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## Teaching Population Health: A Competency Map Approach to Education

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### Abstract

A 2012 Institute of Medicine report is the latest in the growing number of calls to incorporate a population health approach in health professionals' training. Over the last decade, Duke University, particularly its Department of Community and Family Medicine, has been heavily involved with community partners in Durham, North Carolina to improve the local community's health. Based on these initiatives, a group of interprofessional faculty began tackling the need to fill the curriculum gap to train future health professionals in public health practice, community engagement, critical thinking, and team skills to improve population health effectively in Durham and elsewhere.

The Department of Community and Family Medicine has spent years in care delivery redesign and curriculum experimentation, design, and evaluation to distinguish the skills trainees and faculty need for population health improvement and to integrate them into educational programs. These clinical and educational experiences have led to a set of competencies that form an organizational framework for curricular planning and training. This framework delineates which learning objectives are appropriate and necessary for each learning level, from novice through expert, across multiple disciplines and domains. The resulting competency map has guided Duke's efforts to develop, implement, and assess training in population health for learners and faculty. In this article, the authors describe the competency map development process as well as examples of its application and evaluation at Duke and limitations to its use with the hope that other institutions will apply it in different settings.

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Not since the Flexner, Welch-Rose, and Goldmark reports at the beginning of the twentieth century has the training of health care professionals been poised for such an extensive overhaul.<sup>1</sup> As health disparities increase, the United States continues to fall at the wrong end of the scale for health outcomes while also incurring the world's highest per-capita costs for delivering care.<sup>2</sup> The current system is untenable. The global epidemiologic transition from

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acute to chronic conditions, the demographic shift of an aging society, and health system changes to improve quality and reduce costs make a population perspective vitally important to today's health professionals. Although the one-on-one visit, clinician-patient dyad will always be important, that limited scope cannot address the larger concerns of the nation's overall health. The importance of incorporating a population perspective into the preparation of future health professionals to address twenty-first century challenges is becoming clearer.<sup>3,4</sup> Throughout the last decade, many have urged the integration of population health competencies into professional training, the academic medical center, and health care delivery systems with the goal of improving the health of the public, but practical guidance on this merger is scarce.<sup>5-7</sup>

The 2012 Institute of Medicine (IOM) report, *Primary Care and Public Health: Exploring Integration to Improve Population Health*, is the latest in the growing number of calls for stronger links between medicine and public health.<sup>8</sup> To bridge these gaps, medical providers and public health experts need to create a new common culture and shared language.<sup>9,10</sup> Clinician researchers should align and standardize the collection, analysis, and exchange of data to collaborate more effectively with public health researchers.<sup>11</sup> The 2003 IOM report, *Who Will Keep the Public Healthy? Educating Public Health Professionals for the 21<sup>st</sup> Century*, called for a shift toward an ecologic model of health, acknowledging the crucial role that factors other than medical care (e.g., education, economics, work conditions, and public policy) play in the health of individuals and communities.<sup>5</sup> That report directed recommendations toward traditional schools of public health as well as other health professions schools, including schools of medicine. Nine years later, the 2012 report reiterated the continuing need for a clinical and public health workforce trained to work collaboratively.<sup>8</sup>

Traditional clinical training alone will not be adequate to address the health problems that face our nation.<sup>3,7,12-15</sup> Whether managing chronic disease in a patient panel or practice, redesigning health care delivery, or collaborating with others on health promotion, health professionals need new skills to improve population health. The management of populations will grow ever more crucial as pay for performance, accountable care organizations, and patient-centered medical homes become a more prominent part of the health system landscape. With the advent of the American Board of Medical Specialties Maintenance of Certification, clinicians will be required to demonstrate practice-based improvement through an analysis of patient panels and the populations they serve.

Although coverage of prevention and health promotion has increased in medical school curricula over the last decade, the population health perspective (e.g., the ecologic model and social determinants of health, community engagement, and the impact of public policy on health) has not made similar gains.<sup>16</sup> With the notable exception of joint degree programs (e.g., MD/MPH) and preventive medicine residencies, public health and medical education largely have been separate tracks without substantial intersection.<sup>9</sup>

What kinds of population health skills do health care providers need? They must employ community-engaged (i.e., community-relevant, community-informed, and community-anchored) strategies, such as forming and maintaining equitable partnerships with public health departments, local agencies, and community organizations, to understand local population health needs and to jointly address them.<sup>3,7,12-14</sup>

The delivery of care by highly collaborative interprofessional teams is gaining prominence. In 2011, the Interprofessional Education Collaborative Expert Panel published core competencies for interprofessional collaborative practice, with the goal of preparing health

professional students for team-based practices in which multiple professions work together to address local health needs and forge better health outcomes.<sup>17</sup>

The IOM repeatedly has stated that increased clinician leadership is necessary for redesigning our health care system for the twenty-first century.<sup>15,16</sup> Such a system must address population health, in concert with the public health system, and clinician leaders will need to understand and leverage the funding mechanisms necessary for long-term support of such new delivery systems.<sup>9</sup> Although many clinician leaders have attained their positions through achievements in research or clinical practice, today's leaders also need skills in program, personnel, and financial management; interprofessional and intersector teamwork; conflict resolution; communication; consensus building; data analysis; and critical thinking to successfully maneuver the complex and changing health care environment. Certainly, not all clinicians should make population health, research, or health system leadership their career focus. However, all clinicians benefit from being able to assess their patients' needs as a group, redesign their practice accordingly, and collaborate with partners inside and outside the office walls to improve their patients' health.<sup>13,16,18</sup>

## Duke University's Population Health Initiatives

Our approach outlined in this article is based on our experience working to improve the health of Duke University School of Medicine's home community of Durham, North Carolina. Similar to other academic medical centers, Duke is located in an area with considerable health needs.<sup>19,20</sup> Duke University's mission includes the mandate "to help those who suffer, cure disease, and promote health," and "to contribute in diverse ways to the local community."<sup>21</sup> Improving community health also is explicitly part of the mission of Duke Medicine,<sup>22</sup> with a focus on "creating innovative approaches to health and wellness," and "addressing health disparities in our community." Moreover, Duke Medicine has a vested interest in improving the health of the local populace because it provides health care for the majority of the Durham population and runs the county's only emergency departments.

