55)	.82
Time it takes to talk about the vaccine with patients Definitely/somewhat a barrier (n=10) Minor/Not a barrier (n=63)	8 (80) 42 (67)	.49	6 (60) 33 (52)	.75
Adding another vaccine to the vaccination schedule Definitely/somewhat a barrier (n=3) Minor/Not a barrier (n=70)	2 (67) 48 (69)	1.00	2 (67) 37 (53)	1.00
Difficulty ensuring 3 doses will be completed Definitely/somewhat a barrier (n=14) Minor/Not a barrier (n=59)	9 (64) 41 (70)	.76	7 (50) 32 (54)	1.00
Parent/patient concern about the safety of the HPV vaccine Definitely/somewhat a barrier (n=23) Minor/Not a barrier (n=50)	15 (65) 35 (70)	.79	10 (44) 29 (58)	.32
Parent/patient concern about the efficacy of the HPV vaccine Definitely/somewhat a barrier (n=10) Minor/Not a barrier (n=63)	10 (100) 40 (64)	.025	8 (80) 31 (49)	.093
Parent/patient moral opposition to the HPV vaccine Definitely/somewhat a barrier (n=16) Minor/Not a barrier (n=57)	11 (69) 39 (68)	1.00	8 (50) 31 (53)	.79
Parents' concern that the HPV vaccine encourages early initiation of sexual activity Definitely/somewhat a barrier (n=15) Minor/Not a barrier (n=58)	10 (67) 40 (69)	1.00	8 (53) 31 (53)	1.00
Physician concern about the safety of the vaccine Definitely/somewhat a barrier (n=1) Minor/Not a barrier (n=71)	1 (100) 48 (68)	1.00	1 (100) 37 (52)	1.00
Physician concern about the efficacy of the vaccine Definitely/somewhat a barrier (n=1) Minor/Not a barrier (n=72)	1 (100) 49 (68)	1.00	1 (100) 38 (53)	1.00
Attitude that it is not my responsibility because other physicians will give the vaccine Definitely/somewhat a barrier (n=4) Minor/Not a barrier (n=69)	3 (75) 47 (68)	1.00	3 (75) 36 (52)	.62

*P-values were based on Fisher's exact tests.

were significantly associated with whether a physician strongly recommends the HPV vaccine to patients age 11-12 (Table 2).

Table 3 illustrates how physicians who strongly recommended HPV vaccination for girls and boys age 11-12 compare with those who did not in some of the more common attitudes regarding HPV vaccination. Disagreeing with the statement that it is necessary to discuss sexuality before recommending the HPV vaccine to patients was the only significantly different attitude, and it was associated with strongly recommending HPV vaccination for boys age 11-12 ($P = .005$).

Failure of insurance companies to cover the vaccine was identified as a barrier to providing the HPV vaccine by 50% (19/38) of the pediatricians and by 34% (12/35) of the family

physicians (data not shown). Other financial concerns, such as lack of reimbursement for the vaccine and the up-front costs of providing the vaccine, also were frequently cited. Despite these barriers commonly reported by both specialties, they were not significantly associated with whether or not a physician strongly recommended HPV vaccination to girls or boys age 11-12 (Table 4). Only the perception that parents'/patients' concern about the efficacy of the HPV vaccine is a barrier was associated with strong physician recommendation for girls ($P = .025$).

The final multivariable logistic regression model included those physician characteristics, attitudes, and perceived barriers that were identified in the bivariate analysis as being associated with strongly recommending the HPV vaccine to boys or

Table 5. Factors Associated with Strongly Recommending HPV Vaccine to Children Age 11-12 Years*				
	Strongly Recommending for Girls		Strongly Recommending for Boys	
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Physician Characteristics				
Physician specialty Family Medicine as reference group	0.99 (0.37 – 2.67)	0.81 (0.26 – 2.52)	1.85 (0.72 – 4.76)	1.75 (0.58 – 5.24)
Physician Gender Men as reference group	0.70 (0.26 – 1.90)	0.66 (0.19 – 1.87)	0.39 (0.15 – 1.04)	0.39 (0.13 – 1.20)
Sees more than 20 patients age 11-30 years in a week "<20 patients" as reference group	0.36 (0.13 – 1.00)	0.35 (0.11 – 1.10)	0.44 (0.17 – 1.17)	0.45 (0.15 – 1.41)
Perceived Barrier				
Parent/Patient concern about efficacy "A barrier" vs Not	0.72 (0.27 – 1.94)	0.72 (0.25 – 2.11)	0.97 (0.38 – 2.48)	1.03 (0.36 – 2.99)
Attitude				
Need to talk about sex before giving vaccine "A barrier" vs Not	0.34 (0.10 – 1.16)	0.42 (0.11 – 1.54)	0.17 (0.05 – 0.57)	0.18** (0.05 – 0.66)
More parents of 11-12 year old patients than 16-18 year old patients refuse the vaccine "A barrier" vs Not	0.33 (0.11 – 1.02)	0.40 (0.12 – 1.30)	0.59 (0.22 – 1.57)	0.72 (0.23 – 2.24)

*All factors in table 5 included in the final model. **Statistically significant with $P < .05$.

girls 11-12 years old (at $P < .15$). All of the variables listed in Table 5 were included in the final logistic regression model. In the final model, physicians who agreed that "it is necessary to discuss issues of sexuality with patients prior to recommending the HPV vaccine" were significantly less likely to strongly recommend the HPV vaccine to boys 11-12 years old (aOR=0.18, 95% CI: 0.05-0.66). There were no other attitudes, physician characteristics or perceived barriers that were associated with not strongly recommending the HPV vaccine to boys or girls age 11-12.

Discussion

This study's results show that most of Hawai'i's pediatricians and family physicians who responded to this survey stock and administer the HPV vaccine to the female and male patients in their offices. To our knowledge, this is the first study assessing Hawai'i physicians' practices regarding this vaccine. These findings are similar to a nationwide survey of physicians in which 98% of pediatricians and 88% of family physicians stated they stock and administer the vaccine to their female patients.²⁶ Hawai'i's HPV vaccination coverage for adolescent girls receiving the recommended three doses of the HPV vaccine decreased from 43.4% in 2012 to 34.4% in 2013.^{13,14} Furthermore, Hawai'i's numbers remain far short of the Healthy People 2020 target of 80% vaccination coverage for adolescent girls. Clearly, the practice of carrying the vaccine in physicians' offices does not directly translate into uptake of the vaccine by all eligible patients, and other factors need to be considered.

