

Rapid achievement of the child survival millennium development goal: evidence from the Navrongo experiment in Northern Ghana

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Summary

OBJECTIVE To determine the impact of deploying nurses and volunteers to village locations on demographic and health outcomes.

METHOD We implemented an experimental design that emphasizes the value of aligning community health services with traditional social institutions that organize village life. Data for this analysis come from the Navrongo demographic surveillance system, a longitudinal database that tracks fertility, mortality, and migration events over time. The experiment uses conventional demographic methods for estimating mortality rates from longitudinal demographic surveillance registers.

RESULTS Posting nurses to community locations reduced childhood mortality rates by over half in 3 years and accelerated attainment of the childhood-survival millennium development goal (MDG) in the study areas relative to trends observed in comparison areas.

CONCLUSION Results from the Navrongo experiment demonstrate that community health and family planning programmes can have an impact on childhood mortality. Posting nurses to communities can dramatically accelerate the pace of progress in achieving the childhood-survival MDGs. Community-volunteer approaches, however, have no additional impact, a finding that challenges the child survival value of international investment in volunteer-based health programmes. The total cost of the intensive arm of the project is less than \$10 per capita per year. Navrongo research thus demonstrates affordable means of attaining the child survival MDG agenda with existing technologies.

keywords child survival, Ghana, Millennium Goal

Background and introduction

By United Nations consensus, all African countries aim to reduce childhood mortality by two thirds over the 25-year period ending in 2015. Yet, with only a decade remaining in the millennium development goal (MDG) framework, morbidity, poverty, and mortality trends are stagnant or growing in many African countries (UN 2006). Gains that were made in the 1960s, 1970s, and 1980s (Hill 1993) have been eroded by the HIV/AIDS pandemic and the persistence of endemic childhood illnesses (Nicoll *et al.* 1994; Timaeus 1997, 1999; Bawah & Zuberi 2005). While there is general consensus that the persistence of poverty in the region underlies the African health crisis, there is little agreement on specific policies and actions that can resolve this problem (Gwatkin 2002).

This paper reports on health development achievements of the Navrongo Health Research Centre (NHRC), an institution of the Ghana Ministry of Health/Ghana Health Service constituted to conduct research on health policy issues. The NHRC is located in an impoverished rural district of Northern Ghana that exemplifies many of the health development challenges of rural Africa. At the time of the founding of the Centre in 1992, mortality rates were well above national levels and cultural traditions sustained high fertility (Binka *et al.* 1995; Adongo *et al.* 1997). The economy in the study area was dominated by subsistence agriculture, literacy was low; particularly among women, and traditions of marriage, kinship, and family building emphasized the economic and security values of large families. Health decision-making was strongly influenced by traditional beliefs, animist rites, and poverty. Parental

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health-seeking behaviour was governed by tradition rather than knowledge of modern health care options. In response to this challenging environment, various experimental projects were launched by the NHRC to test technologies and new ways of delivering services that combine strategies for improving access to health technologies with mobilization of cultural traditions of community leadership, organization, and communication. To gauge the impact of these intervention programmes, a continuous demographic surveillance system was established to collect information on basic demographic indices such as births, deaths, and migrations (Binka *et al.* 1999). Demographic surveillance and experimental research, conducted in the context of great poverty and adversity, makes the NHRC an international resource for testing strategies for meeting the MDGs in the rural African context.

Recent mortality trends in Africa, Ghana, and the Upper East Region

Although Sub-Saharan Africa has 15% of the world's under-five children, the region accounts for over half of all under-five deaths. The poor performance of many African economies explains the continued prominence of preventable illnesses such as malaria, tuberculosis, and diarrhoea, and the emergence of HIV/AIDS (Hill 1993; Nicoll *et al.* 1994; Caldwell 1997; Timaeus 1999). If current trends continue, mortality rates for under-fives in the region will have fallen by less than a quarter by 2015. The recent upswing in mortality signals an urgent need to rethink strategies for promoting child survival.

