Integrating a nationally scaled workforce of community health workers in primary care: a modelling study

Short title: Community health workers in primary care

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Competing interests

We have read and understood JRSM policy on declaration of interests and declare the following interests: MH is Honorary Consultant in Public health, and BH and AM are both General Practitioners, all working in the NHS. MH worked as a General Practitioner in Brazil between 1999-2003, giving him first-hand experience of the Brazilian healthcare system. Through his affiliation with the Centre for Health Policy, MH is involved in consultancy work for the Health Education England Better Health programme with the Ministry of Health of Brazil. TC, VP and PG declare no competing interests.

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BH is a Clinical Lecturer in Primary Care in the Department of Primary Care and Public Health, Imperial College London, and is funded by the National Institute for Health Research (NIHR). He carried out the literature search, helped draft the manuscript and is guarantor for the article. TC is Assistant Professor in Clinical Epidemiology at the London School of Hygiene and Tropical Medicine. He helped to locate and interpret data sources and contributed to all drafts of the manuscript. VP is a medical student at Monash University, Australia. He carried out the modelling and helped draft the manuscript. PG is a medical student at Auckland University, New Zealand. She carried out the initial data searches and contributed to the final draft. AM is a Professor of Primary Care and Public Health and is Head of the Department of Primary Care and Public Health, Imperial College London. He contributed to the shaping of the article and contributed to the final draft. MH is a Clinical Senior Lecturer in Public Health in the Department of Primary Care and Public Health, Imperial College London. He proposed the idea for the article and contributed to all drafts. All authors approved the final manuscript.

Abstract

Background: Proposed solutions to a primary care workforce crisis in the National Health Service (NHS) in England centre on increasing numbers of General Practitioners (GPs). Several low- and middle-income countries have seen dramatically improved health outcomes through integration of community health workers (CHWs) in primary care. Using the Brazilian Family Health Strategy as exemplar we explore the feasibility of a nationally scaled CHW workforce addressing NHS workload challenges.

Objective: To model cost and benefit of a national CHW workforce.

Design: Modelling exercise based on all general practices in England.

Data sources: Publicly available data on general practice demographics, population density, household size, salary scales, and screening and immunisation uptake.

Main outcome measures: We estimated numbers of CHWs needed, anticipated workload, and likely benefits to patients.

Results: Conservative modelling suggests 110,585 CHWs would be needed to cover the GP practice registered population in England, costing £2.22bn annually. Assuming CHWs could engage with and successfully refer 20 per cent of eligible unscreened or unimmunized individuals, an additional 753,592 cervical cancer screenings, 365,166 breast cancer screenings, and 482,924 bowel cancer screenings could be expected within respective review periods. 16,398 additional children annually could receive their MMR1 at 12 months, and 24,716 their MMR2 at 5 years of age. CHWs would also provide home-based health promotion and lifestyle support to patients with chronic disease.

Conclusion: A scaled CHW workforce integrated into primary care may be a valuable policy alternative. Pilot studies are required to establish feasibility and impact in NHS primary care.

Introduction

Increasing workload, a reduced percentage of the budget, and workforce retention and recruitment problems challenge the capacity of available General Practitioners (GPs) in the United Kingdom's (UK) National Health Service (NHS).[1] Consequently, patients' ability to obtain GP appointments has declined.[2] Political pressure to improve access[3] has been accompanied by promises of increased GP numbers,[4] but with a reported fall in 2016-17,[5] it remains unclear how this will be achieved. Meanwhile, financial constraints have also led to the loss of some community based health services, such as district nursing,[6] and fragmentation of others.[7]

Community health workers (CHWs)

In the 1960s, programmes in the US funded members of the community to provide a bridge between patients and healthcare providers.[8] Facilitating appointment keeping and increasing compliance with medications, community health workers (CHWs) improved access to and quality of healthcare, whilst reducing costs. Growing evidence now supports building primary care services with CHWs.[9] In the UK NHS lay health trainers support patients with smoking cessation, breast feeding, physical activity and weight loss. However, focus on single areas of health and lack of integration with primary care increases system complexity, and leads to missed opportunities and duplication.[10]

Some low- and middle-income countries, such as Ethiopia, Pakistan and Nigeria have taken a much more systematic approach to CHWs in healthcare system design.[10] An example is Brazil's Family Health Strategy, a publicly funded, free-at-point-of-use primary care system, founded in 1988 and now providing services to 70% of the country's 200 million inhabitants.[11]