A substantial number of physicians cited financial concerns as a barrier to providing the HPV vaccine in their offices, mirroring findings of Daley, et al,²⁶ and McCave.²⁸ Despite federal initiatives such as the Patient Protection and Affordable

Care Act, which mandates that the HPV vaccine be covered by insurance plans with no cost-sharing, and the Vaccines for Children Program, many physicians in both specialties agreed that financial affordability for patients, reimbursement for the vaccine by insurance companies, and the upfront costs of stocking and administering the vaccine were barriers to the provision of the vaccine in their offices. An interesting follow up to this study would be to investigate whether insurance companies are complying with federal mandates or if physicians are unaware of how to appropriately access these services.

The most striking outcome from this study is the percentage of physicians who do not strongly recommend the vaccine for adolescents in the recommended age group. A physician's recommendation is a strong predictor of acceptance of the vaccine by adult patients and by parents of adolescents.^{17, 20-25, 29} Despite endorsement by the ACIP and AAP, and integration of the HPV vaccine into the childhood immunization schedule at age 11-12, only 71% of physicians in this study said they strongly recommend the HPV vaccine for 11-12 year old girls and 57% said they strongly recommend the vaccine for 11-12 year old boys. These percentages increased for older aged girls and boys, indicating that physicians feel more comfortable recommending the HPV vaccine to older adolescents, which is consistent with other studies.³⁰ Encouraging more physicians to strongly recommend HPV vaccination, by both illustrating to physicians how powerful their recommendation is and by addressing factors that influence their recommendation, would be a vital aspect of any public health initiative to increase HPV vaccination in Hawai'i.

The sexual transmission of HPV appears to play a role in some physicians' choice not to strongly recommend the vaccine for their patients. Sixty-eight percent (50/73) of physicians in

this survey agreed with the statement “it is necessary to discuss sexual health with patients prior to recommending the HPV vaccine.” Combined with the finding that only 53% (39/73) of physicians reported discussing sexual health “often” with their patients, it is not surprising that physicians in this study who believe it is necessary to discuss sexual health with patients prior to recommending the HPV vaccine were five times less likely to strongly recommend the vaccine for boys age 11-12 (Table 5). Furthermore, many physicians agreed that parents worry that the HPV vaccine encourages early initiation of sexual activity, although this attitude was not significantly related to whether or not physicians strongly recommended the HPV vaccine in this study. This concern could theoretically affect physician-parent communication and how assertively physicians recommend the vaccine to parents they suspect may be less receptive to a vaccine against a sexually transmitted infection. While some physicians report this belief about parental fear, numerous studies of parents have consistently found that most parents do not feel that receiving the HPV vaccine would increase the likelihood that their child would engage in high-risk sexual behavior, such as earlier initiation of sex or multiple sex partners.³¹⁻³³ Addressing this discrepancy between what physicians think parents feel and what parents actually feel would likely be a powerful physician intervention that could improve the likelihood of physician recommendation.

Major limitations of this study were the low response rate, the inability to determine a true response rate based on the recruitment method, and the possibility of a non-response bias. Physicians are known to be a difficult group to survey.³⁴ A recent nationwide survey of obstetrician-gynecologists, family physicians, and internists on knowledge of and barriers to providing adult vaccines, yielded a response rate of 24.8%,³⁵ and there was a 21% response rate by Hawai‘i physicians in a recent survey regarding chlamydia screening.³⁶ While this survey was distributed through the Hawai‘i Chapter of the American Academy of Pediatrics (298 members) and the American Academy of Family Physicians (167 members), only attending physicians who were actively practicing were eligible to respond; therefore, we were unable to determine a true denominator for a response rate calculation. A Cochrane review of survey accrual methods showed that monetary incentives, personalized messages, an interesting topic, and short questionnaires were all more likely to increase response rates among physicians.³⁷ Efforts were made to incorporate some of these methodologies. Even with these limitations, findings of this study are similar to findings from nationwide studies, and although non-responders may differ from responders in regards to whether or not they provide the HPV vaccine in the office, one would not expect significant differences in barriers to provision of the vaccine.

Another limitation is the potential bias of the sample population. Active members of a professional medical society may have different attitudes and practices from non-members. A common assumption is that members of a professional medical organization keep up with practice changes and endorse evidence-based practices; therefore, sampling members would

represent a “best-case scenario.” Despite a “best-case scenario,” only two-thirds of physicians strongly advocate for the HPV vaccine at the recommended age of their patients.

In addition to the above limitations, Hawai‘i is a unique place where practice patterns, attitudes, and insurance and reimbursement concerns cannot be generalized to other parts of the country.

Conclusions

The HPV vaccine has the potential to significantly reduce morbidity and mortality in the US, and immunization against HPV is recognized as a public health priority. Physicians, who can play a major role in increasing the uptake of the vaccine, face barriers to both recommending the vaccine and providing it. These barriers, however, are surmountable. It is critical to assist physicians in overcoming these barriers to improve the health of Hawai‘i’s people.

Conflict of Interest

None of the authors identify a conflict of interest.

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MEDICAL SCHOOL HOTLINE

Last Lecture — Six Lessons To Live By: 2015 Convocation Ceremony of the John A. Burns School of Medicine University of Hawai'i at Manoa, Honolulu, Hawai'i, May 17, 2015

Griffin P. Rodgers MD, MACP

The Medical School Hotline is a monthly column from the John A. Burns School of Medicine and is edited by Satoru Izutsu PhD; HJMPH Contributing Editor. Dr. Izutsu is the vice-dean of the University of Hawai'i John A. Burns School of Medicine and has been the Medical School Hotline editor since 1993.

Dean Hedges ... members of the faculty ... parents and family ... members of the class of 2015 ... Aloha!

I am deeply honored to share this special occasion with you today. The John A. Burns School of Medicine is a longtime partner of NIH and NIDDK ... so I know from first-hand experience that yours is one of the great medical and scientific institutions in the United States. I know you have been brilliantly prepared for whatever comes next in your lives.

Each of you who is graduating today should feel a profound sense of accomplishment. Your families are extremely proud of you. You cannot imagine the sense of relief they are experiencing. As the artist Gary Bolding said, this would be a most opportune time to ask for money!

I know your friends and families are quite anxious to post on Facebook or to Tweet photos of you with your degree. So without further ado, I'd like to share six lessons I've learned over the years ... lessons I hope you find useful as you ponder the wondrous path that lies ahead.

Lesson number one is this: Don't forget where you came from.

When I was a kid in New Orleans, three good friends had sickle cell disease. I watched them suffer in unbearable pain,

helpless to do anything about it. Two died while I was still in high school. My other friend died several years later.

When you're a teenager, you're not supposed to bury your friends. But that's the toll sickle cell takes.

That's why I became a hematologist. Eventually, I was fortunate enough to be part of the team that developed the first ... and still-only ... FDA-approved therapy for sickle cell disease, and more recently my colleagues and I ran a clinical trial of a highly-effective, reduced-intensity stem cell transplant that reverses the disease in nearly 90% of adults, over half of whom are off all immunosuppressive medications. That is the "gold standard" for organ transplantation.