Ghana exemplifies the challenges of reducing childhood mortality in Africa. Successive Ghana Demographic and Health Survey (GDHS) results show that national gains in child survival have been stalled and that decreases in infant and child mortality have been reversed in all areas of the country except the Upper East Region, where the NHRC is located. As Figure 1 shows, national infant mortality rates declined from 77 in 1988 to 57 in 1998 and then increased again to 64 in 2003. Similarly, under-five mortality dropped from 155 to 108 in 1998 and rose to 111 in 2003. In contrast to these national trends, the Upper East Region sustained trends in recent years that were evident in the 1980s and 1990s. According to the 2003 GDHS, the Upper East Region infant mortality rates declined monotonically from 84.5 to 33 (Figure 1) and under-five mortality from 187.7 to 79 over the 1993 to 2003 period (Ghana Statistical Services *et al.* 2004). These declines have occurred despite the fact that the Upper East is Ghana's poorest and most remote region. Progress achieved in the locality cannot be explained by rapid economic progress or social change.

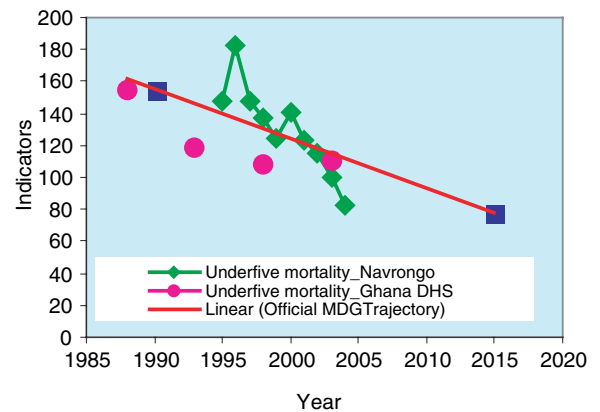


Figure 1 Trends in under-five mortality in Ghana and the MDG targets.

Health programmes in the Upper East Region may explain the contrast between the sustained childhood mortality decline in the region and stagnation elsewhere in Ghana. The Upper East Region is home to the NHRC, where various research studies on the causes of ill health and feasible interventions have had major effects on childhood survival that contribute to the trends evident in Figure 1. Other districts in the region have been at the forefront of national programmes for scaling up Navrongo research results. The NHRC has tested and introduced low-cost technologies and community health service strategies that have had a pronounced combined effect on childhood survival in Kassena-Nankana District. Mortality indices from the demographic surveillance over the past decade have shown drastic reductions in both infant and childhood mortality. Infant mortality declined by 34.5%, from 129.1 during the 1994–1995 period to 84.66 in 2003, while under-five mortality declined by 43.6% from 147.2 to 82.9. If these trends continue, the child survival MDG may be achieved in the study district in the next few years (Figure 2).

We present results from a study of the impact of alternative approaches to developing accessible community health services. This project, known as the Community Health and Family Planning Project (CHFP), was launched as a three-village pilot in 1994 and scaled up to a district-wide factorial trial in 1996. The experimental cells of the study were sustained until 2004 when treatment area services were scaled up throughout Kassena-Nankana District. The design of the CHFP permits the results to be interpreted in reference to a comparison area where the district-wide impact of two previous studies had significant and known effects on child survival: The Vitamin A Supplementation Trial (VAST) and the Insecticide Impregnated Bed net Trial.

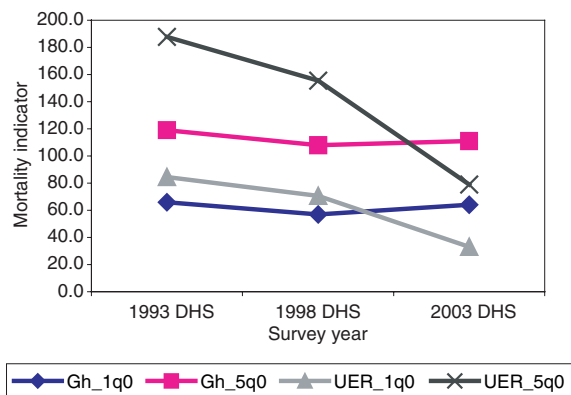


Figure 2 Under-five annual mortality rates by CHFP cell, 1994–2003.

