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- Why are Nepal's maternity services underused?
- Cardiometabolic-risk indices for South Asians
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Why do women deliver in facilities, or not?

A key strategy promoted by international organizations to reduce maternal mortality is skilled birth attendance. This should be a provider trained in the essential elements of delivery care, typically a midwife, who could deliver at home or in an institution. In recognition that this skilled provider on her own can often do little if complications arise, the next extension of the strategy is to promote institutional delivery, either in a health centre with beds, or in a hospital, district or tertiary.[1] In this issue of the *WHO South-East Asia Journal of Public Health*, a literature review by Rajendra Karkee and colleagues explores why maternity services in Nepal are underutilized, despite good overall availability of facilities.[2] Their review highlights that various interventions aimed at increasing use of maternity services have been only partially successful. The main factors common to the reasons for underuse of maternity facilities were: social, distance, cost, and perceived quality of care.

As Karkee and colleagues discuss, these findings from Nepal are similar to those in many other areas in the world. Nepal has particular geographical challenges with high mountains impeding access to health facilities which might be several valleys away. It is hardly surprising that women do not want to undertake such a journey in the late stages of labour, as there is no easy transport. Better roads and more health facilities nearby are the only solution, which is capital-intensive. Moreover, time and sustained effort are needed to change social factors such as cultural practices and a woman needing her mother-in-law's permission to deliver in a facility.

One important reason for women's non-use of facilities is their perception of the quality of care offered. Several surveys in diverse countries have shown that the quality of care provided in health facilities is often suboptimal.[3] Quality might reflect general amenities such as cleanliness, provision of sheets, blanket and food, to the friendliness and technical capacity of staff. Pregnant mothers might not trust the first level facility, and would rather go to a private one or to a higher level facility right away.

One of the major concerns with the push for institutional delivery is patient safety and the prevention of nosocomial infections in particular. Newborns are especially at risk of acquiring multiresistant hospital bacteria as the first organism to colonize the hitherto sterile surfaces. To reduce the risk, it is therefore of utmost importance to improve hygiene practices, and control non-rational prescriptions of often second-line antibiotics in health facilities.

WHO has recently introduced an initiative to improve the quality of maternity care provided by midwives, first level health facilities and referral facilities.[4] This should rectify issues from the provider side, if this is scaled-up in countries. However, complementary efforts will also be needed to influence the perceptions of consumers of the services. Otherwise, pregnant women will continue to stay at home and hope for the best.

Nepal is a forerunner of approaches using women's groups to try to improve health outcomes for mothers and newborns; in a seminal cluster-randomized trial, a participatory intervention with women's groups resulted in a 30% reduction in neonatal mortality and an even larger reduction in maternal mortality.[5] The Nepal study has been replicated in several countries, and found to be successful in settings where access to care is an issue. WHO has recently summarized the evidence and recommends this intervention to improve neonatal and maternal outcomes.[6]

Universal health coverage is the way forward recommended by WHO since 2013.[7] This means that people receive the medical care they need without creating an undue financial burden. Providing free care for mothers and children will certainly have an impact on care-seeking. However, service provision has to be assured. Free access to a health facility without staff that is competent and without the necessary supplies does not constitute universal health coverage. Many countries need to increase their investment in health substantially to achieve this.

In conclusion, the decision where to deliver is a complex interplay of supply and demand factors and social practices. To address this, obstacles in access such as distance, financial burden and attitudes of providers need to be addressed. Quality of care has to be perceived in the community as adequate, so that a hospital is not seen as a place where you only go to die. The recent summary of the experience with women's groups shows a way to address issues on the demand side too. How the factors interplay is different in different settings. Thus the

review from Nepal by Karkee and colleagues gives a useful country perspective, and similar analyses need to be undertaken in all countries to guide policy decisions.