It's hard to describe just how good it feels to see people live longer and better, and to know that your work played a part in that.

Even though I am now an administrator with a broad portfolio, I still keep a hand in the lab conducting hematology research. I will never forget where I came from ... and neither should you.

Lesson number two: Pay it forward.

None of us made it to where we are today on our own. We had the help of parents and other loved ones ... friends ... teachers ... and mentors.



That's why it is our obligation to pay it forward ... by mentoring, supporting and assisting those who seek to follow in our paths.

One way we do that at NIDDK ... and here at JABSOM ... is through STEP-UP ... the Short-Term Research Experience for Underrepresented Persons.

Over its 21 years, STEP-UP has opened doors of opportunity to biomedical research careers for students from disadvantaged backgrounds, making our profession more diverse and inclusive.

JABSOM is one of seven STEP-UP institutions across America. Under the leadership of Dr. George Hui, it offers high school students from Hawai'i, American Samoa, Guam and the Northern Mariana Islands a research internship with a trained mentor. At the end of the program, the students travel to Washington, D.C. for the National STEP-UP Scientific Symposium, where they present their research findings.

I've had the great privilege of participating in the program, and I can tell you that the high school age STEP-UP interns are every bit as impressive as the college and some graduate students who work at NIH.

I want to thank Dr. Hui and JABSOM for your great work on STEP-UP. I strongly encourage you to learn more about the program ... and serve as a mentor to underprivileged students in this or other ways.

Lesson number three: It's not what you know today that counts — it's what you'll learn tomorrow.

I'm living proof of that. When I graduated medical school, the genome was a distant dream. Yet today, it's the driving force behind many of our greatest breakthroughs.

Back in the day, the words "e-mail," "Internet," "cell phones," "texting," "iPad," and "apps" had yet to be invented, much less the technologies they represent. In fact, an app was something you sent off to college or medical school.

But the change I've experienced is tiny compared to what you will encounter.

Because we are living in exponential times.

Everything you learned over the past four years probably has a five-year half-life. Within a decade, most of what you know now will likely be greatly refined or obsolete.

Someday, many of you will work in medical professions and specialties that do not exist today, employing technologies that have yet to be invented to solve problems we are not yet aware of.

So ... your education doesn't end today. It's just beginning.

Lesson number four: Research is a powerful tool for justice.

A big reason why I enjoy working at NIDDK is because its portfolio covers many of the disorders behind the greatest health disparities in America. Obesity, diabetes, liver, and kidney disease are much more likely to afflict African Americans, Latinos, Native Americans ... and Native Hawaiians and Pacific Islanders ... than other Americans.

So each time we break new ground in preventing and better treating these disorders, we strike a blow for justice.

This research is happening on multiple fronts ... from genomics to the microbiome ... from public education to lifestyle interventions.

So no matter your specialty, there are ways you can put your talents to use forging breakthroughs in these and other diseases that disproportionately impact people of color.

In doing so, you'll not only save lives ... you'll also make our society more equitable and inclusive.

Lesson number five: Unleash your inner geek ... and your inner mensch. Here's what I mean:

Everything we do in medicine is based on a comprehensive understanding of how the human body works, down to the cellular and molecular levels.

So we should unleash our inner science geeks. We should stay turned on by everything we're learning about gene expression, cellular function, genomics, epigenomics, proteomics, metabolomics, transcriptomics and other -omics we haven't yet thought of ... limited only perhaps by eco-nomics,

At the same time, we can never lose sight of our ultimate goal: To ensure the health and well-being of unique, precious, irreplaceable human beings.

And that's what I mean when I say you should also unleash your inner mensch, a Yiddish word that means all-around nice guy (or girl) — someone who loves people, and who behaves with integrity and decency toward others. Don't let your passion for science cause you to lose touch with your own humanity — or the humanity of your patients.

Lesson number six: Follow your passions.

More than anything else, you must be true to yourself. That's the only way to be the best you can be in medicine, science or any other part of your life. And that means following your passions wherever they take you.

Never lose touch with what inspired you to choose your field in the first place. Never forget why you attained your degree at JABSOM. Never lose sight of what it was about the health sciences — and what it is in your life — that inspires, stimulates, excites you.

This is the best advice I can give. Believe me, I know it to be true in my own life. And it's true of the best of my colleagues.

And so, my friends and fellow healers, as you leave here today, let your passions guide your journey. It will take you places you didn't think you would go ... perhaps even to NIDDK, where I hope to have the privilege of working with you. But whatever direction your journey takes, by following your passions, it will lead to the greatest reward one can have:

To make a positive, profound difference in people's lives.

And one day, may that be said about every single one of us.

Mahalo ... and Pomaika'i!

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The Importance of Considering Educational Inequity and Health Literacy to Understand Racial/Ethnic Health Disparities

Tetine Sentell PhD and Wei Zhang PhD

Insights in Public Health is a monthly solicited column from the public health community and is coordinated by HJMPH Contributing Editors Tetine L. Sentell PhD from the Office of Public Health Studies at John A. Burns School of Medicine and Donald Hayes MD, MPH from the Hawai'i Department of Health in collaboration with HJMPH Associate Editors Tonya Lowery St. John MPH and Lance K. Ching PhD, MPH from the Hawai'i Department of Health.

Background

Education is a critical determinant of health, and a core building block for numerous other social factors that are themselves highly associated with health, such as occupation, income, and self-efficacy.¹⁻³ However, the United States (US) educational system generally and the state of Hawai'i's educational system specifically do not provide their opportunities equally. Many racial/ethnic minority groups, on average, receive fewer years of schooling and gain fewer educational advantages from schooling compared to whites.⁵⁻⁶ Both inequality in educational quantity and quality are highly relevant to health, although only the first issue is typically considered in depth in most health-related research.