CHWs in Brazil have basic training in disease identification and monitoring, immunisation and screening support, and health promotion. Their skillset includes supporting patients with medication adherence and healthcare system navigation, monitoring chronic disease and identifying new symptoms. Each is responsible for around 150 households, in a defined catchment area, which they visit at least once per month.[12] CHWs gain detailed knowledge of all members of these households, and liaise proactively with GPs and practice nurses to avoid crises and complications .[12]

Having previously explored the complex landscape of community care,[13] we argue that systematic deployment of CHWs in the NHS has the potential to address current problems of fragmentation and inefficiency, whilst improving clinical outcomes through improved uptake of appropriate services.[14] This study builds the case for a scaled CHW workforce by estimating likely costs and key benefits of their deployment throughout NHS primary care in England, following the Brazilian Family Health Strategy model.

Methods

We used published NHS quality data and national demographic census data to model several scenarios, estimating the number of CHWs likely to be required to cover the population of England, and their potential impact.

Estimating the number of CHWs required

A CHW in Brazil typically serves 100–200 households, depending on whether in a rural or urban area. With the average household size of 3.3 persons in Brazil,[15] and 2.4 persons in England,[16] we calculated the number of households a CHW could expect to serve in England:

$$\textit{No. of Households Served by a CHW in England} = \frac{\textit{No. of Patients Served by a CHW in Brazil}}{\textit{Average Household Size in England}}$$

We then estimated the number of households served by a given general practice, for each practice in England, using published GP practice data from the Quality and Outcomes Framework (QOF)[17] and Local Authority District (LAD),[18] with each GP practice assigned to their corresponding LAD.

$$\textit{No. of households in GP Practice} = \frac{\textit{GP practice population}}{\textit{Average household size}}$$

The number of CHWs that would be allocated to each GP practice, accounting for regional variation in household size, was then estimated as follows:

$$\textit{No. of CHWs required by GP practice} = \frac{\textit{No. of households in GP practice}}{\textit{No. of households per CHW}}$$

We considered a population density of one person per hectare to mark the threshold where a CHW would spend more time travelling than visiting. Using published population density data for LADs and estimated travel times to key services,[19] we identified 359 GP practices in LADs with this population density or less, which we excluded from subsequent modelling. Figures for CHWs required for the remaining GP practices were aggregated to give the number required across England.

We also estimated the number of visits CHWs would be able to make to each of their allocated households per year. There were 253 working days in 2018 in England, and newly appointed NHS staff are entitled to 27 days annual leave,[20] leaving 226 days available per CHW. NHS District Nurses in the UK, whose visits are likely to be of greater complexity, routinely carry out 8 visits within a 5 hour daily visiting period.[21] If CHWs carry out a similar number, this would amount to 1808 visits per CHW annually. Number of visits per household per year was calculated as follows:

$$\textit{No. of visits per household per year} = \frac{\textit{No. of visits per CHW per year}}{\textit{No. of households per CHW}}$$

We estimated the annual cost of introducing CHWs in England using published salary figures,[22] with the Band 2 bracket chosen to reflect their responsibilities.

$$\textit{Total expected annual employment cost (£)} = \textit{Total no. of CHWs required} \times \textit{CHW employment cost}$$

Salaries were calculated using three possible Band 2 salary points (Point 2, 5 and 8 - equivalent to salaries of £15,404, £16,536 or £18,157), corresponding to the level of Healthcare Assistant. We also considered other regular employment costs: employer National Insurance contributions were estimated using HMRC's online calculator,[23] while employer pension contributions were calculated at the 14.38% rate required of NHS employers.[24] Initial training and administration costs were considered to be negligible in annual cost calculations.