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Perspective

Unintended consequences of regulating traditional medicine

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ABSTRACT

The World Health Organization (WHO) has the noble goals of advancing traditional medicine and simultaneously promoting the regulation and professionalization of traditional healers. However, such regulation has the unintended consequence of withholding power from traditional practitioners. This review explores this concept through a historical analysis of traditional medicine in both India and Zimbabwe. During the post-colonial period in both countries, traditional medicine contributed to the creation of national identity. In the process of nationalizing traditional medicine, regulations were set in place that led to a rise in the university-style teaching of traditional healing. This period of professionalization of traditional healers resulted in certain types of traditional medicine being marginalized, as they were neither included in regulation nor taught at university. Since then, the current era of globalization has commoditized traditional healing. Private industries like ZEPL and Dabur have rapidly and vastly altered the role of traditional healers. Consumers can now buy traditional medication directly from companies without visiting a healer. Additionally, disputes over patents and other intellectual property rights have led to important questions regarding ownership of certain plants traditionally known for healing properties. Through regulation and commercialization of traditional medicine, healers have lost some of their independence to practise.

Key words: traditional medicine, healer, nationalism, globalization, regulation, professionalization, India, Zimbabwe.

INTRODUCTION

The World Health Organization (WHO) estimates that in certain African and Asian countries, 80% of the population depend on traditional medicine. The newly published WHO Traditional Medicine Strategy 2014–2023 has two key goals: to support Member States in harnessing the potential contribution of traditional medicine to health, wellness and people-centered health care; and to promote the safe and effective use of traditional medicine through the regulation of products, practices and practitioners.[1]

However, increased attempts to streamline the diversity of traditional medical practices have often resulted in detrimental outcomes for many practitioners. Indeed, the evolution in traditional medicine from post-colonial nationalism to globalization in India and Zimbabwe demonstrates that traditional healers have ever decreasing power over their medical practices, first due to regulation and professionalization, initiated in the nationalist era, and subsequently due to medicine's commoditization in the era of globalization.

Prior to colonial rule

Prior to colonization, the ruling classes supported traditional medicine in both India and Zimbabwe. Local kings were responsible for the financial development of medicine.[2] While this paper will not delve into the specifics of medical practices at that time, the diversity of legitimized medicine will be noted. Classical, folk, and religious medicines were all public forms of legitimate medical practices. Educational training occurred through individualized apprenticeship models or even at times through spiritual calling. However, the start of colonization saw an increase in interactions with biomedicine, which resulted in the propagation of scientific rationalization.

Irrational forms of folk and spiritual medicine were disregarded, while classical medicine such as Ayurveda and Unani, became textualized and standardized.[3] In India, for example, Orientalists believed that the golden age of rationalized medicine had been diluted over hundreds of years by the plethora of folk and spiritual medicines prevailing throughout the country in the 18th and 19th centuries. They

saw classical medicines as more reliable, with rational, central, discrete theories.[4] One could argue that traditional forms of medicine were obstructed due solely to pressure from British colonizers. However, it is essential to understand a nuanced argument in which both the nationalized state and private industry are largely responsible for the changes that weakened power from medical practitioners of indigenous medicines.[5]

TRADITIONAL MEDICINE AND NATIONALISM

National identity through traditional medicine

There was strong congruence between indigenous medicine and nation-building in the post-colonial era. In India and Zimbabwe – both of which lacked a strong notion of "nation" due to the existence of different local ethnicities and languages – nationalists used indigenous medicine as a way to create a shared, unified national identity and disown colonial rule. In India, nationalists heavily contextualized Ayurveda within a Hindu and regional identity in order to reinforce nationalism. Ayurveda's ancient and encompassing past was emphasized as a method of unifying local regions as well as glorifying Indian history. Thus, Indian medicine started to reinvent Ayurveda during the nationalist era. "Rational" Sanskrit texts were consolidated into volumes, while texts written in regional languages were marginalized.[6]

Similarly in Zimbabwe, a sense of national identity was created through indigenous medicine during post-colonialism in the 1980s. Interestingly, nationalists used the name of a spirit healer – Nehandra Charwe, who led the first Chimurenga or revolutionary struggle in 1896 – as one of the key symbols of resistance to colonial rule. Almost 80 years after the first Chimuregna, nationalists again used spirit healers and indigenous practitioners to create bonds among ethnic groups, while disowning colonial beliefs.[7]

Governmental regulation and marginalization

However, the creation of national medicine did not occur through a simple glorification of ancient traditional medicine. Rather, the governments of India and Zimbabwe attempted to generate national ownership by officially and legally including certain forms of traditional medicine in the health-care system. This meant that if healers were not registered with the respective national medical councils, they were not legally able to practise. In Zimbabwe, ZINATHA (Zimbabwe National Traditional Healers' Association), formed in 1980, provided certificates to healers that approved their practice.[8] Similarly in India, the Central Council for Indian Medicine officially legalized "Indian medicine," making only vaids and hakims with government certificates legal practitioners.[9]