Health literacy is a topic of growing interest in health research due to its practical relevance, strong associations with health, and potential as an intervention foci.⁷⁻⁸ Health literacy is associated with, but also distinct from, educational attainment as, for instance, even college graduates can have limited health literacy.⁷⁻⁸ Health literacy varies by race/ethnicity and has been shown to help explain health disparities among various populations.⁷⁻⁸ In some cases, health literacy has been a more powerful predictor of health outcomes than education.⁷⁻⁸

This essay will briefly consider the utility of educational attainment, educational quality, and health literacy in explaining racial/ethnic health disparities generally and specifically in the context of Hawai'i. One example of an important health disparity to understand and resolve is the higher rates of diabetes among some racial/ethnic groups, including Native Hawaiians and other Pacific Islanders. For instance, age-adjusted diabetes prevalence is approximately 3 times higher for Native Hawaiians and other Pacific Islanders compared to non-Hispanic whites.⁹

Educational Attainment

In health research, as in much social science research, educational attainment is typically measured by either years completed in school or degree attained.¹⁰ This operationalization of "education" is well-suited to control for the fact that, in most cases, fewer members of racial/ethnic minority groups gradu-

ate from high school, college, or graduate school compared to whites.¹¹ For instance, nationally, 30.9% of the non-Hispanic white population had a bachelor's degree or higher compared to 15.9% of those who identify as Native Hawaiian.¹² In 2013 Census data, 75% of whites in Hawai'i had more than a high school education, compared to 61% of Asians, and 44% of Native Hawaiians and other Pacific Islanders.¹³ Population-based studies in Hawai'i have found that 21% of Native Hawaiians, 20% of Filipinos, 45% of Chinese, 39% of Japanese, and 48% of the non-Hispanic whites have a college degree or higher.¹⁴

When education is included in research studies as years completed in school or degree attained, the association between race/ethnicity and health typically diminishes but does not disappear.^{5,15-16} For instance, at every level of educational attainment, racial/ethnic minorities still report poorer health status compared to whites.² This suggests that quality of education may also be important for understanding racial/ethnic disparities in health.

Educational Quality

Educational quality for racial/ethnic minorities is also, on average, poorer than educational quality for whites.^{1-6,17} Educational quality represents the cognitive and skill-based benefits acquired from schooling and can be captured by measures such as context (eg, educational policies, funding, length of school days), process (eg, class size, student-teacher ratio), or achievement (eg, reading and math test performance).¹⁶ Not surprisingly, given the same years of education, some racial/ethnic minorities, on average, perform worse on tests of functional skills.¹⁷⁻¹⁸ For instance, the 2007 National Assessment of Educational Progress found that, despite strong educational gains, African Americans scored below whites on all measures of math and reading.¹⁷ Similarly, some racial/ethnic minorities have lower literacy than whites across all levels of education, from "no formal schooling" to graduate degrees.¹⁸ Many minority adults thus get less "education" for their years of schooling. The traditional education variables used in research, such as years of schooling and degree attained, provide insufficient measures for these disparities in learning outcomes.

Health Literacy

Literacy in general and health literacy in particular can be seen as proxy indicators for some aspects of educational quality. Adult literacy was once considered an all-or-nothing proficiency, based on one's ability to perform a certain basic task such as signing one's name. Now, adult literacy is conceived and measured as a set of functional skills relevant to the demands of everyday life, such as the ability to locate a time on a bus schedule or to find information in a newspaper article.¹⁹⁻²⁰

As one important aspect of adult literacy, health literacy involves a specific set of skills and abilities, and is defined in *Healthy People 2010* as "the degree to which individuals have the capacity to obtain, process, and understand basic health information and services for appropriate health decisions."²¹ Health literacy is an important predictor of health status and health behaviors in the general population.⁷⁻⁸ In Hawai'i, self-reported low health literacy varies significantly by racial/ethnic group: 23.9% among Filipinos, 20.6% in other Asian Americans and Pacific Islanders, 16.0% in Japanese, 15.9% in Native Hawaiians, and 13.2% in whites.²²

Health literacy has been found to be associated with health outcomes independently of education. For instance, in a population-based study in Hawai'i, low health literacy (as measured by self-reported confidence in filling out medical forms) was associated with self-reported health in Japanese, Filipinos, and whites, as well as with diabetes in Native Hawaiians and Japanese, and with depression in Native Hawaiians.²² Of note in these findings are potential differences not only of racial/ethnic differences in health literacy, but also in differential relationships of health literacy to health outcomes by race/ethnicity.²² Also, low health literacy was associated with diabetes in Native Hawaiians, which may help to explain the significant disparities in diabetes for this population noted above.

Utility in Explaining Racial/Ethnic Health Disparities

In some studies, when a literacy-focused variable is added to the multivariate models, the significance of race/ethnicity (as well as education) to the health variable will diminish in significance, and sometimes disappear. For instance, using a large national sample, Bennett, et al, (2009) found that health literacy mediated racial/ethnic and educational disparities in self-rated health and the receipt of a flu vaccine.²³ Using a different large, national sample, Sentell and Halpin (2003) found that African-American race and education were no longer significantly associated with having either a work-impairing condition or a long-term illness after literacy was included in the model.²⁴ Several other studies using samples in specific clinical settings have found health literacy to be a more powerful predictor of health status, health-related behaviors, and health-related knowledge than race/ethnicity and/or education.²⁵⁻³⁰ However, this finding is not consistent across all studies, likely indicating variation in the strength and importance of education and health literacy-related factors across various health outcomes and distinct population groups.³¹

In much health-related research, health literacy is distinguished from general literacy, but is often measured by general literacy skills, particularly reading skill, applied to the health domain.³² In this operationalization, health literacy could be considered as a more race-neutral measure of functional skills. As such, it may provide a potential means to measure core aspects of educational quality and/or educational attainment that may be associated with health. Literacy, health literacy, and/or other variables to measure educational quality should be considered in statistical models that seek to explain the association of race/ethnicity to health. If they are not included, variations in health status, access, or health behaviors that are associated with literacy/functional skills/educational quality may incorrectly appear to be due to race/ethnicity.

Utilizing health literacy in explaining race/ethnicity disparities in health has theoretical implications. Education is theorized to impact health through at least three major pathways: (1) providing skills, abilities, and knowledge directly; (2) determining economic/professional conditions and status; and (3) supplying psychosocial resources such as personal control, social support, and strong social networks.^{2,33} Given unequal quality of education by race/ethnicity, minority adults could possibly be more disadvantaged in each of these pathways specifically and would thus not reap the same instrumental or psychosocial benefits for their years of schooling. Adding a consideration of literacy and/or other measures of educational quality to our quantitative and theoretical models may help illuminate and explain intriguing findings about racial/ethnic variation in the strength of the association of education in particular, and socioeconomic status generally, to health.^{5,34} Some empirical studies that considered this question found that literacy improvement was associated with the same health benefits for whites compared to African Americans, and lesser rewards for Hispanics.²⁴

Hawai'i Context

To our knowledge, few of the issues mentioned above have been considered in detail in health outcomes research in the state of Hawai'i. However, health literacy, general literacy, and educational inequities may be very useful topics for understanding racial/ethnic health disparities in Hawai'i. As a state, we have significant health disparities by race/ethnicity as well as educational disparities.^{13-14,35}

Racial/ethnic groups with typically more privileged socioeconomic status in Hawai'i (whites, Chinese Americans, and Japanese Americans) have greater access to strong educational options, including safe and high quality public schools, as well as private schools.³⁶ Groups with lower average socioeconomic status, including Native Hawaiians, Filipinos, Samoans, and other Pacific Islanders, have less access to high quality education.³⁶ In fact, some have argued that Hawai'i's underfunded public education system from kindergarten through the college level functions as a "site of institutionalized inequality that maintains the ethnic stratification order."³⁶

There are particular complexities studying these issues in Hawai'i. For one, we have a large proportion of students attend-

ing private schools (16%, twice the national average).³⁷ This adds complexity to the measure of educational attainment as, unlike public schools, private schools are not required to make their data open to the public.³⁸ Also, private schools have a strong incentive to advertise only the selected facts that signal high quality. As a result, obtaining information about metrics of educational quality for all children in Hawai'i would be more challenging than many other states in the US.

