The Impact of Primary Healthcare on Population Health in Low- and Middle-Income Countries

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Abstract: This article assesses 36 peer-reviewed studies of the impact of primary healthcare (PHC) on health outcomes in low- and middle-income countries. Studies were abstracted and assessed according to where they took place, the research design used, target population, primary care measures, and overall conclusions. Results indicate that the bulk of evidence for PHC effectiveness is focused on infant and child health, but there is also evidence of the positive role PHC has on population health over time. Although the peer-reviewed literature is lacking in rigorous experimental studies, a small number of relatively well-designed observational studies and the consistency of findings generally support the contention that an integrated approach to primary care can improve health. A few large-scale experiences also help identify elements of good practice. The review concludes with several recommendations for future studies, including a focus on better conceptualizing and measuring PHC, further investigation into the advantages of comprehensive over selective PHC, need for experimental or quasi-experimental research designs that allow testing of the independent effect of primary care on outcomes over time, and a more detailed conceptual framework guiding overall evaluation design that places limits on the parameters under consideration and describes relationships among different levels and types of data likely to be collected in the evaluation process. **Key words:** *developing country, evaluation, population health, primary healthcare*

THE WORLD HEALTH ORGANIZATION (WHO) formalized its commitment to primary healthcare (PHC) in 1978, when it was identified as central to the achievement of the goal of "Health for All" and as a key instrument for improving health throughout the world (WHO, 1978).

In the decades following Alma Ata, many low- and middle-income countries have undergone dramatic changes, including democratization, economic liberalization in an increasingly globalized world, redefining the role of the state, and reforming their health and social services systems. Health reforms, in particular, have aimed at streamlining healthcare financing and decentralizing authority for planning and implementation. There is increasing evidence that not all of these reforms have strengthened PHC, nor have they uniformly contributed to improving health or equity in its distribution (Infante & de Mata, 2000; Mackintosh, 2000; Varatharajan & Thankappan, 2004).

In many high-income countries, various attributes of primary care have been shown to exert a positive influence on health costs, appropriateness of care, and outcomes for most of the major health indicators (Bindman et al., 1996; Forrest & Starfield, 1996, 1998; Starfield, 1998; Starfield et al., 2005a, 2005b).

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There is also evidence that countries characterized by a strong primary care orientation have better and more equitable health outcomes than those systems that are oriented toward specialty care (Macinko et al., 2003; Starfield, 1996; Starfield & Shi, 2002). Nevertheless, there is considerable debate about how effective PHC has been in improving population health in low- and middle-income countries (Filmer et al., 2000; Lewis et al., 2004).

The 30-year anniversary of the Alma Ata meeting, the changing health challenges in the developing world, and the widespread dissatisfaction with the status quo have generated interest in a renewed and reinvigorated approach to health systems development based on PHC ("Margaret Chan puts primary health care," 2008; Pan American Health Organization, 2005; WHO, 2008). To aid in this process, the present review assesses the peer-reviewed literature for evidence of the effectiveness of previous PHC experiences with the goal of identifying lessons learned and providing suggestions for strengthening the PHC evidence base.

METHODS

The literature review was conducted by searching the US National Library of Medicine's PubMed database, the *Cochrane Database of Systematic Reviews*, and the Internet (via Google) for articles that contained the phrases "primary care" or "primary health care" along with the terms "evaluation" or "impact" in either the title or the abstract. Several journals that publish on healthcare in the developing world were also hand searched. All articles were then culled to identify additional references. This process revealed more than 10 000 potential articles as of July 2008.

From the large potential pool of articles, we excluded all commentaries and non–peer-reviewed works and all articles related to European or other Organization for Economic Cooperation and Development countries. Abstracts and study designs were then reviewed to identify articles that addressed the evaluation of PHC programs, systems, and services and to exclude articles that (1) did not explicitly define the scope of the PHC intervention; (2) evaluated only one component of selective primary care services (eg, immunization, oral rehydration therapy); or (3) did not include data on changes in health outcomes attributed to the PHC intervention. Overall, 36 key articles were retrieved and abstracted.

The Appendix contains a synthesis of the main objectives, study designs, outcomes, PHC measures, and results of the reviewed articles. We adopt the term "selective" to characterize interventions directed at selected individual health conditions (such as control of diarrheal diseases) and "integrated" to describe approaches that are more directed at health in general. In the presentation of results, we distinguish between PHC tasks or services (ie, directed at a specific health problem) and PHC functions (ie, directed at assuming the main role of PHC within health systems, regardless of the specific health problem).

RESULTS

Figure 1 shows the distribution of new articles by year on the topic of PHC, which has increased each year and, after a relatively stable period from 1995 to 2003, now averages about 500 new articles per year.

Table 1 shows characteristics of the 36 abstracted studies. Geographically, they are fairly evenly distributed: slightly more than a third are from Africa, about a third are from Latin America and the Caribbean, a quarter from Asia, with the remaining representing multiple regions. In terms of study design, most (45%) use a pre- and postintervention cross-sectional design with controls or comparison groups, about 14% use a case-control design, another 11% use multivariable longitudinal analyses of ecological data, 1 study uses an experimental design, and 1 uses a cohort approach. All remaining studies employed a variety of observational designs without controls.