One of Durham's most important health-related collaborations is the Partnership for a Healthy Durham. Based in the Durham County Health Department, this coalition of citizens and over 60 local agencies and community organizations is dedicated to improving the physical, mental, and social health of Durham residents and to gathering and disseminating county-level health data.<sup>23</sup>

Duke's Department of Community and Family Medicine (CFM) has led institutional efforts to improve community health.<sup>24-27</sup> CFM is comprised of five divisions: Family Medicine, Community Health, Occupational and Environmental Medicine, and the Physician Assistant (PA) and Doctor of Physical Therapy (DPT) Programs. During the last decade, CFM has worked with the Durham County Health Department and other community partners to design and implement a succession of programs to improve the health of Durham residents.<sup>20</sup>

CFM is also the lead agency in the Durham Community Health Network (DCHN), which is a member of Community Care of North Carolina, a central, not-for-profit organization providing cooperative, coordinated care for Medicaid patients across North Carolina through a medical home model.<sup>28</sup> DCHN's care management teams include social workers, nurses, health educators, nutritionists, and community health workers to provide team-based care management for county residents with Medicaid or Children's Health Insurance Program coverage. An information system shares data with local and state partners, including alerts to care managers and information about emergency department visits, prescriptions, and preventive services. Sharing of decisions, funds, and information has resulted in such

improved outcomes as increased medication compliance and immunization rates, as well as dramatic decreases in hospital admissions for patients with asthma.<sup>26</sup>

Duke also sponsors other local health programs, including neighborhood- and school-based primary care clinics and in-home primary care, nutrition, occupational therapy, and case management for older and disabled residents in public housing (known as Just for Us).<sup>29</sup> The development of these initiatives required effective use of population health data and community engagement to identify health needs and mobilize resources and local assets. Interprofessional teams provide services in community settings; assessment data provide essential information to support patient care, manage changes needed in these services, and measure outcomes. The evaluation of the Just for Us program determined that after one year, ambulance, emergency department, and inpatient costs each decreased by almost half among participants, while control of participants' hypertension and diabetes improved.<sup>29,30</sup>

In 2006, Duke expanded its population health initiatives with the Duke Center for Community Research (DCCR), the community engagement pillar of the Duke Translational Medicine Institute. The DCCR launched Durham Health Innovations (DHI) in 2008 as a central coordinating umbrella for addressing the community's most pressing health needs (e.g., birth outcomes, obesity, diabetes, asthma, and cardiovascular disease). Because of DHI's work during the last three years, seven Durham neighborhoods have increased their coordination around disease prevention and health promotion.

These initiatives create a strong platform for integrating population health into clinical training programs. Based on these experiences, we have identified as the keys to successful population health programs: (1) using public health methods, including an emphasis on prevention and collaboration with public health departments; (2) engaging diverse community partners; (3) critical thinking and assessment, using analytic and data-driven approaches; and (4) working together in interprofessional teams. In this article, we propose a competency map based in these four areas as an organizational structure to help guide the content and sequence of training for health professionals to improve population health.

## The Competency Map: An Organizational Framework to Improve Population Health Education

Effectively responding to calls for educational reform requires identifying the specific new knowledge, skills, and attitudes needed by future health care professionals. For the first 15 years of Duke's efforts in population health improvement, a lack of clarity on exactly what trainees needed to learn was a constant obstacle in translating what we learned from care redesign to education programs. Only recently, after years of experimentation with the family medicine residency program, did we reach consensus and attempt to delineate specific learning objectives for all of our levels and types of learners. Rather than identify these learning objectives independently for each program, we chose to create an overarching framework that can be applied across disciplines.

In writing this article, we used three critical concepts. First, we accepted the IOM's definition of *public health* as "fulfilling society's interest in assuring conditions in which people can be healthy."<sup>31</sup> To ensure healthy conditions, public health incorporates diverse public and private stakeholders working in different ways to advance society's health. Next, we adopted Kindig and Stoddart's definition of *population health* as "the health outcomes of a group of individuals, including the distribution of such outcomes within the group."<sup>32</sup> Thus, population health (i.e., the health of populations) is the ultimate goal; we must employ public health methods and approaches to achieve it. Finally, we followed the National

Institutes of Health, the Centers for Disease Control and Prevention, and other federal agencies' definition of *community engagement* as:

the process of working collaboratively with and through groups of people affiliated by geographic proximity, special interest, or similar situations to address issues affecting the well-being of those people... It often involves partnerships and coalitions that help mobilize resources and influence systems, change relationships among partners, and serve as catalysts for changing policies, programs, and practices.<sup>33</sup>

By using effective community engagement strategies in a culturally respectful manner, health professionals can begin to build trust and form partnerships with community organizations, learn about the community, and, together, identify and address health concerns.<sup>24</sup>