In addition, Hawai'i has a large number of individuals (25.7%) who speak a language other than English at home³⁹ due to its large proportion of foreign-born residents (18%, 5% higher than the national level).⁴⁰ Approximately 13.5% of school children in the state are in limited-English proficiency programs.⁴¹ Language barriers present significant challenges to learning, particularly in under-resourced schools. More research on this topic is needed, especially considering those who enter American schools in middle or high school when academic subjects become "more abstract, complex, and, arguably, language dependent."⁴² Besides children and adolescents, many young adults chose to immigrate to the US and Hawai'i after completion of their higher education. For them, factors such as place of education should be considered in health research as it is closely related to educational quality, as well as health returns.⁴³

Also, educational and/or literacy-related disparities, even as ideally measured, are unlikely to explain all the reasons for poor health outcomes by race/ethnicity. For instance, Native Hawaiians have poor health outcomes compared to many other groups in the state, but did not report particularly high rates of low health literacy.^{22, 35} Other associated factors are certainly important, including poverty. Of the 182,706 children in Hawai'i's public schools, 49.2% children are eligible for free/reduced lunch, which is higher than the national average.⁴⁴ In 2007, children who were school lunch-eligible in Hawai'i performed below their peers in writing, math, and writing.⁴⁵ Indeed, a strong base of evidence supports other explanations for the persistent findings on race-based health inequality when education and other socioeconomic status variables are controlled besides the fact that "education" is not sufficiently controlled in the models.^{5, 23} Unequal educational attainment and quality are, in fact, key outcomes of some other social forces, such as residential segregation and racism.^{5,36, 46} Education that centers on indigenous values is important to consider as a potential mechanism to resolve educational inequities and improve health disparities in indigenous communities.⁴⁷

However, because education, even as currently (often insufficiently) measured, is such a key determinant of health in both quantitative and theoretical models, we believe it is critical to disentangle specific years of educational attainment from other factors such as educational quality, literacy, and health literacy.

Conclusions

Studies have found that population-level improvements in educational attainment might reap greater health and economic benefits than investment in medical care.⁴⁸ When we consider

policies to address social determinants of health, particularly education, to improve health and reduce health disparities, we need to promote both high attainment and high quality of education.⁴⁹⁻⁵⁰ Providing years of inadequate education to meet a benchmark (eg, a college degree) is unlikely to provide the health benefits suggested under the assumption that all attainment is equal, and will not do much to reduce race/ethnic health disparities, if current inequity in educational quality remains by race/ethnicity.

Addressing inequity in education quality and quantity is particularly important, as education is not just an individual-level variable. Education impacts health across generations; parental education, for instance, is strongly tied with both children's health, children's educational attainment, and so on.² Generations of educational inequity perpetuate race-based health inequalities over time, and should be eliminated.

The impact of unequal quality of education by race/ethnicity on health is a key unanswered question that researchers and policy makers should invest in to more fully understand the contributors to health among racial/ethnic minorities and to make a better progress towards effectively addressing racial inequalities in health. In recent studies, we have shown the importance of community education and community health literacy above and beyond individual-level literacy on individual health outcomes.^{14,51} Thus, community educational attainment as well as community health literacy may be an important future area of focus to resolve the persistent racial/ethnic health disparities.

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THE DANIEL K. INOUE COLLEGE OF PHARMACY SCRIPTS

Pharm2Pharm: Leveraging Medication Expertise Across the Continuum of Care

Karen L. Pellegrin, PhD, MBA

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Pharm2Pharm is a new service model funded by the Centers for Medicare & Medicaid Services (CMS) Innovation Center that aims to improve care and reduce costs by leveraging the unique expertise of pharmacists to optimize medications across care settings. This model is called “Pharm2Pharm” because of the collaboration between hospital and community pharmacists as patients are being discharged and transition home. Approximately 2,500 patients who are at risk of medication-related hospitalization and emergency department (ED) use in Hawai'i have been enrolled in Pharm2Pharm statewide. Initially, this model was launched in the three rural counties of Hawai'i, where physician shortages are more severe.¹ This service model has since been expanded to Honolulu County in areas with the highest preventable hospitalization rates.² This article describes the key elements of the Pharm2Pharm model, the health information technology currently supporting the program, and the economics necessary to sustain this new model of medication management.

The Pharm2Pharm Model

Pharm2Pharm aims to address medication problems among complex, high risk patients during care transitions and for up to one year post-discharge to ensure their medications are optimized and that patients are actively self-managing. During care transitions, common medication problems include unresolved medication discrepancies, patient confusion about which home medications to resume and which to discontinue, and adjustments needed due to diet and activity changes from hospital to home. Once in the community, the patient can experience medication problems due to lack of coordination among prescribers, lack of medication expertise (eg, regarding medications to avoid in the elderly), inadequate monitoring, and barriers to medication adherence. The Pharm2Pharm model aims to improve patient health, improve the healthcare system, and reduce total costs of care. Pharm2Pharm is funded by a Health Care Innovation Award through the CMS Innovation Center.

Pharm2Pharm began with the vision of the founding leaders of the Hawai'i Community Pharmacist Association (HCPA), a network of independent, not publicly traded pharmacies in

Hawai'i, to move underutilized community pharmacists out of traditional, reactive, isolated roles and into proactive, integrated, targeted roles that are completely independent of dispensing. In the dispensing role, pharmacists wait for prescriptions to come in, fill them, and offer counseling on the dispensed medications (Figure 1). Medication counseling is often provided without access to relevant patient-specific clinical information, as pharmacists are peripheral to the healthcare providers treating the patient. In Pharm2Pharm, hospital-based and community-based “consulting pharmacists” find high risk patients, gather relevant clinical information, and systematically identify and resolve drug therapy problems in collaboration with the patient and members of the care team. While this role shift has already occurred in some integrated, closed healthcare systems, Pharm2Pharm project partners have demonstrated that this model can be implemented across care settings regardless of the patient's insurance coverage, primary care provider, or dispensing pharmacies.