Modelling the clinical impact of CHWs

Evidence suggests impact of CHWs on a variety of aspects of primary care including chronic disease management, and immunisation and cancer screening uptake.[9,25,26] We have previously

estimated that 88 per cent of households in England and Wales have at least one person eligible for a service where CHW intervention may provide benefit.[27] Consequently we modelled the potential impact of their integration in UK primary care in the following areas:

i. Chronic disease management

We selected five chronic diseases to model the patients CHWs would support. Asthma, chronic obstructive pulmonary disease (COPD), dementia, diabetes and hypertension were chosen based on their high prevalence and the likelihood of their management being improved through CHW visits. Using published QOF prevalence data for each GP practice,[17] we estimated the number of patients with each condition that a CHW would manage in each practice.

$$\textit{No. of patients with chronic disease managed by CHW} = \textit{No. of patients managed by CHW} \times \frac{\textit{Prevalence of chronic disease in each GP practice (\%)}}{100}$$

ii. Cancer screening and immunisation uptake

We also modelled the impact of CHWs on cancer screening and childhood immunisation uptake rates. Estimates of the impact of CHWs in these areas vary,[9,26] so we calculated rates assuming that CHWs could successfully refer either 10%, 20% or 30% of eligible individuals who had missed the opportunity to be screened or vaccinated.

$$\textit{No. of additional patients screened or immunised} = \textit{No. of eligible persons who did not receive screening or immunisation} \times \frac{\textit{\% CHW intervention}}{100}$$

Data for cancer screening were obtained from the National Health Application Infrastructure Services via the Open Exeter system.[28] Since routine cancer screenings have various time intervals, the screening programmes use differing review periods; we followed these to estimate the impact of CHWs on screening uptake rates for each cancer. Women of 25-49 years are invited for cervical cancer screening every 3 years, whilst women of 50-64 are invited every 5 years. A combined period (3.5 and 5.5 years) is used to determine screening coverage, which we followed to estimate the number of additional people screened through CHW intervention. Women between 50-71 years are invited for breast screening every three years; the screening programme uses a 3-year screening coverage period. Bowel cancer screening is offered to all

men and women aged 60-74 every two years; screening uptake is calculated over 2.5-years. Impact on MMR 1 and MMR 2 immunisation uptake was calculated in terms of additional children immunised annually based on NHS England data on immunisation rates.[29]

Results

In Brazil, CHWs are responsible for between 100-200 households corresponding to 137.5-275 households in England. We additionally modelled a mid-point (206.25 households).

Assuming 226 working days per CHW per year, and visiting of 8 households daily,[21] if CHWs each had responsibility for 137.5 households, they would visit each household 13.1 times per year. With a case load of 206.25 households, they would visit 8.8 times per year; if managing 275 households, they would visit 6.6 times per year.

If CHWs were each responsible for 137.5 households, 165,878 would be needed to cover the population registered with GP practices in England. 110,585 CHWs would be required if there were 206.25 households per CHW, and 82,939 if 275 households. Assuming a mid-point salary scale of Band 2 Point 5, we estimate annual NHS employment costs of these numbers of CHWs to be £3.32bn, £2.22bn and £1.66bn respectively (Table 1).

Tables 2 and 3 show modelled estimates of cost and benefit of a national CHW workforce assuming low (137.5), medium (206.25) and high (275) household responsibility for each CHW. Taking the middle scenario, assuming 206.25 households per CHW, each would regularly support approximately 29 patients with asthma, 9 patients with COPD, 4 patients with dementia, 34 patients with diabetes, and 69 patients with hypertension.

If CHWs led to successful screening of 20% of previously missed individuals, this would equate to an additional 753,592 new cervical cancer screenings nationally, with 365,166 new breast cancer screenings, and 482,924 bowel cancer screenings, during the relevant time periods for each programme. Successful referral of 20% of children that had missed immunizations would mean that each year a further 16,398 children would receive MMR1 at 12 months, and 24,716 children would receive MMR2 at 5 years of age.

Discussion

Summary

Our mid-range estimate of households per CHW, with each household visited at least every 6 weeks, requires a workforce of 110,585, costing the NHS £2.22bn annually. If CHWs resulted in 20% of individuals who had missed immunization or cancer screening taking up these opportunities, we could expect an additional 753,592 cervical cancer screenings, 365,166 breast cancer screenings, and 482,924 bowel cancer screenings during their respective time periods. An additional 16,398 children per year would receive their MMR1 at 12 months, and 24,716 children would receive their MMR2 at 5 years of age. All patients with chronic diseases would have regular health promotion, and individuals would be proactively identified for emerging physical health, mental health or social care issues.