After agreeing on these definitions, our first step in developing this framework was to clarify our desired outcome competencies in the areas of public health and community engagement for all health professionals. We conducted a review of the literature in 2011 and 2012, which revealed several published lists of proposed competencies.<sup>16,34–36</sup> We also reviewed the Accreditation Council for Graduate Medical Education residency requirements for selected primary care specialties. Family medicine and pediatrics requirements include community health, policy, advocacy, and scholarly activity.<sup>37,38</sup> Family medicine defines *community medicine* as including population epidemiology, the interpretation of public health statistical information, community-based disease screening, prevention, health promotion, health disparities, and the role of family physicians in reducing such gaps.<sup>37</sup> The preventive medicine requirements (including occupational medicine) extensively cover population and community health, including graduate level courses in “epidemiology, biostatistics, ... environmental health; and the behavioral aspects of health.” Residency graduates must demonstrate proficiency in public health and community engagement.<sup>39</sup> In contrast, the internal medicine residency review committee requirements do not mention community health.<sup>40</sup>

Taking into consideration all of these documents, we generated a list of competencies needed by clinicians in general (especially those in primary care) to bridge the gap between public health and medicine and to improve the health of the populations served. Throughout the process, we identified additional skills required of health professionals based on our own experiences in community-engaged population health improvement. We circulated the resulting list within CFM for input from multiple disciplines. After several revisions, we reached consensus on 15 competencies in the two domains of public health and community engagement.

In September 2011, an interprofessional group of Duke faculty (representing family medicine, PA, DPT, and community health, and including some of the authors of this article) was charged with dividing these competencies into the degrees of achievement expected for different learner groups. That is, what should medical students know and be able to do? Should certain medical students know and be able to do more? Residents in primary care? Faculty? Physician assistants, physical therapists, and other clinicians? Program directors and other faculty began carefully crafting measurable learning objectives with descriptors of the levels of knowledge, skills, and attitudes expected for each learner type and level.

We took major steps to ensure that the competency map was consistent with Bloom's taxonomy for learning.<sup>35</sup> We grouped learners of multiple types and amounts of training into three levels of desired achievement.



1. Foundational: a basic awareness of the principles and an appreciation for their impact and importance in community health. We believe that all clinicians, regardless of specialty, should have at least this level of knowledge and attitudes. All future physicians, PAs, PTs, nurses, and other clinicians need to know the language of a population health approach.
2. Applied: an intermediate level of learning, enabling skilled participation in community-engaged population health activities. We agreed that residents, PAs, and nurse practitioners in primary care should achieve at least this level of skills, which are needed, for example, for the patient-centered medical home. This level is also the goal for MD and PA students in Duke's new Primary Care Leadership programs.
3. Proficient: advanced learners who achieve competence for the independent practice of population health or the leadership of the design and implementation of community-engaged health improvement activities. Duke community health faculty have this degree of competence, gained through experience and training in public health. Because of this department's goal to produce clinician leaders in community health improvement, this level of competence is our target for Duke family medicine faculty and residency graduates. We believe that those who wish to be leaders in the future health care system will need this level of expertise.

In reviewing initial drafts of the competency map, we identified multiple other skills and attitudes essential for the team delivery of population-focused care that were neither included in traditional medical curricula nor reflected in these initial drafts. Many of these related to working in teams and collaborating across health professions; others concerned the analysis of population data and critical appraisal. Although some of these topics are covered in a number of medical school curricula,<sup>41</sup> most are not systematically covered at the majority of medical schools, nor are they systematically evaluated in any of the medical licensing examinations. Thus, we added the team skills and critical thinking domains to the map to address these key competencies.

With the basic structure of four domains created, we filled in the cells of the competency map table to define the level of accomplishment expected for each learner type in each competency area. Leaders of four programs--family medicine residency, family medicine medical student program, PA program, and DPT program--initially recommended the levels they would anticipate for their own graduates. One of us (VSK) then made revisions for consistency and progression through the education continuum for health professionals. We circulated multiple iterations, and group members revised and approved them. We also agreed that individual programs would need to develop and add discipline-specific objectives where needed (e.g., the DPT program might add objectives more specifically focused on the role of a physical therapist).

In December 2011, we distributed this revised draft to content experts within and outside the Duke community for input and further refinement. These experts included physicians; public health officials at the local, state, and national levels; a PA; a nurse; a PT; and a dietitian. After additional revisions, we, including the interprofessional group at Duke and the outside reviewers, reached agreement in April 2012 on a working version, with the understanding that it is a dynamic document that will be refined continually as it is used and as the field of population health evolves (see Appendix 1).

The competency map is intended as an organizational framework that helps to structure educators' thinking about the new skills and knowledge needed for population-based care and health improvement. Although we assigned each competency to a single domain, the four domains are highly interrelated. By defining developmentally appropriate objectives for

different levels of learners, the map assists us in designing better learning activities and targeting limited educational resources to achieve the desired outcomes for different audiences. Grouping learners with similar desired outcomes helps to identify opportunities for collaboration and interprofessional learning. By bringing students of different disciplines together to learn from, about, and with each other, the process of learning can build synergistically on the content to develop highly collaborative interprofessional teams.

## Applying the Competency Map

The competency map provides an outline of the population health content to be incorporated into each of our health professions programs. Before the mapping, when challenged to do more to prepare trainees in population health improvement, faculty struggled to identify what was missing. Having a competency map allows faculty to see what is missing from current attempts to add population health to various curricula.<sup>42</sup> Three brief examples of how the competency map is being applied at Duke follow.