In the Pharm2Pharm model, the hospital consulting pharmacist (HCP) screens new hospital admissions for patients who are at risk for medication-related problems and who will be discharged home (or to short-term rehabilitation, then home). Specific enrollment criteria are described in the Pharm2Pharm Standard Operating Procedure manual³ and focus on the following evidence-based risk factors:

- Number of medications (the greater the number, the greater the risk, especially among the elderly)⁴
- Type of medications (warfarin, oral antiplatelet agents, insulins, oral hypoglycemic agents, opioid analgesics, and digoxin are the most commonly involved medications in emergency admissions among older adults)⁵
- Previous acute care use (ie, hospitalization or ED visit) due to medication problems.⁶

Once eligibility is determined, the HCP begins educating the patient about their medications and encourages patients to work with a community consulting pharmacist (CCP) after discharge. Patients select the CCP they would like to work with

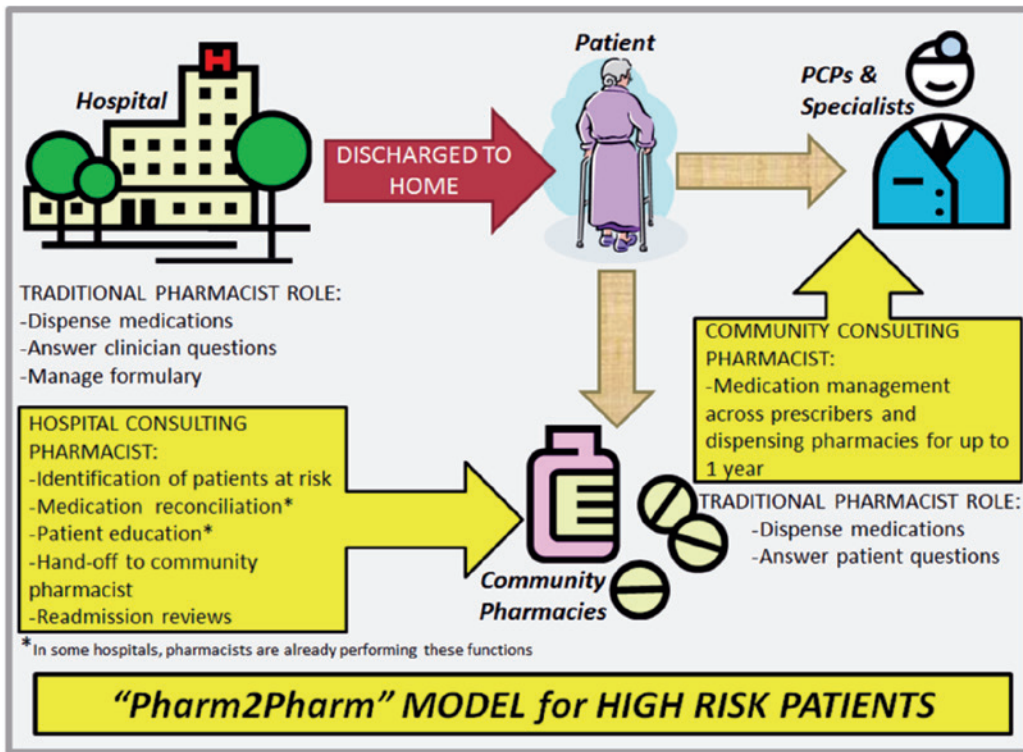
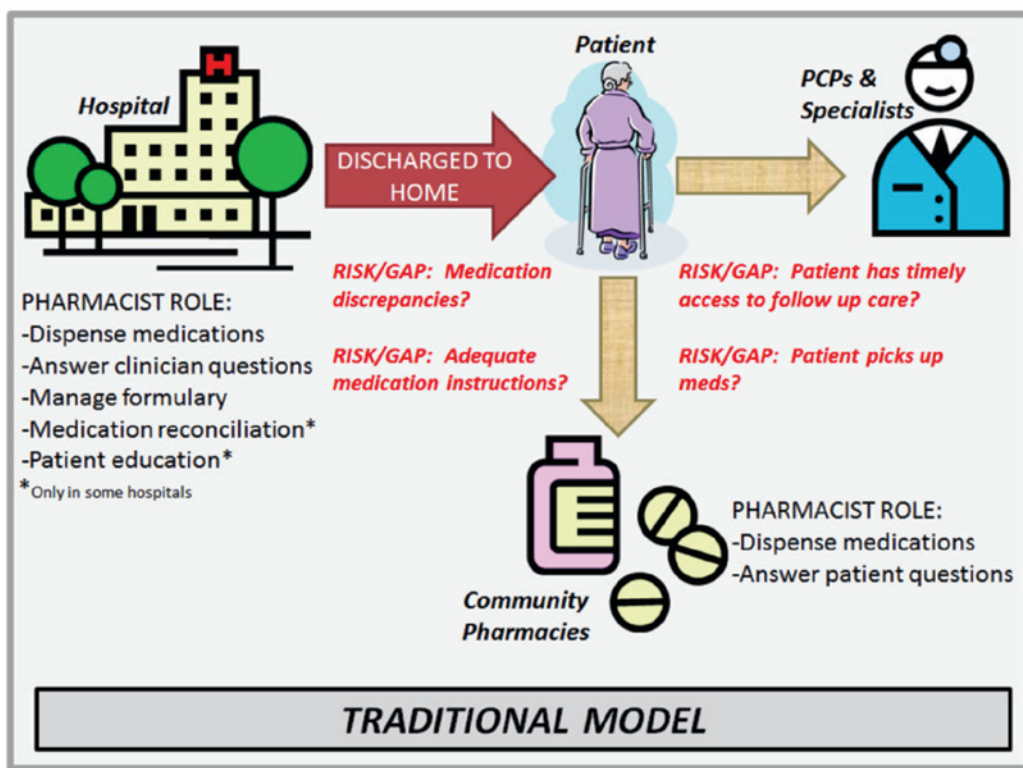


Figure 1. Traditional Pharmacist Roles Compared to Pharm2Pharm Roles

and an appointment is scheduled within three days of discharge. The HCP reconciles the patients' medications and works to resolve any drug therapy problems prior to discharge. Within a day of discharge, the HCP calls each patient to ensure the patient has obtained the correct medications and knows which medications to take and which not to take and to remind them of their appointments with the CCP and with their follow-up provider. The HCP sends care transition documents to the CCP and sends written notification of enrollment to the patient's primary care provider. Finally, the HCP reviews any readmissions to determine if the admission was potentially preventable and medication-related. If so, model enhancements, additional training, and other improvements are considered to prevent future recurrence.