Vitamin A Supplementation Trial was a randomized placebo-controlled experiment conducted in Kassena-Nankana District over the 1989 to 1991 period which showed that repeated large doses of vitamin A reduced all-cause mortality by nearly 19% in children who received vitamin A compared with the group that received placebo. Episodes of morbidity also decreased significantly among children who received vitamin A, leading to fewer hospital admissions (Ghana VAST 1993). Vitamin A distribution was scaled up throughout the district in response to these results. Although supplementation became official policy in Ghana, implementation of the policy was only initiated in the Upper East Region.

After VAST, a community-based, randomized trial of the mortality impact of permethrin-impregnated bed nets was launched (Binka *et al.* 1996). The trial showed that the use of these nets was associated with a 17% reduction in all-cause mortality in children aged 6 months to 4 years. In response to this trial, bed nets were introduced in all study area clusters and promotion of bed net use was adopted as national policy. As in the case of the VAST results, findings were more rapidly scaled up in the Upper East Region than in other regions of Ghana. Results from the latest demographic and health survey show that bed net use in the Upper East region is 21% compared with the national average of 3% (Ghana Statistical Services *et al.* 2004). Taken together, the impact of these experiments, when scaled up throughout the district, undoubtedly contributed to the rapid decline in childhood mortality that is portrayed in Figure 2. By 2004, under-five mortality in the district was only slightly higher than the national goal of reducing it to 78 by 2015.

The question is whether convenient community-based health services can add to the impact of vitamin A supplementation and bed net introduction. The CHFP was

launched in 1996 to the impact of alternative strategies for making a package of known health technologies conveniently available in village locations. This trial was a randomized plausibility trial of the relative impact of two sets of strategies for introducing community health services in the communities of Kassena-Nankana District (Binka *et al.* 1995): One arm of the CHFP tested the impact of augmenting clinical services with community-based volunteer provided health services, and building revolving funds and user fees into operations to ensure sustainability. Inspired by elements of the UNICEF/WHO-sponsored Bamako Initiative (UNICEF 1995), the package of interventions was designed to translate the social institutions that organize African daily life into mechanisms for organizing, financing, and sustaining community health services (Knippenberg *et al.* 1990; UNICEF unpublished; Agyepong *et al.* 1992; McPake *et al.* 1993; Habicht *et al.* 1999). Supervisors were trained and deployed to recruit community health volunteers, organize community supervision of their work, and manage essential health resources that communities would sustain through user fees and revolving accounts.

The second experimental arm was configured in response to the limited range of services that volunteers and health committees could provide by deploying 'Community Health Officers' to village locations. By 1994, nearly 2000 nurses had been hired, trained for 18 months, and posted to districts throughout Ghana to supplant the Village Health Worker (VHW) initiative. As nurses lacked facilities in communities where they could reside and work, their services remained sub-district health centre based, and located on average >10 km away from rural households. The Navrongo project attempted to solve this problem by engaging communities in the task of constructing dwelling units with volunteer labour, while providing community backstopping and support for resident nurse-provided services.

The two sets of strategies were implemented as arms of a quasi-experimental study for testing the impact of community mobilization with volunteer services *vs.* deploying nurses to communities *vs.* the joint effect of both sets of strategies combined. A fourth cell served as a comparison area. Clusters of villages were randomized into four contiguous areas, comprising cells of a plausibility trial with child survival as the endpoint (Phillips *et al.* 2006). Impact was assessed with surveillance of all demographic events in a total population of 139 000 observed at 90-day intervals, a process that began well before the experiment in mid-1993 and continues until the present, including a period extending from 2004 to 2005 when the 'cell 3' service strategy was scaled up throughout Kassena-Nankana District. Open cohorts of under-five children

ever exposed to residence in each of the four experimental zones over this period comprised the study population.

Results

Posting nurses to community locations reduced childhood mortality rates substantially over 8 years and accelerated progress towards the childhood-survival MDG in the two study areas relative to trends observed in comparison areas. Developing volunteer services has no impact on child survival, however, and shown by the fact that the slope in the cell where volunteers worked without the presence of a nurse followed the same trajectory as in comparison areas, indicating that volunteers made no incremental contribution to survival. As expected, a comparison area downwards trend in mortality was evident owing to the effect of the bed net introduction, vitamin supplementation, and other interventions involving the introduction in critically needed health technologies. However, declines were more pronounced in communities where nurses were assigned than in other communities.