### Medical students

The Duke University School of Medicine launched the Primary Care Leadership Track (PCLT) in 2011 to train a cadre of primary care leaders to become change agents for the health care system. Students committed to primary care are recruited specifically, and they participate in an innovative four-year curriculum designed to support their interest and develop the skills they need for community-engaged, population-focused practice and leadership positions. PCLT students learn community engagement through participation in community health teams. They are required to complete a research project that derives from community-expressed needs; this activity addresses all four of the domains in our competency map. The PCLT curriculum builds on the longstanding partnership between Duke and Durham community organizations to prepare future doctors at the applied (intermediate) level of the competency map. All PCLT graduates will enter residency prepared to engage with communities and practices to improve health outcomes.

### Family medicine residents

The Duke Department of Community and Family Medicine redesigned its family medicine residency program in 2007 to incorporate population health concepts. Starting in 2006, residents began continuity experiences in community health clinics, in addition to their regular Duke Family Medicine Center practices. A certificate program in clinical leadership was incorporated in 2007, and a curriculum in community-engaged population health research was added in 2010. For the 2012–2013 academic year, all of these elements were combined into an integrated population health improvement curriculum that trains both residents and faculty to the applied (intermediate) level of the competency map. After the existing curriculum elements were combined, the competency map enabled us to identify gaps and add curriculum components in key areas (e.g., team leadership). The previous required resident research project, for example, which typically focused on quality improvement in the clinical setting, has evolved into a two-year population health improvement project accomplished by residents matched with family medicine faculty. Future enhancements will be incorporated to train residents to achieve the proficient (advanced) level of the competency map. These changes are likely to include e-learning modules to make it easier to reach residents as well as practicing physicians.<sup>43</sup>

### PA students

Duke's PA Program has included population approaches in its curriculum since the 1990s. Courses in health systems and professional issues, evidence-based medicine, and prevention incorporate concepts in public health, community engagement, practice-based improvement,

and chronic disease management. The curriculum prepares graduates with foundational awareness and knowledge (basic level), as well as selected skills of the applied (intermediate) level of the competency map. Our new community-based, longitudinal Primary Care Scholars Program enables selected students to engage more deeply in population health efforts and achieve the applied (intermediate) level. These students also study the concepts of the patient-centered medical home in collaboration with medical students in the PCLT.

## **Incorporating the Competency Map into Evaluations**

Strategies to assess learners' achievement of objectives must be flexible to meet the needs of different educational levels and programs. To minimize the amount of testing for busy trainees and faculty, we have incorporated the needed domains (based on the competency map) into existing evaluations or assessments whenever possible. Examples include educational portfolios, learner satisfaction surveys, knowledge tests, team training evaluations, presentation feedback, and mentor comments on population health projects (required by each program). At the applied and proficient levels, project requirements necessitate that learners demonstrate the population health skills associated with those achievement levels (e.g., using population data to identify opportunities for improvement; proposing, implementing, and evaluating evidence-based and context-appropriate intervention strategies; and consistently working collaboratively with community or clinical partners). Faculty trained in population health mentor and assess these learners' skills. Program directors will review aggregate data for continual improvement of the programs.

The evaluation of our success at developing population health skills in trainees and faculty will go beyond assessing individuals' performances with specific curricula or projects. Faculty at the proficient (advanced) level will serve as proctors to assess other individuals' ability to independently practice population health improvement. Clinical credentials in community health will be granted to faculty who successfully demonstrate proficiency. Trends in the numbers and types of faculty with community health credentials will reflect the dissemination of these skills.

An additional tool we will use to paint a broader picture of skill development is an annual survey of CFM residents, graduated trainees, faculty, and staff. The survey has been revised over the past two years to assess knowledge, attitudes, and competencies in population health activities, mirroring the competency map. Because the map has been in use for less than a year, no results are yet available on its impact. We also will track residents after graduation to determine whether they are putting population health skills into practice.

Arguably, the ideal way to evaluate training is to assess whether graduates use the skills they learn to actually improve the health of a population. Learners are taught that program evaluation is essential to population health improvement efforts and, at the applied and proficient levels, are provided with the skills to conduct basic collaborative evaluations. We will use learners' evaluations of their own projects to help assess their contributions to population health, and we are exploring assessment tools for community and clinical partners to capture their perceptions of learner contributions. Our ultimate goal, of course, is improvement in local health status; we will track this information as well, recognizing that other factors also contribute to any changes.

## **The Broader Application and Limitations of the Competency Map**

The IOM's 2012 report offers the most detailed portrait yet of the landscape for integrating medicine and public health, along with principles that can serve as a roadmap toward improved population health and a more efficient health care system.<sup>8</sup> Two of the report's



conclusions are that academic health centers can facilitate integration efforts and that the clinical and public health workforces should be trained to collaborate. The competency map responds to that call for action, and it presents one example of how such integration is under way. Although the map was informed and is continuously refined by local forces, the imperatives for action that we have discussed here support its broader application.

We believe the proposed competency map makes a unique contribution to the literature for the following reasons:

- It focuses on the spectrum of core skills required for population health, including public health, teamwork, community engagement, and critical thinking, to improve health on a population scale. The map applies much of the work proposed by the 2012 IOM report and grounds it in a community-based approach.
- It is specific and measurable. The competencies in the four domains are broken down to three levels of accomplishment to guide learners' training at different levels.
- It is generalizable across a wide range of programs. The knowledge, skills, and attitudes outlined in the learning objectives are not limited to any specific health profession.
- It builds on existing literature and more than a decade of collaboration between an academic medical center and its surrounding community to redesign care and improve health outcomes for the region.
- Its development is based on the needs of a population, rather than the perspectives of the health professions. In contrast with previously published competencies, our map is designed specifically to bridge the gap between public health and medicine by focusing on the needs of the population.
- It is based in broad curriculum redesign efforts spanning multiple disciplines and levels of learning.