While most care transition programs focus on the 30-day post-discharge period, the CCP follows Pharm2Pharm patients on a case-by-case basis during the one-year period after discharge. Extending the CCP support beyond the 30-day post-discharge period is critical for these complex patients because it takes time to optimize medications. It also takes time to fully educate patients about their medications and for them to gain competency and efficacy in self-care management. Stress experienced in the hospital setting (eg, sleep disturbance, poor nutrition, discomfort, inactivity) can affect cognitive functioning and complicate recovery after discharge.⁷

At each visit, the CCP completes the following procedures sequentially:

- Reconciles medications to ensure there is a complete and accurate list of what the patient is taking and is currently prescribed, including over-the-counter medications (OTCs), herbal medicines, and supplements.
- Checks each medication for :
 - indication,
 - effectiveness in achieving the clinical goals,
 - safety and side effects, and
 - proper adherence
- Checks for any untreated conditions for which drug therapy is indicated.
- Notifies prescribers of any updates to the medication list.
- Works to resolve any drug therapy problems through patient education, adherence counseling, and/or making recommendations to prescribers.

The CCP is the outpatient medication expert who is responsible for coordinating medications and systematically resolving drug therapy problems across prescribers and across dispensing pharmacies—an important role for optimally managing complex, high risk patients.

Hawai'i Pacific Health and Hawai'i Health Systems Corporation have been collaborating partners in Pharm2Pharm implementation, launching patient enrollment from several of their hospitals.

The Health Information Technology Supporting Pharm2Pharm

Initially, the Pharm2Pharm model was implemented without health information technology (IT) so that key technology needs could be clearly identified and defined based on experience with the model. Hawai'i Health Information Exchange (HHIE) has the infrastructure to support Health Information Exchange (HIE) state-wide and across payers and providers and has been a key project partner in facilitating assessment and implementation of targeted health IT. The following technology is now in use:

- All written communications among HCPs and CCPs (including care transition documents) are sent via HHIE secure email rather than fax. An increasing number of physicians have requested that the consulting pharmacists use HHIE instead of fax when sending written communications.
- HCS Med 360 is a software solution used to support medication reconciliation. This technology allows the consulting pharmacists to rapidly query over a dozen national databases and see the patient's prescription fill history as well as gaps in the fill history. Experience to date shows that this robust system captures all prescription medications in Hawai'i except those filled at Kaiser or the VA and those paid 100% self pay. The consulting pharmacist then completes the reconciliation process and produces a current medication list, including OTC medications, herbals, and supplements. The fill history and complete medication list are being built so that this information can be included in the patient's HHIE Community Health Record.
- Language Access Network, a virtual translation service currently in use at most hospitals in Hawai'i, is now available to CCPs so that patients with language barriers can enroll into Pharm2Pharm.
- An electronic registry has been implemented via HHIE allowing consulting pharmacists to easily manage their Pharm2Pharm patients. The registry automatically verifies and transfers information among different technology tools, thus reducing data entry time and errors.
- The HHIE Community Health Record is now being used by consulting pharmacists to access patient labs and other clinical information to support medication management. The Community Health Record allows real-time patient data from the hospitals and laboratories to be viewed securely through a single portal, reducing the need to refer to paper records received through mail, fax and other less efficient means.

In Hawai'i, this is the first time that health IT has been implemented on a state-wide basis and integrates community pharmacists into care teams outside of integrated health systems.

Why Now?

Given how frequently medication problems are at the root of hospitalization and ER visits, why hasn't this model been implemented previously? There are two primary reasons: workforce shortages and limited reimbursement for clinical pharmacy services.

Nationwide there has been a severe pharmacist shortage with projections of the shortage worsening.⁸ However, given that the Doctor of Pharmacy degree has been in high demand by students who seek a health profession, there has been a corresponding growth in the number of colleges of pharmacy and subsequently the pharmacists shortage has eased.⁹ The other barrier is inadequate compensation for pharmacist services other than dispensing. As noted in a 2011 report to the US Surgeon General, compensation is severely lagging for these roles: “Pharmacists are increasingly requested by many health systems, providers, and primary care teams to improve outcomes and delivery of care. However, in terms of pharmacist services, as the complexity or level of clinical service increases, the revenue generation potential is reduced. This is in stark contrast to the clinical services provided by other health professionals.”¹⁰ The Health Care Innovation Award has provided funding for both HCPs and CCPs in Hawai‘i. However, this funding source is time-limited and must be replaced by other sources for these pharmacists to continue providing Pharm2Pharm services.

The Economics of Pharm2Pharm

Pharm2Pharm is not a randomized controlled trial, so scientific conclusions about effectiveness are limited. However, qualitative and quantitative analyses are underway by the project team and independently by the CMS Innovation Center. In addition, previous research has demonstrated that pharmacists, deployed strategically, can add significant value to the healthcare system. For example, Fairview Health Services in Minnesota integrated pharmacists into several primary care clinics and examined the impact on quality and cost. Compared to a control group, patients receiving medication management services from these pharmacists were more likely to meet criteria for hypertension and cholesterol management. In addition, the total cost of care for the patients receiving these services decreased by more than 30% even though the cost of patients’ prescription medications increased almost 20%.¹¹ The cost of hospitalizations and ED use decreased nearly 60%. The types of medication problems found and corrected by the pharmacists in the Minnesota study shed light on the cost impact. The most common problem found was the patient needed additional medication for an untreated indication (more than 5 times as common as needing to discontinue an unnecessary medication). In addition to indication problems, these pharmacists also addressed effectiveness, safety, and adherence problems.¹¹ This demonstrates that pharmacists focused on getting patients on the right medications (not necessarily the cheapest medications) can save costs overall by preventing much more expensive acute care use.

Pharm2Pharm was designed to achieve similar results outside of an integrated healthcare system by targeting high risk inpatients and improving medication management from discharge to home.

The following are key facts pertaining to the sustainability of the Pharm2Pharm model:

- **HCP enrollment volume:** In hospitals with adequate infrastructure and support, each full-time HCP can enroll and hand-off over 20 patients per month. Placing an HCP in the hospital is an efficient and effective way to find high cost, high risk patients and get them on a path toward medication optimization and lower acute care costs. Additionally, HCPs provide specialized patient education and resolve discrepancies missed by other clinicians. In Hawai‘i, seven hospitals have participated in the Pharm2Pharm model.

- **Community pharmacy payment:** The payment to community pharmacies for providing this comprehensive medication management service in the current model is \$695 per patient per year. For patients who exit the service early, the payments are prorated to a lower amount. HCPA-member pharmacies have provided the CCP services in the Pharm2Pharm model.