This finding is corroborated by qualitative research on parental health-seeking behaviour. Parents dealing with childhood illness tend to seek traditional healers as their first provider owing to deferred payment customs and social arrangements that make traditional healing a more feasible option for impoverished families than clinical care. Volunteers lack the credibility to change this dynamic, while community nurses substitute for traditional health-seeking practices. Nurses working in concert with chiefs and elders develop social insurance mechanisms that elude other modern health care providers. By co-opting social trust customs that traditional healers employ to facilitate prompt health-seeking behaviour, community-based nurses provide modern health technologies without the delays that were previously associated with clinical care. Reducing parental health-seeking delays introduced major gains in child survival. While volunteers made no contribution to child survival, they contributed to reproductive health impact. Therefore, the 'combined cell' has been adopted as the service model for the national health programme.

Conclusion

Findings from the Navrongo CHFP demonstrate that it is possible to achieve rapid reductions in childhood mortality even in the context of extreme poverty, social isolation, and traditionalism. This finding is relevant to policy deliberations throughout Africa where initial child survival gains witnessed in the 1960s and 1970s are being eroded. A 2005 United Nations review noted the

upwards turn in mortality in some countries and that general trends bring into question prospects for achieving the MDG goals in the region. A recent review by Sachs and McArthur (2005) nonetheless asserts that success in the remaining decade is achievable. Results from the Navrongo experiment lend strong empirical support to this assertion and thus provide a promising blueprint for achieving the child survival MDG. By combining the provision of cheap and effective technologies with strategies for mobilizing community participation and extending access to nursing services, Navrongo has demonstrated feasible means of accelerating the pace of child survival improvement. If trends observed in this analysis were extrapolated by a year, the national child mortality MDG goal of 78 would have been surpassed in 2005 (Figure 3). While international investment in developing new technologies is critically needed, Navrongo community health research demonstrates the need for investments that make existing, effective, and cheap modalities conveniently available.

Ghana is now in the process of scaling up service strategies and technologies that have been successfully developed and tested in Navrongo (Nyonator *et al.* 2006). Beginning with a programme of replication trial, involving the transfer the CHFP to ten 'lead districts', community health services were found to be replicable and sustainable with existing resources (Antwi *et al.* 2004; Awoonor-Williams *et al.* 2004). In response to this successful replication programme, a national scaling up initiative was launched in 2000 with the goal of extending the CHFP cell three service model to every community in Ghana (Nyonator *et al.* 2005). By the beginning of 2006, elements of this programme had reached 104 of the 138 districts of Ghana. Monitoring operations show that 10% of Ghana's population is now served by the Navrongo model for community health services (<http://www.ghana-chps.org>).

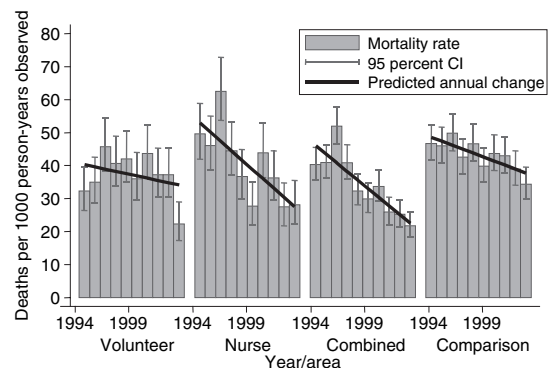


Figure 3 Under-five mortality rates by CHFP cell, 1994–2003.

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By testing replication and scaling up operations, Ghana has demonstrated that the CHFP is not merely an experimental study; the project has been an instrument for national community health service reform.

Not all CHFP strategies worked, however, and scaling up has therefore focused on cells of the project that were found to be successful. In particular, posting nurses to communities for the treatment of childhood illness accelerates progress in achieving the child survival MDG, but where volunteers worked alone there was no impact on survival. Volunteers nonetheless play a useful role as health mobilizers who assist nurses in reaching men with family planning advice (Phillips *et al.* 2006). Therefore, the Navrongo combined nurse and volunteer cell has become the national model for community health services. Costs of this strategy are low, but not trivial. During the study period, nurse posting required additional revenue of €1.53 per capita per year over and above the usual Government of Ghana primary health care revenue budget of €5.44 per capita (Akazili & Phillips, unpublished manuscript). Thus, an investment of less than €8 per capita per year can accelerate efforts to achieve the child survival MDG in a sub-Saharan African setting.