The proposed competency map, however, has limitations. Most notably, it has been used only at a single institution and is based on the lessons learned within that institution's local community context. Duke has strong and longstanding partnerships within the Durham community. Because communities vary much more than academic health centers and because the important challenges that matter to their constituencies are different, leaders at other institutions will need to adapt the lessons we shared here to apply to their specific situations.

Another limitation is the relative newness of the competency map, which continues to be refined. It has not yet withstood the test of time, nor are long-term outcomes available. Because of the timeliness of the topic and the widespread struggles with these challenges in health professions education, we decided to share our framework in the hope that it will be as helpful to others as it has been for us.

In addition, although the map was developed by an interprofessional team with a view across the health professions, it is limited in the scope of the disciplines involved. Duke's family medicine and occupational medicine programs, as well as the PA and DPT programs, have been integrally involved; a few individuals from other professions contributed, but broad input from these groups is lacking. We anticipate that further revisions or adaptations to the competency map will be needed as it is applied more broadly. Furthermore, although the map emphasizes community and patient engagement in programs to improve health, we have not succeeded yet in broadly engaging patients, community organizations, and agencies in teaching our learners these skills. The Duke community has

achieved early success in limited activities (e.g., patient “Community Partners” who teach medical and nursing students about living with chronic disease), but additional opportunities remain for further expansion.

Although we are enthusiastic about this approach, we recognize that it originates, in part, from theoretical recommendations that have not been tested thoroughly in practice. We have outlined the compelling reasons for all clinicians to have these foundational knowledge and skills, but the clinical environment continues to be built around traditional fee-for-service payment models. Trainees with substantive skills in population health might not immediately find a job market seeking those competencies. Changes in reimbursement systems (e.g., per-member-per-month payments for population health metrics) have occurred, but the structure does not always reward clinicians for viewing patient care through the lens of population health. Time is needed for the health care system as a whole to catch up to the recommendations that we reference, and graduates of our new model might not be able to use immediately all of the skills they have learned. We recognize that we are preparing trainees for a future whose shape is not yet fully formed.

Evaluating the impact of our efforts will be challenging. Even with the measures we outlined here, numerous changes in our health care system and the national context will affect health status locally and beyond, and isolating the effects of individual interventions such as the competency map might be impossible. Comparing its impact across institutions and communities will be necessary and useful.

## Going Forward

The competency map represents a deliberate step in aligning our educational programs with what we have learned about the process of improving population health in collaboration with our community. Our journey is still in its early stages, as we move from educational programs governed by professional norms and historically isolated from our community partnerships to more integrated team-oriented education focused on improving health outcomes and building on the strengths of a diverse cadre of professional and community colleagues. If achieving population health requires teams in the office and community, so too does teaching about population health.

Integrating across disciplines and incorporating community partners as colleagues are our goals. We have increasingly partnered with groups within our institution to create new curricula and new methods of learning and evaluation, yet we have yet to incorporate our community partners consistently in educational design. The competency map has been a helpful tool in integrating previously separate curricula into a coherent whole that is more acceptable to learners while also better addressing local and national needs.

We now hope to find willing colleagues to test and compare efforts at other institutions and in different settings. Comparative evaluation and long-term outcomes tracking are necessary for assessing effectiveness in achieving the ultimate goal of improving health status. For us, the final proof of the success of our educational programs is seeing our graduates demonstrably helping to improve health outcomes in diverse communities and sharing what they have learned with others.

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**Appendix 1**

**Appendix 1**

A Competency Map for Integrating Population Health Into Clinician Education, Duke University School of Medicine, 2011\*

Competency and training level	Foundational (Basic): Awareness*	Applied (Intermediate): Skilled participation <sup>†</sup>	Proficient (Advanced): Independent practice <sup>‡</sup>
<b>Public health (PH)</b>	<i>Learners will be able to...</i>	<i>Learners will be able to meet all basic objectives, plus...</i>	<i>Learners will be able to meet all basic and intermediate objectives, plus...</i>
PH-1: Examine the characteristics that bind people together as a community—including social ties, common perspectives and interests, and geography—and how these relate to health	<ul style="list-style-type: none"> <li>• Define community</li> <li>• Discuss the role of community in health</li> <li>• Define a meaningful population for health improvement purposes</li> </ul>	<ul style="list-style-type: none"> <li>• Assess unifying characteristics of a population</li> <li>• Consider how these characteristics can help or hinder a proposed intervention</li> <li>• Identify the characteristics of communities and groups that are associated with</li> </ul>	<ul style="list-style-type: none"> <li>• Assess the characteristics of communities and groups that are associated with disproportionate burden of disease</li> <li>• Describe key disease states that demonstrate disproportionate burden of disease within specific populations</li> </ul>