In terms of outcomes, more than three-quarters of the studies focused on infant or under-5 mortality, with the remainder dealing
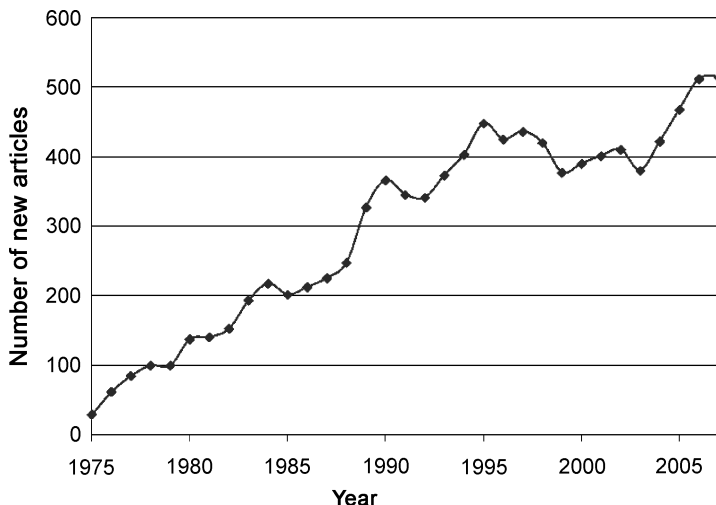
Figure 1. The number of new articles published in PubMed with "primary health care" in the abstract or title, by year (1975–2007).

Table 1. Characteristics of studies reviewed ($N = 36$)

Domain	Number of studies
Geographic region	
Latin America and the Caribbean Sub-Saharan	12
Africa	16
Asia	8
Other (or multiple regions)	1
Study design	
Experimental or quasi-experimental	5
Prospective study with control group	1
Repeated (pre/post) cross-sectional design with control	16
Case-control	5
Repeated (pre/post) cross-sectional design without control	5
Systematic literature review	1
Observation/qualitative study/single cross-section	3
Main outcome studied	
Infant or under-5 mortality	28
Other (child)	1
Other (adult)	7

with maternal mortality, life expectancy, all-cause mortality, and cause-specific mortality in adults. All but 3 studies measured PHC exposure by residence in a geographic area in which PHC services were being delivered. The other 3 assessed individual use of specific PHC services. Nearly all studies point to a positive impact of the PHC intervention studied: only 5 articles show no improvement attributable to PHC.

The magnitude of impact also varied considerably. Reductions in infant and under-5 mortality attributed to PHC averaged more than 40% and varied from 0 to as high as 71%, with interventions lasting from 2 years to more than 10 years.

Studies on specific PHC tasks

Several studies analyzed the association of specific primary care tasks with health outcomes. Moore et al. (2003) conducted a panel study of 22 Latin American countries over the period from 1990 to 1998. The study found that the most important contributor to lower under-5 mortality was women's literacy, followed by vaccination coverage and use of oral rehydration therapy. A similar analysis conducted by using Demographic and Health Surveys from 5 East African countries estimated that nearly three-quarters of the

attributable risks for mortality in children younger than 1 year might be amenable to preventive services, including antenatal care, immunizations, fertility regulation, and use of potable water (Brockerhoff & Derose, 1996). In both studies, the extent to which these services were part of an integrated PHC system or the result of an effort targeted only at major causes of infant and child mortality is unclear.

Dugbatey (1999) assessed the relationship between a set of "Health for All" policies (health education, nutrition, water and sanitation, and maternal/child health services) and health outcomes at the national level in 4 African countries in the 1990s. Through a comparative case study design, the author showed that PHC-sensitive conditions (such as infant mortality) were improved in the 2 countries with more comprehensive PHC policies (Botswana and Zimbabwe), as opposed to those with a less coherent set of PHC policies (Ghana and Cote d'Ivoire), in spite of the latter having higher gross national product per capita (Dugbatey, 1999).

The Bellagio Child Survival Study Group concluded that nearly 10 million child deaths worldwide could be averted by tasks or services including combined use of oral rehydration therapy (Victora et al., 2000), immunization (England et al., 2001), micronutrient supplementation, promotion of exclusive breast-feeding (Arifeen et al., 2001), and others, all but one of which (neonatal intensive care) would be expected to be delivered by a PHC system. This estimate is supported by another study (Berman, 2000) that estimated that about 62% of all disability adjusted life years (lost in the adult and child population of developing countries) would be amenable to primary care services (termed "ambulatory healthcare" by Berman). Access to primary care appears to be particularly important in Africa; some authors suggest that up to 80% of child deaths occur at home, without the child having any contact with the health system (Oluwole et al., 2000)

Integrated management of childhood illness (IMCI) reflects a horizontal primary care approach in the sense that it combines several specific interventions. An evaluation of IMCI programs in Brazil, Peru, Uganda, Egypt, and Tanzania showed that although the approach was in many cases more comprehensive and effective than individual vertical interventions, poor access, low levels of utilization, and structural weaknesses in health systems limit its impact on population health (Bryce et al., 2003; WHO, 2004) A recent review suggested that a more comprehensive approach to PHC and health systems development will be required for strategies such as the IMCI program to flourish (Freedman et al., 2005).

Rohde et al. (2008) identify 13 countries that have implemented comprehensive PHC (Thailand, Turkey, Vietnam, Brazil, Sri Lanka, El Salvador, Tunisia, Dominican Republic, Iran, Kazakhstan, Turkmenistan, China, and Cuba). Their analysis suggests that these countries experienced important health gains and that in comparison with countries having more selective PHC approaches, health improvements—particularly for conditions that require sustained and coordinated care—seem to "depend on progression to comprehensive primary health care with a reliable referral system linking to functioning facilities" (Rohde et al., 2008, p. 958).

Studies of specific primary care programs

The Navrongo experiment in Ghana was the only experimental study identified. In it, villages received 1 of 4 different interventions: professional community nurses; voluntary community health workers (CHWs); a combination of both; and nothing (control). In the nurse-only intervention areas, under-5 mortality fell by 14% during 5 years of program implementation, compared with that before the intervention period (Pence et al., 2007; Phillips et al., 2006). In the volunteer-only villages, under-5 mortality increased by 14%. The professional nurse intervention added approximately $2 per capita to the $6.80 per capita budgeted for PHC services. Note that the study used a "plausibility" rather than a "probability" design, meaning that treatments were not truly randomly assigned.