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Atteinte rapide de l'objectif de développement du millénaire sur la survie de l'enfant: Évidence de l'expérience de Navrongo au nord du Ghana

OBJECTIF Déterminer l'impact du déploiement d'infirmières et de volontaires au sein des villages sur les résultats démographiques et de santé.

MÉTHODE Nous avons mis en place un concept expérimental qui souligne la valeur de l'alignement des services de santé communautaires avec les institutions sociales traditionnelles sur lesquelles est organisée la vie de village. Les données de cette analyse proviennent du système de surveillance démographique de Navrongo, une base de données longitudinale qui suit la fertilité, la mortalité et les événements de migration en fonction du temps. L'expérience emploie des méthodes démographiques conventionnelles pour estimer les taux de mortalité à partir des registres de surveillances démographiques longitudinales.

RÉSULTATS Le placement d'infirmières au sein même des communautés a réduit de plus de la moitié, en trois ans, les taux de mortalité infantile et accéléré l'atteinte de l'objectif de développement du millénaire sur la survie de l'enfant dans les endroits étudiés par rapport à la tendance observée dans les endroits contrôles.

CONCLUSION Les résultats de l'expérience de Navrongo démontrent que les programmes de santé communautaire et de planification familiale peuvent avoir un impact sur la mortalité d'enfance. Placer les infirmières au sein des communautés accélère nettement le pas vers le progrès en atteignant les objectifs de développement du millénaire sur la survie de l'enfant. Cependant, les approches par les volontaires communautaires n'ont aucun impact additionnel, une constatation qui défie la valeur de survie de l'enfant pour les programmes de santé internationaux qui investissent dans l'approche basée sur les volontaires. Le coût total de la part importante du projet revient à moins de 10 dollars US par habitant par an. L'étude de Navrongo démontre ainsi des moyens accessibles pour atteindre l'ordre du jour de l'objectif de développement du millénaire sur la survie de l'enfant en utilisant des technologies existantes.

mots clés survie de l'enfant, Ghana, objectif du millénaire

Logros rápidos en el Objetivo del Milenio de Aumento de la Supervivencia Infantil: Evidencia del Experimento de Navrongo, en Ghana del Norte

OBJETIVO Determinar el impacto, sobre resultados demográficos y sanitarios, de desplegar enfermeras y voluntarios a poblados.

MÉTODO Hemos implementado un diseño experimental que enfatiza el valor de alinear los servicios sanitarios comunitarios con instituciones sociales que organizan la vida del poblado. Los datos para el análisis provienen del sistema de seguimiento demográfico de Navrongo, una base longitudinal con un historial de eventos de fertilidad, mortalidad y migración a lo largo del tiempo. El experimento utiliza métodos demográficos convencionales para estimar las tasas de mortalidad de registros longitudinales de seguimiento demográfico.

RESULTADOS El colocar enfermeras en emplazamientos comunitarios redujo en tres años las tasas de mortalidad infantil a la mitad, y aceleró el lograr alcanzar los objetivos de desarrollo del milenio (ODM) en términos de aumentar la supervivencia infantil en el área de estudio, con respecto a las tendencias observadas en áreas comparables.

CONCLUSIÓN Los resultados del experimento de Navrongo demuestran que los programas de salud comunitaria y de planeación familiar pueden tener un impacto sobre la mortalidad infantil. El colocar enfermeras en la comunidad puede acelerar, de manera dramática, el progreso hacia alcanzar el ODM en lo que a aumentar la supervivencia infantil se refiere. Sin embargo, el enfoque de voluntarios comunitarios no tiene un impacto adicional, lo cual pone un desafío al valor que sobre la supervivencia infantil tiene la inversión internacional en programas de salud basados en voluntarios. El coste total del proyecto fue de menos de \$10 per capita por año. El proyecto de Navrongo presenta una forma asequible de alcanzar la supervivencia infantil propuesta en los ODM con tecnologías existentes.

palabras clave supervivencia infantil, Ghana, Objetivo del Milenio