Competency and training level	Foundational (Basic): Awareness*	Applied (Intermediate): Skilled participation <sup>†</sup>	Proficient (Advanced): Independent practice <sup>‡</sup>
		disproportionate burden of disease	
PH-2: Address the role of socioeconomic, environmental, cultural, and other population-level determinants of health on the health status and health care of individuals and populations	<ul style="list-style-type: none"> <li>Describe population-level determinants of health</li> <li>Discuss how these factors influence health status and health care delivery</li> </ul>	<ul style="list-style-type: none"> <li>Explain population-level determinants affecting the health of a population</li> <li>Discuss potential strategies for addressing population-level determinants of health</li> </ul>	<ul style="list-style-type: none"> <li>Collaborate with stakeholders to design and implement strategies to address population-level determinants of health</li> <li>Report on the social and economic determinants of the burden of disease in specific populations</li> </ul>
PH-3: Use community assets and resources to improve health at the individual and population levels	<ul style="list-style-type: none"> <li>List potentially helpful community assets and resources</li> <li>Refer individual patients to resources that can assist in meeting their health needs</li> </ul>	<ul style="list-style-type: none"> <li>Describe relevant assets and resources for population health improvement within a specific community</li> <li>Discuss potential collaborations with community resources to improve population health</li> </ul>	<ul style="list-style-type: none"> <li>Analyze gaps in community resources</li> <li>Develop partnerships and programs to fill these gaps</li> <li>Demonstrate leadership skills for building partnerships</li> </ul>
PH-4: Apply strategies that improve the health of populations	<ul style="list-style-type: none"> <li>Define primary, secondary, and tertiary prevention</li> <li>Identify examples of individual and population-based preventive strategies</li> <li>Discuss potential population-based</li> </ul>	<ul style="list-style-type: none"> <li>Identify prevention strategies that can affect identified health needs</li> <li>Identify preventive strategies for a population on the basis of literature, data assessment, and stakeholder input</li> <li>Propose measures to assess impact of preventive strategies</li> <li>Evaluate strategies and propose improvements based on</li> </ul>	<ul style="list-style-type: none"> <li>Develop and implement population-based prevention strategies in collaboration with community partners</li> <li>Measure and document improvements in health status</li> <li>Apply evidence-based approaches in development, evaluation, and continual</li> </ul>

Competency and training level	Foundational (Basic): Awareness*	Applied (Intermediate): Skilled participation†	Proficient (Advanced): Independent practice‡
	interventions to improve health	evaluation results	improvement of interventions
PH-5: Discuss the essential functions of public health systems	<ul style="list-style-type: none"> <li>Describe the role of public health in the community</li> <li>Identify specific public health entities in the community</li> <li>Discuss how these public health entities are funded</li> </ul>	<ul style="list-style-type: none"> <li>Describe the 10 essential functions of the public health system</li> <li>Discuss ways in which primary care clinicians can partner with public health entities in the community</li> </ul>	<ul style="list-style-type: none"> <li>Analyze existing functions of public health systems and identify new potential strategies to improve population health</li> <li>Analyze interactions between the medical and public health systems, and recommend improvements in both so that these systems can work together more easily</li> </ul>
PH-6: Integrate population health and community engagement in daily practice	<ul style="list-style-type: none"> <li>Discuss how social determinants affect individual's health</li> <li>Describe how collaborations can help meet individual and community needs</li> </ul>	<ul style="list-style-type: none"> <li>Describe how a patient-centered medical home (PCMH) meets its goals</li> <li>Describe the use of population health data in care redesign and the function of new delivery models to meet their goals</li> <li>Discuss possible applications of community engagement in a PCMH or accountable care organization</li> <li>Conduct quality improvement (QI) for practice improvement</li> </ul>	<ul style="list-style-type: none"> <li>Engage the community in guidance of the PCMH and care redesign</li> <li>Conduct research for practice improvement</li> </ul>
PH-7: Understand and support the principles of accountability and accreditation at the community or public health agency level	<ul style="list-style-type: none"> <li>Describe the interaction between government, industry, community, and the individual physician as it affects care</li> <li>Describe legal and regulatory requirements and processes that affect credentialing, licensing, and practice</li> <li>Describe the variables that influence the organization and delivery of health care</li> </ul>	<ul style="list-style-type: none"> <li>Discuss applicable laws and regulations in management of community health</li> <li>Seek assistance from knowledgeable experts to ensure compliance with all legal requirements</li> <li>Advocate for policy and</li> </ul>	<ul style="list-style-type: none"> <li>Analyze complex regulatory problems relevant to community and population health efforts in collaboration with legal experts</li> <li>Ensure compliance of programs with all regulatory requirements</li> </ul>

Competency and training level	Foundational (Basic): Awareness*	Applied (Intermediate): Skilled participation†	Proficient (Advanced): Independent practice‡
		regulations to support public health	
<b>Community engagement (CE)</b>	<i>Learners will be able to...</i>	<i>Learners will be able to meet all basic objectives, plus...</i>	<i>Learners will be able to meet all basic and intermediate objectives, plus...</i>
CE-1: Discuss the principles of community engagement and how they contribute to the creation of community-academic partnerships	<ul style="list-style-type: none"> <li>Define community engagement and community-engaged research (CEnR)</li> <li>Recognize the principles of CEnR as defined by the Centers for Disease Control and Prevention (CDC)</li> </ul>	<ul style="list-style-type: none"> <li>Describe the principles and practices of CEnR as defined by the CDC</li> <li>Discuss the application of these principles within a specific community</li> <li>Discuss how these practices can contribute to the creation of community-academic partnerships</li> </ul>	<ul style="list-style-type: none"> <li>Participate in the design or implementation of a CEnR activity</li> <li>Apply the principles of community-engaged research to improve health among diverse populations</li> </ul>
CE-2: Analyze the role of community engagement as a strategy for identifying community health concerns, improving health, and reducing health disparities	<ul style="list-style-type: none"> <li>Discuss the role of community engagement as a strategy for improving health and reducing health disparities</li> </ul>	<ul style="list-style-type: none"> <li>Discuss strategies for community engagement to identify priority health concerns</li> <li>Discuss the importance of needs and assets assessment</li> <li>Propose partnerships or methods for engaging the community regarding a health concern</li> </ul>	<ul style="list-style-type: none"> <li>Employing the principles of community engagement, organize community partnerships</li> </ul>
CE-3: Analyze the ethical complexities of conducting CEnR	<ul style="list-style-type: none"> <li>Identify potential ethical issues in CEnR</li> </ul>	<ul style="list-style-type: none"> <li>Discuss ethics problems related to CEnR</li> <li>Analyze a CEnR project or proposal for ethics concerns</li> </ul>	<ul style="list-style-type: none"> <li>Draft a CEnR proposal for the institutional review board, accounting for ethics complexities</li> </ul>
CE-4: Specify how cultural and linguistic competence and health literacy influence the conduct of CEnR and population health interventions	<ul style="list-style-type: none"> <li>Define health literacy</li> <li>Identify local customs and health beliefs that affect population health</li> <li>Explain why health care providers need to understand this local health knowledge</li> </ul>	<ul style="list-style-type: none"> <li>Discuss how levels of health literacy affect the conduct of CEnR</li> <li>Identify instruments and materials that are culturally and linguistically appropriate and</li> </ul>	<ul style="list-style-type: none"> <li>Design instruments that are culturally and linguistically appropriate and that meet the literacy level of the intended population</li> <li>Develop programs responsive to the</li> </ul>