Strengths and limitations

Brazil is an example of a country where CHWs have been integrated in a systematic manner in primary care. The Brazilian health system differs from that in the UK, and the impact of CHWs in the UK may be smaller overall, given differences in baseline health provision, health needs, health inequalities and health literacy. However, evidence does exist for CHWs in high income countries. While this generally focuses on low income and minority populations,[9] CHWs' potential merits are significant in any population where there are missed opportunities to immunise, screen, actively case find and promote health. In the US there is a growing belief that the CHW model can inform community based healthcare services.[30]

As in any modelling exercise, this study is limited by assumptions such as average household size and the number of households that CHWs have responsibility for. We took measures to minimise the effect of these by using published data on GP practice list size, population characteristics, population density, disease prevalence, and screening and immunisation uptake, and by modelling a variety of different scenarios.

We excluded GP practices in sparsely populated areas because we considered CHWs unlikely to be effective in these areas. In reality, alternative arrangements would have to be made for these areas either through additional support for GP provision, or with the introduction of more novel interventions such as telemedicine services, to avoid inequalities.

Modelling impact of CHWs on cancer screening and immunization uptake required assumptions as to possible effect size. Wide variation exists in reported effect size of CHW interventions, ranging in immunization uptake from no effect to 36% relative increase in

immunizations.[9] We opted therefore to provide alternative models assuming CHWs facilitate uptake by 10, 20 or 30 per cent of eligible but unscreened or unimmunized individuals.

Mixed evidence for the impact of CHWs on chronic disease management meant it was not possible to estimate impact in terms of clinical outcomes. Consequently, we selected five chronic diseases common in UK primary care, and used published prevalence data to illustrate the numbers of patients with these conditions that CHWs might provide with home-based support, thus indicating the possible benefit to GP practices in additional chronic disease management.

Comparison with existing literature

Increasing evidence supports the effectiveness of the CHW model, which has in Brazil been associated with a remarkable decline in infant mortality[31] and cardiovascular and cerebrovascular disease mortality,[32] reductions in hospitalizations,[33] and improvements in equity of access.[34,35] Although CHWs have not been shown to be singularly responsible, studies have shown a dose-response relationship between coverage with CHWs and benefits.[32,33,35]

Heterogeneity of interventions and outcomes in previous studies have made comparisons and translation into practice difficult. Systematic reviews of CHW interventions[9,25,26] have concluded that they have promise in improving some specific health outcomes, such as childhood immunisation and cancer screening uptake, and chronic disease management, but that further research is required. Furthermore, the few studies providing economic information, and the heterogeneity of methods, mean that while there is evidence of cost effectiveness of CHWs in some settings, this is insufficient to draw broader conclusions.[25,36] Nevertheless, the possibility of improvements in patient engagement in areas such as health promotion and disease prevention,[37] chronic disease management,[37] cancer screening[38] and immunization,[9] suggest that CHWs in England could have important beneficial effects on health outcomes, particularly if deployed systematically. In addition, their ability to liaise closely with GPs, identifying problems early, and supporting chronic disease monitoring, indicates potential to reduce unnecessary workload burden on GPs, improving access while reducing use of acute and secondary care services.[37]

To our knowledge, there has been no other attempt to date to model the feasibility of a nationally scaled CHW workforce in primary care in England.

Implications for research and practice

The 2017 Report of the Select Committee on the Long-term Sustainability of the NHS and Adult Social Care,[39] stated that the absence of any comprehensive national long-term strategy to secure an appropriately skilled and committed workforce represents the biggest internal threat to the long-term sustainability of the NHS. Several other recent high profile reports have focused on community care and the need for streamlining of health and social care, joined up working, breaking barriers between services, and reducing system complexity.[7,40] Elements of care provided by CHWs in Brazil are being introduced in the NHS in the form of social prescribing, but evidence for these alone is lacking.[41] Numerous interventions and government initiatives over some 20 years have failed to result in actual system wide integrated care.[42] A scaled and integrated CHW workforce, offering proactive, preventative and holistic community based care, may have the potential to succeed in achieving these aims where previous efforts have failed.