In the Gambia, Hill et al. (2000) compared PHC and non-PHC communities over a 15-year period. Primary care was assessed by the presence of a community health nurse as a supervisor to village health workers (VHWs) and traditional birth attendants; presence of an expanded program of immunization and a basic package of maternal and child health services; and community participation in healthcare provision, priority setting, and fund raising. The study found that although child mortality declined in intervention and control villages, the decline was generally steeper in PHC villages (Hill et al., 2000). As a type of natural experiment, the authors report that once PHC services were stopped in the villages (because of lack of funds), the trend reversed and infant mortality increased to levels higher than those in control (non-PHC) villages.

Velema et al. (1991) studied access and longitudinality of primary care services to a population of about 13 000 in Benin. In a matched case-control study, 2 factors were particularly influential in predicting death risk: measles vaccination before their first birthday (Odds ratio [OR] = 0.4) and regular contact with VHWs (OR = 0.36). The authors concluded that regular contact with VHWs, which is consistent with the person-focused care over time function of primary care, improves the likelihood of child survival.

In Haiti, the activities of an integrated local health system, based on a PHC model (the Hôpital Albert Schweitzer or HAS), were associated with infant and under-5 mortality that are about half of those in other areas with similar income levels (Perry et al., 2007). This was accomplished through a decades-long partnership with local communities. In terms of resources, HAS had fewer physicians and fewer hospital beds per capita than did the rest of Haiti but more nurses, CHWs, and other outreach and support staff. The HAS system costs about $19 per capita, including community development initiatives (Perry et al., 2006).

Other studies of PHC programs using pre- and postintervention measures and control or comparison groups include the following:

- A large NGO-delivered PHC program (focused on maternal and child health services) targeted about 340 000 poor households in Bangladesh. Services were delivered through trained family health visitors and included regular household visits, illustrating the importance of a family focus in PHC. After 5 to 6 years, program areas experienced a 52% reduction in infant mortality and a 49% reduction in under-5 mortality, larger decreases than those experienced in control areas (Mercer et al., 2004). Another study in Matlab, Bangladesh, showed the impact of a community-based PHC approach employing supervised and trained VHWs (with referrals to health centers staffed by healthcare professionals) on lowering under-5 mortality from acute lower respiratory tract infections by 32% in 2 years (Fauveau et al., 1992). Prior studies in Matlab had also documented reductions in under-5 and maternal mortality due to different PHC interventions (Chen et al., 1983; Fauveau et al., 1991).

- In a cohort study conducted in Pondicherry, India, provision of a broad range of PHC services, including home visits by PHC nurses in 12 villages (total population of about 16 000), decreased infant and child mortality by more than 65% (Dutt & Srinivasa, 1997). Another smaller-scale Indian study assessed the effects of VHW provision of primary and maternity care and health education to pregnant women and grandmothers, resulting in reductions in neonatal mortality by 62% and infant mortality by 71%, as compared with preintervention levels (Bang et al., 1999).

- In Liberia (Becker et al., 1993) and Zaire (Chahnazarian et al., 1993; Taylor et al., 1993), a more selective PHC approach was attributed to reductions in under-5 mortality by as much as 28% over a 5-year period, an improvement that was significantly greater than that reported in comparison areas.

- A study using 2 waves of nationally representative surveys in Indonesia found that,

while holding other village- and maternal-level variables constant, the addition of a maternity clinic and a physician to a village was found to decrease the odds of infant death (relative to an infant born before the clinic existed) by about 15% and 1.7%, respectively (Frankenberg, 1995).

- In Bolivia, a comprehensive community-based PHC program (delivered by paid nurses and community volunteers with some physician support) serving a population of about 15 000 successfully reduced under-5 mortality by more than 52% over a 5- to 6-year period, as compared with control areas (Perry et al., 1998, 2003). Costs for the program were estimated at about $10 per person.
- In Pakistan, a case-control study of children who had diarrhea or acute respiratory tract infections showed that the use of a traditional healer (as opposed to a trained VHW) raised the odds of a child's death by a factor of 14 (OR = 14.5; 95% confidence interval [CI] = 4.23–49.8), and frequent changing of providers (ie, lack of continuity with a PHC provider) raised the odds of death 8 times (OR = 8; 95% CI = 2.22–28.8) (D'Souza & Bryant, 1999).

Studies of countrywide PHC experiences

There have been only a few studies that directly test the hypothesis that health systems based on a strong PHC orientation (based on PHC principles) lead to better overall indicators.

By 1985, Costa Rica's life expectancy had reached 74 years, and infant mortality declined from 60 per 1000 in 1970 to 19 per 1000, levels comparable with those in more developed countries. Explanations for this rapid progress include the development of a universal social security system and a multidimensional approach to health improvement, which included expanding PHC services, investing in education and sanitation, and improving access to secondary and tertiary healthcare services (Haines & Avery, 1982; Klijzing & Taylor, 1982; Rosero-Bixby,

1986). PHC improvements beginning in the 1970s were estimated to have reduced infant mortality by between 40% and 75% (Rosero-Bixby, 1991).

In the 1990s, additional Costa Rican reforms sought to improve PHC coverage and efficiency. A quasi-experimental study comparing 3 groups of districts on the basis of when they adopted PHC reforms found that, in addition to other improvements in living standards, PHC reforms significantly reduced mortality in both adults and children (Rosero-Bixby, 2004a). For every 5 additional years after PHC reforms, child mortality declined by 13% and adult mortality by 4%. The proportion of the population with insufficient access to PHC services declined by 15% in reformed districts compared with only a 2% decline in districts that did not undergo reforms. The reforms additionally improved equity in access by targeting the least privileged population first (Rosero-Bixby, 2004b).