Competency and training level	Foundational (Basic): Awareness*	Applied (Intermediate): Skilled participation†	Proficient (Advanced): Independent practice‡
		that meet the literacy level of the intended populations	diverse cultural values and traditions of the communities being served
CE-5: Participate in population health improvement strategies by using community-based participatory methodologies	<ul style="list-style-type: none"> <li>Identify existing community-based programs to improve population health</li> <li>Participate in a school-based or community-based outreach program to address a community's health need</li> </ul>	<ul style="list-style-type: none"> <li>Participate with a community health team addressing patients with unmet needs</li> <li>Propose effective population health improvement strategies acceptable to the target groups</li> </ul>	<ul style="list-style-type: none"> <li>In collaboration with community stakeholders, design and implement population health improvement programs that are evidence-based and responsive to local needs</li> </ul>
<b>Critical thinking (CT)</b>	<i>Learners will be able to...</i>	<i>Learners will be able to meet all basic objectives, plus...</i>	<i>Learners will be able to meet all basic and intermediate objectives, plus...</i>
CT-1: Use qualitative and quantitative data to assess the health status of a population	<ul style="list-style-type: none"> <li>Recognize potential data sources</li> <li>Review available statistics to identify health problems or areas of concern</li> <li>Recognize data integrity and comparability</li> <li>Discuss possible reasons for conflicting data</li> </ul>	<ul style="list-style-type: none"> <li>Locate available data sources</li> <li>Examine the data's integrity and comparability</li> <li>Recognize the data's limitations and level of certainty possible from analysis</li> <li>Interpret data analysis to assess a population's health</li> <li>Identify additional data needs and possible ways of generating those data, given available resources</li> </ul>	<ul style="list-style-type: none"> <li>Collect and analyze new data</li> <li>Evaluate the data's integrity and comparability</li> <li>Apply clinical judgment to make inferences and decisions when data are conflicting or incomplete</li> </ul>
CT-2: Appraise the quality of the evidence of peer-reviewed medical and public health literature and its implications at patient and population levels	<ul style="list-style-type: none"> <li>Read literature applicable to problems identified among patients and populations</li> <li>Identify strengths and weaknesses in study designs</li> </ul>	<ul style="list-style-type: none"> <li>Analyze literature for evidence of applicability to specific situations</li> <li>Review the literature to identify best practices</li> <li>Identify meaningful research</li> </ul>	<ul style="list-style-type: none"> <li>Perform thorough and systematic literature analysis</li> <li>Synthesize results from the literature in intervention design</li> <li>Generate novel methods for answering complex research</li> </ul>



Competency and training level	Foundational (Basic): Awareness*	Applied (Intermediate): Skilled participation <sup>†</sup>	Proficient (Advanced): Independent practice <sup>‡</sup>
		<p>questions where the outcomes can provide information for decision making related to community health</p> <ul style="list-style-type: none"> <li>Apply literature analysis in identifying needs and developing potential interventions</li> </ul>	<p>questions about a population's health status</p>
CT-3: Apply QI principles in community or public health	<ul style="list-style-type: none"> <li>Describe commonly accepted QI models</li> <li>Discuss quality measurement in relation to provider credentialing, institutional accreditation, and other regulatory requirements</li> <li>Perform basic QI skills, including chart audits and root-cause analyses</li> <li>Identify types of additional data needed for needs or assets assessment and solution design</li> </ul>	<ul style="list-style-type: none"> <li>Propose a QI project by using available population data sources and community resources</li> <li>With guidance, develop a plan for collecting and analyzing new data</li> <li>Collaborate with community partners or agencies in a QI effort</li> <li>Use available data analyses to support QI initiatives</li> </ul>	<ul style="list-style-type: none"> <li>Design QI initiatives for community or population health in conjunction with community partners and agencies</li> <li>Develop new community partnerships to support or facilitate QI initiatives</li> </ul>
CT-4: Assess process and outcomes of interventions	<ul style="list-style-type: none"> <li>Describe the role of evaluation in program improvement and advocacy</li> <li>Identify different types of evaluation and their purposes</li> <li>Discuss different methods of data collection, both qualitative and quantitative</li> <li>Discuss the role of community engagement in evaluation</li> <li>Participate in the collection of quantitative and qualitative data to assess impact</li> </ul>	<ul style="list-style-type: none"> <li>Define health outcomes potentially affected by interventions</li> <li>Design data collection methods to assess impact</li> <li>Use quantitative and qualitative data to assess impact of interventions</li> <li>Critique methods and instruments for collecting valid and reliable quantitative and qualitative data</li> </ul>	<ul style="list-style-type: none"> <li>Design and implement an evaluation plan by using quantitative and qualitative methods for determining an intervention's health impact</li> <li>Independently develop a plan for collecting and analyzing new data</li> <li>Independently develop data collection instruments and procedures</li> <li>Independently conduct simple data analyses</li> <li>Collaborate on more</li> </ul>