- **Baseline hospital cost per patient:** The average baseline acute care cost of Pharm2Pharm patients prior to their enrollment and handoff to a CCP is over \$26,000 per patient per year (these data are based on actual inpatient, observation, and ER charges provided by Hawai‘i Health Information Corporation, with a 0.385 cost-to-charge ratio applied per CMS methodology, a common approach that uses hospital charges to estimate acute care cost).¹²

Since the launch of the Daniel K. Inouye College of Pharmacy, the supply of pharmacists in Hawai‘i has greatly improved. If deployed strategically, this workforce can extend the short supply of physicians and add unique medication expertise to the healthcare system. Stakeholders here in Hawai‘i and nationally have an opportunity now to leverage pharmacist expertise by integrating them into teams across the continuum of care.

Acknowledgement

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DESPERATE TIMES. DESPERATE SOLUTIONS.

Michael Pence, Governor of Indiana, signed a bill allowing people who are battling life-threatening conditions, to gain access to experimental medicines. Known as a “right to try” law, the intent is to leapfrog a drug-development process that may take years before new treatments become available. The move is a reflection of the frustration with a Food and Drug Administration program called expanded access. People who are seriously ill can obtain a drug under development, even though they aren’t enrolled in a clinical trial. Whether the “right to try” rallying cry will make a difference is unknown, but 11 states have a similar statute. Facing a very serious or potentially fatal illness, one is driven to seek help, irrespective of the risk.

STATUS QUO. LATIN FOR THE MESS WE’RE IN.

Despite the complexity of separating 15,000 FAA air traffic control employees, the House Aviation sub-committee endorsed the concept of either privatizing ATC or creating a government corporation. Six of seven people who were asked to testify agreed with the committee’s recommendation. The panelists who backed the change included Paul Rinaldi, president of the air traffic controllers union and Douglas Parker, CEO of American Airlines, spokesman for the coalition of major airlines. John Engler, president of the Business Roundtable, noted the efficiency of private modern ATC in Australia, Canada, Germany and the United Kingdom. The major difficulty will be moving inbred inertia at the FAA, and unseating a stubborn collection of bureaucrats. Good luck with that.

THE MCAT JOINS THE 21ST CENTURY.

For the first time in 25 years the MCAT (Medical College Admission Test) was changed this April. The Association of American Medical Colleges (AAMC) that develops and administers the MCAT, eliminated the essay portion and introduced a large new section. One-fourth of the test covers psychology, sociology and the biological foundations of behavior. AAMC said the revised exam is the product of prodigious planning by the review committee that held 90 outreach events, surveyed 2700 medical school faculty, students, and residents, and consulted with pre-med advisors. The 8200 applicants had to prepare for 11 suggested prerequisite courses compared to 8 in past exams. They were scheduled for a test time of 7 ½ hours not 4 hours 10 minutes, 230 questions rather than 144, and 4 sections not 3. Students must demonstrate what they know and how to apply it. The changes are designed to mirror the evolution of health care delivery. AAMC committee considered making MCAT pass/fail, but it was ultimately decided that reporting scores gives admission committees more flexibility in deciding selections. Buckle up, pre-meds. The road to medical school just got steeper and rockier.

THE AMERICAN ACADEMY OF PEDIATRICS VS THE NRA.

For reasons of public safety the American Academy of Pediatrics advised its members to inquire about the presence of firearms in the home. Florida and three other states have passed laws with National Rifle Association support limiting such inquiry, apparently believing it is not a matter for conversation in the doctor/patient-parent relationship. At least 14 other states across the country have considered similar legislation. Florida physicians fear that patients (parents) who believe the doctor is violating the law can be reported to the state medical board. Physicians argue that a gag would be a violation of free speech. The issue has arrived at the US Court of Appeals that will either uphold the statute or not. “Lay that pistol down, Babe, lay that pistol down...”

MAKING HEALTH CARE AVAILABLE IN THE STICKS.

In many rural areas in America, medical care is often sketchy or non-existent. Nebraska became the 20th state to provide a change in

medical practice to allow nurses with most advanced degrees to provide medical care without physician oversight. Maryland’s governor recently signed a similar law and eight more states are considering such legislation, according to the American Association of Nurse Practitioners. Not surprisingly, the American Medical Association is opposed to the change, stating nurses lack the knowledge and skills to diagnose complex illnesses. In all, nurse practitioners constitute a quarter of the primary care work force, according to the Institute of Medicine which called on states to lift barriers to their full practice.

DEMANDS OF THE ACA CAN LEAD TO BURNOUT.

Meantime, in Minnesota physician burnout is emphasizing an already compromised medical work force. Long hours and emotionally straining cases are compounded by patient record reforms and a digital reimbursement system that judges doctors by their patient’s health. A series of influential studies by researchers suggest that burnout could aggravate the state’s shortage of primary care doctors and drive some into early retirement. Does Minnesota law permit nurse practitioners?

BREAKING UP IS SO HARD TO DO.

According to police records released in April, the 24 year-old woman (awaiting trial for manslaughter) was texting sarcastic insults to her ex-boyfriend while bar hopping (her blood alcohol content later measured 0.178). According to the police report her last text to the ex-boyfriend was “driving drunk woo... I’ll be dead thanks to you.” Sadly, she got that wrong as well. She ran a red light and smashed into a pickup truck. She suffered serious injuries but survived while her passenger was killed.

AIR BAGS AND SAFETY — A DOUBLE EDGED SWORD FOR 17 MILLION VEHICLES.

Ten automakers are involved in a massive recall of 17 million vehicles each equipped with two Takata airbags. More than 100 injuries, including serious eye damage, and 6 deaths have been directly tied to the exploding airbags. While the exact mechanism has yet to be determined, a strong suspicion centers around ammonium nitrate, the primary explosive compound that opens the airbag. Ammonium nitrate is the main ingredient in some bombs and becomes unstable at temperatures over 100 degrees Fahrenheit. A closed car can reach 140 deg. parked in the summer sun. Timothy McVeigh used ammonium nitrate to ignite the bomb that destroyed the Oklahoma City federal building with 168 deaths and hundreds injured. Other less volatile compounds are available, but are more expensive. It may not be as simple as just one root cause according to former administrator of the National Highway Traffic Safety Administration, David Kelly, who has been hired to lead the investigation. Between exploding airbags (Takata) and faulty ignition systems (General Motors), driving to the store is not risk free.

ADDENDA

- The color combination with the most visual impact? Black on yellow.
- “You’d be surprised how much it costs to look this cheap.”
Dolly Parton
- Never try to keep up with the Joneses. Drag them down to your level.
- Men always scratch their asses when they’re thinking.
Maybe that’s where their brains are.
- People who think they know everything are very irritating to those of us who do.

ALOHA AND KEEP THE FAITH rts

(Editorial comment is strictly that of the writer.)



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