Brazil's family health program (FHP) is now perhaps the largest community-based PHC system in the world. In 2007, the program encompassed more than 27 000 community-based teams responsible for providing care to about 85 million people (Brazilian Ministry of Health, Department of Primary Care, 2006). The FHP is based on an explicit strategy to provide all core primary care functions, including first-contact access for each new need, long-term person-focused care, comprehensive care for most health needs, coordinated care when it must be sought elsewhere, and a focus on the family and the community. These functions are achieved through the program's decentralized organization, elimination of copays for services, incentives to local government for increasing access to the program, and multidisciplinary teams composed of a physician and a nurse who deliver clinic-based care along with CHWs who make regular home visits and perform community-based health-promotion activities (Ministry of Health of Brazil, 2003). Costs for the program (which includes access to pharmaceuticals) are estimated at between $25 and $35 (Macinko et al., 2007). A panel data analysis

of Brazilian states from 1990 to 2002 showed that an increase in FHP coverage by 10% was associated with an average 4.6% decrease in infant mortality, controlling for other health determinants, including water supply, living conditions, doctor and hospital supply, and women's education (Macinko et al., 2006). A follow-up study conducted at the microregional level for 1999–2004 showed that the effect of FHP coverage was especially strong for conditions that are known to be sensitive to primary care (such as postneonatal mortality and deaths from diarrheal diseases) (Macinko et al., 2007). Several studies also demonstrated associations between CHWs and lower infant mortality in specific Brazilian states (Emond et al., 2002; Svitone et al., 2000).

A few other countrywide observations are suggestive of the role of PHC in population health improvements, although these studies do not explicitly quantify the contribution of PHC to health improvements or explicitly test the impact of specific PHC interventions.

Cuba's universal PHC program uses family health physicians and nurses, who provide universal, comprehensive, integrated, and intersectorial care to geographically defined areas with a focus on families (Evans et al., 2008; Waitzkin, 1997). Changes in PHC access, organization, and delivery over the past 40 years correspond to about a 40% decline in infant mortality over the same period, even while other indicators such as gross national product per capita have not substantially increased (Riverón Corteguera, 2000). Investments in prevention integrated into PHC may also have contributed to the control of cardiovascular diseases, resulting in lower-than-expected mortality and fewer avoidable hospitalizations for these and related conditions (Spiegel & Yassi, 2004). Lessons learned from the Cuban experience suggest the potential benefits of organizing an entire health system around the PHC approach (Franco et al., 2007).

In Mexico, child mortality declined from 64 per 1000 live births in 1980 to 23 per 1000 in 2006 (Sepulveda et al., 2006). These reductions were consequent to a strategy that began with a number of disease-specific programs and expanded to a broader strategy that combined vertical programs with more comprehensive PHC and human development approaches, including legislation making access to maternal and child health services a citizen's right (Frenk et al., 2003). Reyes et al. (1997) also found that in Mexico, primary care characteristics (such as adequate referral processes, continuity of care, being seen by the same provider, and being attended in a public facility) had an important, independent effect on reducing a child's odds of dying. Similarly, Gutiérrez et al. (1999) point to the importance of access to primary care (as measured by nurse and physician supply) as well as investments in public health (immunization and improved water and sanitation) and education as particularly important for reducing infant mortality in Mexico.

In Thailand, decreases in under-5 infant mortality occurred after primary care reform, which included developing at least 1 primary care health center for every rural village by 1990 and a government medical welfare scheme started in 1993. In the corresponding decade, under-5 mortality declined by 44% in the poorest population quintile, 41% in the next poorest quintile, 22% in the third, 23% in the fourth, and 13% in the wealthiest quintile (Vapattanawong et al., 2007)

In Indonesia, a 20% reduction in infant mortality during the early 1990s has been attributed to improvements in PHC (Simms & Rowson, 2003). Some evidence for this attribution comes from the observation that in the later 1990s, once primary care spending declined substantially (and hospital spending increased by almost 25%), infant mortality actually *increased* by 14% in almost every province of the country (Simms & Rowson, 2003).

Finally, the 2008 *World Health Report* on PHC presents numerous case studies of PHC experiences. Although it does not contain a systematic review of the evidence on the benefits of PHC, it reviewed the evidence for the benefits of PHC components and concluded that there is an overwhelming justification for a focus on developing and strengthening PHC in all countries (WHO, 2008).

Studies finding little or no impact of PHC on health outcomes

In Niger, a prospective study found that there was no additional survival advantage for children in villages with a "village health team" present, although the presence of a dispensary lowered the odds of death by 32%, as compared with villages with no services (Magnani et al., 1996). In explanation for the apparent lack of an effect, Magnani et al. suggest the need for more comprehensive packages of health services than those delivered by the project, because the single interventions were possibly offset by continued high levels of exposure to other unchanged factors.

In the Philippines, the Bohol project provided very low-cost PHC services to a population of about 400 000 residents for 5 years. The evaluation included pre- and postintervention surveys and comparison with a control village. The project increased the utilization of some health services but did not significantly decrease infant mortality (Williamson, 1982). Williamson suggests that potential reasons for the lack of an effect include the generally poor quality of health services provided, a selective rather than a comprehensive approach to PHC with a strong emphasis on family planning (fertility did decline), and overworked and/or inadequately trained staff.

In a retrospective study with control communities in the Gambia (De Francisco et al., 1994), there were no significant differences ($P = .88$) in under-5 mortality between villages with VHWs and those without them (35.5/1000 vs 35.8/1000). De Francisco et al. suggest that different health service utilization patterns (based on the type of child illnesses) and preferences for traditional healers may partially explain the lack of effect. In addition, there was no indication that these VHWs were achieving PHC functions, including provision of good-quality care and referral to trained healthcare professionals when indicated.

In Brazil, one study found that participation in FHP between 1994 and 1998 did not significantly improve child health indicators in municipalities with high coverage, as opposed to those in municipalities with low or no coverage. Infant mortality declined by 42% and 45.5% in the intervention and control groups, respectively, a nonsignificant difference (Morsch et al., 2001). A possible explanation for the lack of an effect might have been the inability to control for variables related to the performance of primary care services, such as the technical quality of care or accessibility, which vary by municipality.