Competency and training level	Foundational (Basic): Awareness*	Applied (Intermediate): Skilled participation†	Proficient (Advanced): Independent practice‡
			sophisticated data analyses
<b>Team skills (TS)</b>	<i>Learners will be able to...</i>	<i>Learners will be able to meet all basic objectives, plus...</i>	<i>Learners will be able to meet all basic and intermediate objectives, plus...</i>
TS-1: Effectively practice as a member of interprofessional health care teams	<ul style="list-style-type: none"> <li>Identify the stages of team development (e.g., forming, storming, and norming)</li> <li>Deliver balanced, behavior-specific feedback</li> <li>Listen respectfully and respond to feedback and recommendations</li> <li>Discuss how QI principles can be applied to improving team function</li> <li>Describe the scope of practice of different health professionals and their respective contributions to the health care team</li> <li>Follow directions</li> <li>Respect and follow the leadership of others, even when opinions differ</li> </ul>	<ul style="list-style-type: none"> <li>List components of successful team dynamics</li> <li>Explain elements of giving effective feedback and managing disruptive behaviors within interprofessional teams</li> <li>Clarify expectations, establish accountability, and solicit feedback from teammates</li> <li>Collaborate with different health professionals in team problem-solving</li> </ul>	<ul style="list-style-type: none"> <li>Employ effective feedback in managing conflict and disruptive behavior in interprofessional teams</li> <li>Apply QI methods to improve team function</li> </ul>
TS-2: Lead interprofessional teams in health improvement	<ul style="list-style-type: none"> <li>Identify personal strengths and weaknesses</li> <li>Describe emotional intelligence</li> <li>Observe and reflect on performance, including one's own</li> <li>Identify perspectives or experiences that might be helpful in understanding and addressing complex health concerns</li> </ul>	<ul style="list-style-type: none"> <li>Define preferred leadership style and the strengths or limitations of that style</li> <li>Develop a personal leadership philosophy and vision</li> <li>Assess one's own emotional intelligence and develop plans for ongoing self-improvement</li> <li>Lead a small team in a local health improvement project</li> </ul>	<ul style="list-style-type: none"> <li>Lead broad-based teams in developing and implementing community-based health improvement initiatives</li> <li>Discuss methods of promoting and supporting diversity in leadership positions</li> </ul>
TS-3: Communicate with team members to clarify each person's responsibility in executing a health intervention	<ul style="list-style-type: none"> <li>Identify unique and complementary abilities of different team members</li> <li>Identify tasks and responsibilities for team members to make</li> </ul>	<ul style="list-style-type: none"> <li>Collaborate with team members to divide necessary tasks and responsibilities</li> </ul>	<ul style="list-style-type: none"> <li>Perform effectively in different roles and settings</li> <li>Negotiate division of responsibilities</li> </ul>

Competency and training level	Foundational (Basic): Awareness <sup>*</sup>	Applied (Intermediate): Skilled participation <sup>†</sup>	Proficient (Advanced): Independent practice <sup>‡</sup>
	<ul style="list-style-type: none"> <li>optimal use of their abilities</li> <li>Accept direction from other teammates when appropriate to roles</li> </ul>	<ul style="list-style-type: none"> <li>Identify and engage key persons missing from the team, including non-clinicians</li> </ul>	<ul style="list-style-type: none"> <li>among team members when conflict arises</li> </ul>
TS-4: Support and manage change in complex environments	<ul style="list-style-type: none"> <li>Describe available sources of data to assess organizational performance</li> <li>Discuss forces motivating change in health care organizations</li> <li>Discuss the importance of negotiation and delegation in leadership situations</li> </ul>	<ul style="list-style-type: none"> <li>Describe uses of information and data for prompting change and improving organizational performance</li> <li>Discuss membership criteria for groups charged with managing or leading change</li> <li>Discuss operational management strategies important in complex organizations</li> <li>Describe benefits and disadvantages of using specific leadership styles in the midst of changing work demands and environments</li> <li>Discuss legal and ethics considerations in leadership</li> <li>Self-assess and develop strategies to improve negotiation and delegation skills</li> </ul>	<ul style="list-style-type: none"> <li>Apply clinical informatics resources to drive change and improve population health</li> <li>Distinguish and employ different leadership styles needed for different situations and organizational environments</li> <li>Demonstrate effective delegation and supervision</li> <li>Effectively negotiate with team and community members in team management</li> <li>Assemble and charge diverse groups that will be responsible for preparing recommendations for change to ensure that needed perspectives and experiences are included</li> <li>Manage resistance to change in complex environments</li> </ul>

<sup>\*</sup>Learner types: all students and residents

<sup>†</sup>Learner types: Primary Care Leadership Track (PCLT) students; primary care residents; Department of Community and Family Medicine (CFM) faculty (minimum)

<sup>‡</sup>Learner types: population health fellows; community health (CH) scholars; CH faculty