Large scale implementation of NHS funded CHWs in the UK represents a significant investment and recruitment challenge. However, this should be viewed in the context of other recent policy recommendations. For example, the Government remains committed to recruiting and funding 5,000 additional NHS GPs.[4] This number of GPs would serve approximately 8.6m patients assuming a practice list size of 1,724 patients per GP,[43] far fewer than the population served by the CHW model. The annual salary cost would be £354.6m and, as it costs £388,000 to train a GP, including tuition, clinical supervision and salary during training,[44] the likely overall cost for 5000 GPs would be £1.94bn. We anticipate minimal training and support costs for CHWs, who in Brazil receive only a few weeks' basic training. In the UK a qualification currently exists for health trainers, costing £1250. If a similar cost applied to CHWs, 110,585 individuals could be trained for £138m. In terms of recruitment, under far more challenging physical, environmental and public health constraints, Brazil recruited 250,000 CHWs.[14] In England, various community interventions using health trainers exist; many of these individuals could be redeployed in the proposed model. We therefore anticipate that actual numbers of new CHWs required, and consequent recruitment and additional salary costs, may be significantly less than those modelled.

However, implementation in the NHS would undoubtedly be complex, and integration with the current primary care workforce would require careful planning. Whilst many existing

community workers may be happy to take on this role, sensitivity will be needed to avoid conflict with roles of other professionals. There are other ongoing changes in the primary care workforce, including increased use of nurse practitioners, and introduction of physician associates, and pharmacists in primary care.[45] This paper does not suggest replacement of these professionals. The focus of introduction of CHWs would be in the community as opposed to within GP practices. In fact, CHWs are likely to help new primary care professionals such as pharmacists and physician associates to work more effectively through improved communication, and early identification of health or social care problems.

In addition, while one of the aims of integration of CHWs is to support primary care and reduce GP workload, it is possible that their proactive approach, with early alerting of GPs to possible problems may initially result in increased demand on GPs. Finally, this model of CHW provision would require households to register with the same GP practice. Although people living in the same household usually do, it might be difficult to make this a requirement.

Next steps should include pilot studies to explore acceptability and feasibility of introduction of CHWs in NHS primary care following the Brazilian model, allowing a reference case health technology assessment to be carried out. However, deployment at some scale will be necessary to see benefits in chronic disease management, immunisation and cancer screening uptake and other outcomes.

Conclusion

A traditional view of general practice emphasises relationship continuity, with patients having a GP they and their families knew over many years. High workload, large practices, part-time working, and access problems mean this is not always a practical reality in the NHS. However, there may be lessons to learn from other models of primary care which provide some of the benefits of such continuity, whilst potentially improving access and reducing workload.

Systematic integration of community health workers at scale in NHS primary care could represent a timely and relatively rapidly implemented approach to the workload crisis. Chronic disease management, cancer screening and MMR immunization uptake provide examples of potential benefits; there is a need for formal piloting to establish the impact of CHWs in NHS primary care.

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Table 1: NHS employment costs per CHW

Annual salary (Band 2 Point 2, 5, 8)	Monthly salary	Monthly employer NI (HMRC calculator, NI Category A)	Annual employer NI contribution	Employer pension contribution (14.38% of annual salary)	Total annual cost including contributions
15404	1283.67	83.31	999.72	2215.10	18618.82
16536	1378.00	96.32	1155.84	2377.88	20069.72
18157	1513.08	114.96	1379.52	2610.98	22147.50

Table 2: Number and expected cost of CHWs required to serve NHS England and chronic disease patient load

		Number of CHWs required	Expected annual cost (billion £)			Chronic disease patient load per CHW				
			Salary Point 2	Salary Point 5	Salary Point 8	Asthma	COPD	Dementia	Diabetes	Hypertension
Number of households (patients) served by CHW	**137.5 (330)**	165,878	3.08	3.32	3.67	19	6	2	23	46
	206.25 (495)	110,586	2.05	2.22	2.45	29	9	4	34	69
	275 (660)	82,939	1.54	1.66	1.84	39	13	5	45	92

Table 3: Impact of CHWs on cancer screening and MMR immunisation uptake

		Additional people screened			Additional people immunised per year		
		Cervical cancer (Combined 3.5 and 5.5 year coverage)	Breast cancer (3 year coverage)	Bowel cancer (2.5 year coverage)	MMR 1 (24 months)	MMR 1 (5 years)	MMR 2 (5 years)
CHW impact level	10%	376,796	182,583	241,462	5,466	4,086	8,239
	20%	753,592	365,167	482,924	16,399	12,258	24,716
	30%	1,130,388	547,750	724,387	32,797	24,517	49,432