Finally, in their systematic review of "integration" of primary care in developing countries, Briggs et al. (2001) discuss an essential feature of primary care: the extent to which it provides a range of services meant to attend to most common healthcare problems. This feature of primary care is more often termed "comprehensiveness." The review of Briggs et al. (2001) contains only 4 studies, and they conclude that no overall conclusions can be drawn from their results. As a possible explanation for the lack of a conclusive finding, the authors point to the poor quality of many of the studies conducted, including poor recording of outcomes, inadequate randomization processes, and control groups that were not entirely comparable with experimental groups. Moreover, each study defined and measured integration in a different way.

DISCUSSION

This review of the evidence of the effectiveness of PHC on population health in low-income countries has shown that several analyses provide consistent evidence of the impact of PHC on improved health outcomes. Nevertheless, many studies suffered from important methodological weaknesses, including inadequate controls for individual- or community-level confounders in multivariable analyses. Reductions in infant mortality (the most frequently studied outcome) attributed to PHC actions averaged about 40% and varied from 0% to as high as a 71% over intervention periods ranging between 2 and 10 or more years. Costs for comprehensive PHC programs ranged from about $10 to $35 per capita per year.

Despite the apparent consistency of results, analysis of the studies revealed that PHC has only rarely been evaluated in a consistent and reproducible way. Rather, it is often only various aspects of health services that are assumed to be part of PHC that have been the focus of attention. For example, all but 3 studies measured PHC exposure as residence within a geographic area in which the PHC program or project was implemented. In addition, the definition of the PHC program also varied considerably, from the mere presence of a VHW in a community to the use of specific services to the development of an integrated network of health and social services in the community. For this reason, there is little that can be gleaned regarding the mechanisms by which these PHC approaches might achieve important primary care functions, such as first-contact access, longitudinality, comprehensiveness, and coordination of care.

The general failure to use an operational conceptualization of PHC has also made identification of studies about PHC difficult. For this reason, the literature probably contains more evidence than is discoverable from the abstracts or titles of published articles.

Publication bias is also likely to have limited the scope of this review. Many successful (as well as unsuccessful) experiences have simply not been documented in peer-reviewed journals. As an illustration, we were unable to retrieve any peer-reviewed articles that adequately assessed the impact of PHC on population health in Sri Lanka, China, or Vietnam, although each country's PHC approach has been discussed elsewhere as "successful"(Bloom, 1998; Fritzen, 2007; Halstead et al., 1985).

In addition, there is little peer-reviewed evidence on the role of PHC on improvements in adult health in low- and middle-income countries, because most published studies have focused only on infant and under-5 mortality. Thus, the potential for PHC to help control adult chronic and infectious diseases in the developing world remains largely unexplored.

The studies that found no effect of PHC on health indirectly provide support for a comprehensive approach to PHC: most involved interventions that focused only on selective PHC tasks. They also point to the importance of accurately measuring variations in the technical quality of primary care delivered, a topic that certainly deserves far more attention in the literature reviewed here.

In view of the limitations of these studies, an agenda for the evaluation of the contribution of PHC tasks and functions to population health would benefit from the following considerations.

First, a clear conceptualization of primary care is needed, including specification of each of its component features, for example, first-contact access and use, longitudinality (person-focused care over time), comprehensiveness (addressing the breadth of common health needs), and coordination (integration of services with other levels of care).

Second, studies should start with a conceptual framework to guide the overall evaluation, design the characteristics under consideration, and describe relationships among different levels and types of data to be collected in the evaluation process. This framework should provide a model of how primary care is conceptualized in relation to biological, social, and environmental influences on health (Starfield, 2001).

Third, future studies require clear specification and measurement of the PHC *system*, including specific structural characteristics (input and policy), process (service delivery modalities), and relevant health outcomes and outputs.

Fourth, as noted throughout the PHC literature (Chen et al., 1993; Hill et al., 2000), there is still an urgent need for more rigorous research designs that allow testing of the independent effect of primary care on outcomes over time. This should include individual- and community/contextual-level data derived from longitudinal sources, appropriate control or comparison groups, and control for relevant individual- and contextual-level covariates. Such evaluations will require a commitment from donor organizations and national governments to provide necessary resources and to ensure the scientific integrity of the research process.

In the short term, 3 approaches could be implemented to aid in providing more

systematic evaluation of primary care, as follows:

1. Existing or planned cohort studies could begin to incorporate PHC measures through the use of validated instruments such as the Primary Care Assessment Tools (Harzheim et al., 2006; Macinko et al., 2007; Pasarin et al., 2007).

2. Standardized surveys such as the Demographic and Health Surveys or Living Standards Measurement Surveys could include modules derived from the Primary Care Assessment Tools along with health system variables to identify how and where populations are receiving effective PHC services.

3. Researchers could direct their attention to countries that are currently undergoing reform of their primary care system, thus opening the possibility for analysis of natural experiments in which reformed states or municipalities could be compared with otherwise similar regions without reformed primary care systems. Better yet, experimental assignment of different PHC approaches could be used to help phase in reforms and more rigorously evaluate their impact (King et al., 2007).

Finally, there is a need to encourage the publication of evaluations of PHC experiences, both successful and unsuccessful, so that the PHC approach can be guided by a wider body of high-quality evidence.

CONCLUSION

The WHO proposal for renewing PHC reinforces the idea that strengthened health systems should be viewed as a necessary (though not sufficient) condition for meeting internationally agreed-upon development goals such as those contained in the Millennium Development Goals (WHO, 2008). Basing health systems more strongly on PHC represents an important strategy to address emerging health problems (Fuster & Voute, 2005), scale up existing interventions, and effectively combat health threats such as HIV/AIDS (Buve et al., 2003), tuberculosis (Mahendradhata et al., 2003), chronic illnesses (Rothman & Wagner, 2003), and others.

These observations are also relevant to the renewal of primary care in the United States. Recently, the American Academy of Family Physicians, the American Academy of Pediatrics, the American College of Physicians, and the American Osteopathic Association (2007) united to endorse the "Joint Principles of the Patient-Centered Medical Home," which describes characteristics of a patient-centered medical home (PCMH) as including a personal physician, physician-directed medical practice, whole-person orientation, coordinated and integrated care, quality and safety, enhanced access to care, and payment that "appropriately recognizes the added value provided to patients. . .." Lessons learned from the evaluation of PHC in the developing world may also have relevance to the assessment of the PCMH, as it is apparent that definitions and tools of measurement should be consistent, standardized, and based on evidence of effectiveness of primary care components. Without greater attention to these aspects, the PCMH model may fall short of reaching its goal of renewing a PHC approach to healthcare organization and delivery in the United States.

As national governments, the WHO, and other international organizations move to renew their PHC strategies, greater clarity in specifying PHC in terms that allow for more standardized measurement and investment in rigorous evaluation of PHC effectiveness and its effects on equity will be essential.

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Appendix

Review of Literature on the Evaluation of Primary Healthcare in Developing Countries

Country/region (reference)	Type[a]	Population	PHC measures	Main outcome	Impact/result
Bangladesh (Mercer et al., 2004)	C	Women and children	Presence of a family health visitor to provide family planning counseling, contraceptives	Infant, under-5, and maternal mortality	Infant mortality declined in the 12 NGO areas in 1999–2002 from 52.8 to 28.3/1000 (among the poorest children) and from 41.6 to 28.2/1000 among other children. From 2000 to 2002, under-5 mortality declined from 15.8 to 9.7/1000 (poorest) and from 10.8 to 9.2 /1000 among other children.
Bangladesh (Fauveau et al. 1991, 1992)	C	Children younger than 5 y in Matlab	Presence of CHWs	Cause-specific under-5 mortality	For all children younger than 5 y in the intervention area, ALRI-specific mortality from 1986 to 1987 was 28% lower in the intervention area than in the comparison area ($P < .01$). From 1988 to 1989, the mortality was 48% lower in the intervention area than in the control area. ALRI-specific mortality in all children younger than 5 y in the intervention area declined ($P = .003$) by 32% between 1986/1987 and 1988/1989.
Benin (rural) (Velema et al., 1991)	D	Children 4–35 mo of age	Visit to VHWs	Under-5 mortality	Measles vaccination before the first birthday (an indicator of access) reduced risk of death ($R^2 = 0.4$); children in regular contact with a VHW had lower risk of death ($R^2 = 0.3$).
Bhutan (Bohler, 1994)	E	Infants	VHW activities (health education, vaccination, treatment)	Infant mortality	Infant mortality was reduced significantly from 145 in 1984 to 49 in 1991 ($P < .001$). During both periods (1984 and 1991), children of mothers with a high birth frequency had significantly higher infant mortality (268 in 1984 and 93 in 1991) than those with low birth frequency (47 in 1984 and 12 in 1991) ($P < .001$ for 1984 and $P = .002$ for 1991).

(*continues*)

Country/region (reference)	Type[a]	Population	PHC measures	Main outcome	Impact/result
Bolivia (Perry et al., 1998, 2003)	C	Children in intervention and nonintervention areas	Comprehensive public health services, including improvement of clean water and sanitation	Under-5 mortality	In 1992–1993, under-5 mortality was 205.5/1000 (comparison areas) and 98.5/1000 (intervention areas), a difference of 107/1000 deaths ($P < .001$, 95% CI = 141.3–72.7) or 52.1% (95% CI = 35.2–68.8%) lower mortality in the intervention areas. Program costs estimated at about $10 per capita.
Botswana Cote d'Ivoire, Ghana, and Zimbabwe (Dugbatey, 1999)	G	National policies of 4 countries	Health education, food, nutrition, water, sanitation, maternal/child health policies	Infant mortality, life expectancy	Botswana and Zimbabwe performed better than Cote d'Ivoire and Ghana in terms of health outcomes. This relationship did not appear to be related to income only because richer countries (Cote d'Ivoire) scored worse than Zimbabwe and Ghana. The author concludes that "policies formulated and implemented in accordance with key PHC principles could account for improvements in national health status."
Brazil (Macinko et al., 2006, 2007)	A	Brazilian population (states and microregions)	Proportion of population covered by the FHP	Infant mortality	A 10% increase in FHP coverage was associated with a 4.5% decrease in infant mortality, controlling for all other health determinants ($P < .01$). Access to clean water and hospital beds per 1000 were negatively associated with infant mortality, whereas female illiteracy, fertility rates, and mean income were positively associated with infant mortality. The program may reduce infant mortality at least partly through reductions in diarrhea deaths.
Brazil (Morsch et al., 2001)	C	Infants in different municipal areas	Community health agents program coverage	Infant mortality	Participation in the program between 1994 and 1998 did not significantly improve child health indicators compared with no participation. The proportionate infant mortality declined by 42% and 45.5% in the intervention and control groups, respectively; and the differences were not significant.

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Country/region (reference)	Type[a]	Population	PHC measures	Main outcome	Impact/result
Brazil (Natal) (Emond et al., 2002)	C	Women, pregnant women, and children younger than 5 y	Coverage by VHW program	Maternal and infant mortality	After 30 mo, community surveys reported a significant reduction in infant mortality from 60/1000 to 37/1000; decreased maternal mortality; improved infant feeding and caretaking practices; improved immunization rates; increased rates of consultation with physicians; and a greater percentage of births taking place in community clinics rather than in hospitals.
Brazil (Ceará) (Svitone et al., 2000)	E	Mothers and children in Ceará state	Coverage by community health agents program	Infant mortality (by cause)	Percentages of breast-feeding, giving ORT, receiving prenatal care, vaccination coverage, institutional deliveries, and infant mortality improved. Program success includes longitudinality; family and community orientation, first contact, and intersectorial collaboration. Weaknesses include referral mechanisms, access barriers, and living conditions.
Costa Rica (Rosero-Bixby, 1991, 2004a, 2004b)	A, A	Infants and women	District level, based on when they began the health reform process	Infant mortality and fertility	Reform of primary care significantly reduced mortality in both adults (2%) and children (8%). For every 5 additional years of reform, child mortality was reduced by 13% and adult mortality declined by 4%. Population with limited access to health services decreased 15% in reform areas (only 2% in nonreform areas). In multivariate analyses, from 1970 to 1980, PHC accounted for 41% of infant mortality declines, other medical care (32%), socioeconomic progress (22%), and fertility decline (5%).
Cuba (Franco et al., 2007; Riverón Corteguera, 2000)	G, G	Infants and adults	Description of PHC services, organization and service delivery, and policies	Infant mortality, cardiovascular disease mortality (adults)	Changes in access, organization, and delivery of PHC over 40 y associated with 40% decline in infant mortality in the 1970s, 1980s, and 1990, while socioeconomic conditions remained similar.

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Country/region (reference)	Type[a]	Population	PHC measures	Main outcome	Impact/result
The Gambia (Hill et al., 2000)	C	Children	Presence of the PHC program (nurses, CHWs, TBAs, supplies, services, participation)	Infant and under-5 mortality	Infant and under-5 mortality declined in both PHC and non-PHC villages. The decline was sharper in PHC villages (infant mortality 134/1000 to 69/1000) vs non-PHC villages (155/1000 to 91/1000). Since 1994, after support and funding for PHC declined, the trend reversed (infant mortality 98/1000 in PHC villages vs 78/1000 in non-PHC villages).
The Gambia (De Francisco et al. 1994; Greenwood et al., 1990)	C, C	Children younger than 5 y	Vaccination, healthcare use, health education, environmental health, nutrition, treatment, and referrals by VHWs and TBAs	Child mortality	No significant difference ($P = .88$) in under-5 mortality between villages with VHWs and those without (rate = 35.5 per 1000/y vs 35.8 per 1000/y).
Ghana (Pence et al. 2007; Phillips et al., 2006)	A	Women and children in intervention areas	Presence of a professional nurse, volunteers, and both in different communities	Infant and under-5 mortality	The study combined 4 arms: professional nurses (under-5 mortality declined by 14% in 5 y), local health volunteers (under-5 mortality increased by 14%); a combination of both (under-5 mortality increased by 8%; and no new interventions (under-5 mortality decreased by 4%).
Ghana (Afari et al., 1995)	C	Children younger than 5 y in 3 villages	Provision of services (health education on infant feeding, disease prevention, and drug distribution)	Infant and under-5 mortality	PHC services decreased infant and child mortality and improved the health of children in the villages. Infant mortality declined from 114.6/1000 live births in 1987 to 40.8/1000 live births in 1990. Under-5 mortality decreased from 155.6/1000 live births in 1987 to 61.2/1000 live births in 1990.

(continues)

Country/region (reference)	Type[a]	Population	PHC measures	Main outcome	Impact/result
Haiti (Perry et al., 2006, 2007)	C	Population covered by HAS	Provision of integrated primary, secondary, and tertiary care to people living within HAS catchment areas	Infant and under-5 mortality	Infant and under-5 mortality reported 50% lowering in HAS areas than that in the rest of Haiti. Infant mortality in HAS areas declined in the mid-1970s and has remained at around 62–66/1000. Infant mortality in the rest of Haiti has declined from nearly 4 times higher (224 in 1971–1973) to about 2 times higher (119/1000) in 1999. HAS includes comprehensive community-based PHC, intersectoral actions, and referral hospitals.
India (Bang et al. 1999, 2005)	C, C	Neonates and infants in intervention and nonintervention areas	Activities of CHWs	Neonatal, infant, and perinatal mortality	Home-based neonatal care reduced neonatal mortality at the end of the third year of intervention by more than the targeted 25%. In intervention areas, neonatal mortality reduced from 62.0/1000 live births at baseline (1993–1995) to 25.5/1000 live births at year 3 (1997–1998), reflecting a 62.2% net percentage reduction ($P < .01$). Similarly, infant mortality declined from 75.5/1000 live births to 38.8/1000 live births (45.7% net reduction) and perinatal mortality declined from 68.3/1000 births to 47.8/1000 births (71.0% net reduction) in intervention areas ($P < .01$). Gains were sustained after 7 y.
India (Dutt & Srinivasa, 1997)	B	Infants followed from birth to 5 y of age	Availability of medical facilities, antenatal and under-5 clinics, home visits by public health nurses, health education, nutrition supplements	Infant and child mortality; child survival index	Provision of adequate maternal and child health services improved child survival, decreased infant and child mortality. Resulted in high child survival index of 91.2%; infant mortality declined from 201/1000 in 1967 to 64/1000 live births in 1989, whereas child death rates decreased from 39.4/1000 in 1970 to 18/1000 in 1992 among children 1–4 y of age.

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Country/region (reference)	Type[a]	Population	PHC measures	Main outcome	Impact/result
India, Nepal, Tanzania, Togo (Briggs et al., 2001)	F	Published studies	Integrated primary care delivery vs vertical primary care services	Varied	In one study, integration showed a positive effect on outputs; in another study, integrated programs had outcomes similar to those of vertical programs. In the remaining 2 studies, integrated programs performed worse than vertical ones.
Indonesia (Frankenberg, 1995)	D	Infants	Service availability	Infant mortality	Within a village, an increase of 1 maternity clinic decreases the odds of death of an infant with access to that clinic by about 15%, relative to the infant born before the clinic existed. An infant born after health workers are added to a village has about 1.3% ($P < .1$) lower odds of death than an infant born before the addition of health workers.
Liberia (Becker et al., 1993)	C	Women and children in program and nonprogram areas	Presence of the Combating Childhood Communicable Disease project	Infant and under-5 mortality	Immunization and malaria treatment increased in intervention areas and infant mortality declined by 25% and under-5 mortality declined by 28% from baseline levels. Note that this was a selective PHC intervention focused on tetanus and childhood immunizations, ORT, and malaria treatment.
Mexico (Reyes et al., 1997)	D	Infants	Primary care (no. of physicians seen, no. of visits, private or public physicians, antibiotics, hospital referral, access)	Infant mortality from ARI	Primary care processes had an independent effect (controlling for individual and family socioeconomics, access to care) on ARI deaths (OR = 9.68, 95% CI = 3.59–26.1). Significant predictors included inadequate referral, lack of continuity (attended by multiple physicians), and being attended by a private provider (as opposed to a public provider).

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Country/region (reference)	Type[a]	Population	PHC measures	Main outcome	Impact/result
Mozambique (Edward et al., 2007)	C	Children younger than 5 y	IMCI program coverage	Infant and under-5 mortality	Implementation of activities associated with the IMCI program resulted in a 66% reduction in infant mortality and a 62% reduction in under-5 mortality.
Niger (Magnani et al., 1996)	C	Children younger than 5 y	Geographical proximity and the use of health services	Under-5 mortality	Children in villages with a dispensary were 32% less likely to have died during the study period than were children in villages with no services. No survival advantage in villages with the village health team present.
Pakistan (D'Souza & Bryant, 1999)	D	Children in 6 Karachi slums	Health service use (type of provider, longitudinality, ability to explain clearly)	Infant mortality	The use of traditional healers (as opposed to trained VHWs or doctors) (OR = 14.52; 95% CI = 4.23–49.83) and frequent switching of healthcare providers (lack of longitudinality) (OR = 8; 95% CI = 2.22–28.81) as increasing the odds of infant death from respiratory infections or diarrhea.
The Philippines (Williamson, 1982)	C	Women and children in the project area	PHC centers (midwives, (drugstores, hospital units)	Infant mortality	The program had no effect on infant mortality. Potential reasons include poor quality or quantity of health services, a selective approach to PHC with emphasis on family planning (fertility did decline), overworked and/or inadequately trained staff.
Senegal (Pison et al., 1993)	E	Infants in intervention areas	Presence of integrated PHC program in the area of study	Under-5 mortality	Under-5 mortality declined from 350 to 81 deaths/1000 live births from 1970 to 1993. Reductions seen primarily from diseases prevented by immunization. Diarrhea and ARIs are lower than in other rural areas of Senegal; only 4% of deaths attributed to malaria.
South Africa (Coleman et al., 1998)	E	Adults with chronic illnesses	Clinics using updated protocols for the management of chronic diseases	Control of chronic diseases	The utilization of protocols enabled local nurses to control clinical conditions of 68% of patients with hypertension, 82% of those with non–insulin-dependent diabetes, and 84% of those with asthma. Patient-reported adherence to treatment increased from 79% to 87% ($P = .03$) over 2 y. Decreased utilization of hospitals for routine care.

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Country/region (reference)	Type[a]	Population	PHC measures	Main outcome	Impact/result
South Africa (den Besten et al., 1995)	E	Children younger than 5 y	Provision of GOBI-FFF services (growth monitoring, ORT, breast-feeding, immunization, family planning, food supplementation, female education)	Under-5 morbidity	PHC activities improved anthropometric of children younger than 5 y between 1982 and 1990. The prevalence of underweight increased from 28% to 31% from 1982 to 1984, and then declined to 23% and 19% in 1988 and 1990, respectively ($P < .01$). The prevalence of stunting decreased steadily from 33% in 1982 to 17% in 1990. The low prevalence of low weight for height (wasting) declined from 5% in 1982 to 1% in 1990 ($P < .01$). The prevalence of severe malnutrition increased from 3% in 1982 to 14% in 1984 and then declined rapidly to 5% in 1988 and to 4% in 1990.
Zaire (Chahnazarian et al., 1993; Taylor et al. 1993)	C	Women and children in program and nonprogram areas	Presence of the Combating Childhood Communicable Disease project	Under-5 mortality	Intervention included tetanus and childhood immunizations, ORT, malaria treatment. Under-5 mortality declined by 33% from baseline levels. The intervention was "estimated to have reduced mortality at ages 6–35 mo by at least 18%–23% associated with the change in the incidence of measles and may have been responsible for the full 28% reduction recorded between 1980–1984 and 1985–1989."
Kenya, Madagascar, Malawi, Tanzania, Zambia (Brockerhoff & Derose, 1996)	G	Neonates, infants, and children younger than 5 y from Demographic and Health Surveys	Use of prenatal care and immunization coverage	Neonatal, infant, and under-5 mortality	Selective PHC services have an important impact on child survival. In terms of attributable risk, incomplete immunizations are responsible for 34% of deaths, lack of clean water for 16%, inadequate prenatal care and delivery for 11%, and high fertility for 12%, while controlling for other health determinants (covariates include socioeconomic and biologic status and infrastructure).
Latin America (22 countries) (Moore et al., 2003)	A	Children in 22 Latin American countries	Vaccination coverage, use of ORT, breast-feeding, physician supply	Under-5 mortality	Five main variables were associated with reduced under-5 mortality: female literacy, BCG vaccination rate, access to safe water, use of ORT, and gross national product per capita.

Abbreviations: ALRI, acute lower respiratory infection; ARI, acute respiratory infection; CHW, community health worker; CI, confidence interval; FHP, family health program; HAS, Hospital Albert-Schweitzer; IMCI, integrated management of childhood illness; ORT, oral rehydration therapy; OR, odds ratio; PHC, primary healthcare; TBA, traditional birth attendant; VHW, village health worker.

[a]A, experimental or quasi-experimental; B, prospective design with control; C, repeated cross-sectional design with comparison/control; D, case-control study; E, repeated cross-sectional design without comparison control; F, systematic literature review; G, observation/qualitative/single cross-section.