An examination of medicines approved as national medicine in both Zimbabwe and India highlights the marginalization of certain types of traditional medicines. Power in the newly independent nations was in the hands of people who had been educated through the colonial system. Thus, similar to colonials, the national governments showed support only for scientific forms of traditional healing.[10]

In Zimbabwe, for example, even though nationalists initially idealized spirit healers like Charwe, ZINATHA did not recognize spirit healing as regulated national medicine. Indeed, government officials educated in elite schools portrayed spirit mediums as witchcraft.[11] Thus, the nationalists themselves created a system of regulation that marginalized unscientific aspects of healing.[12]

The Indian Government, through the Indian Systems of Medicines (ISM), categorizes seven traditional systems – Ayurevda, Yoga, Naturopathy, Unani, Siddha, Sowa rigpa, and Homeopathy. However, while these are adopted symbols of national identity, and various educational and research institutions have been created, folk and spiritual medicine that cannot be scientifically proven has been heavily marginalized.

The process of officially adopting national medicines inherently creates a barrier, thus marginalizing certain medicines and significantly altering the diversity of indigenous medicine. Folk medicine was recognized for the first time by the Indian Government in 2002 in the National Policy on Indian Systems of Medicine and Homeopathy,[13] and was thus finally endorsed as mainstream traditional medicine.[14] However, Lambert highlights that haad vaids (bone doctors) were marginalized as their knowledge was not textualized.[15] Similarly, dais (midwives) are considered neither as traditional practitioners nor as skilled birth attendants. Only since 2005 have certain states in India created Dai Training Programmes, attempting to bring midwives into mainstream traditional practices.[16] Visha (poison) healers and folk psychiatric healers, again because of their oral-only and regionally diverse traditions, have also been excluded from the Indian Systems of Medicine.

Professionalization through universities

To validate national medicines, the governments of Zimbabwe and India set up systems to professionalize them through universities. This allowed direct national control over medical practitioners and ownership of the traditional medicine itself. In India, both public and private organizations created Ayurvedic universities. Similarly, ZINATHA created medical courses.[17] India allowed experience-based registration prior to 1970; vaids and hakims who had completed an apprenticeship (traditional guru-shishya method) could demonstrate their ability to practise and earn national qualifications. However, post-1970, formal qualifications were only provided to vaids and hakims who trained at medical colleges for professional degrees.[18] Thus, the national state controlled both how traditional medicine was practised and the medical educational model. By completely restructuring education into a university format, both the Government and the private sector pulled power away from local indigenous practitioners.

While universities have helped regulate traditional medicine with the intention of creating adequate medical practitioners, there are various negative consequences of university-

setting Ayurveda and Unani education. Langford, through an ethnographic analysis of various Ayurvedic colleges, demonstrates the heavy influence of biomedicine at these colleges. Instead of first understanding a patient's doshas (Ayurvedic method of understanding body composition), students identify the biomedical disease and subsequently apply a dosha to the ailment. Most students interviewed stated that they planned to use their Bachelor of Ayurveda, Medicine and Surgery (BAMS) degree in a career in Ayurveda and biomedicine.[19] This is mirrored by Nisula's study of Ayurvedic practitioners in Mysore, India who believed it was necessary to integrate modern medicine into Ayurveda for it to be popular.[20]

The 2002 National Policy on Indian Systems of Medicine and Homeopathy stated that the "component of modern medicine should be reduced, and study of Sanskrit in Ayurveda discipline and Urdu and Persian in Unani discipline should be incorporated in the curricula."[13] Thus, there was an understanding that current traditional medicine universities had become too heavily focused on biomedicine. With regard to the wave of professionalization, the Policy stated that "the deep interest in the biomedical model of health has often been prompted by considerations which are not always rooted in concern for the health of citizens."[13] Professionalization and regulation of traditional medicine should therefore be modified to allow its niche in public health.

Globalization and commoditization of traditional medicine

Globalization led to another trajectory of nations or states reducing power from traditional practitioners. In parallel, private industries started to profit from indigenous knowledge, selling traditional medicine pharmaceuticals nationally and internationally. Two examples of this follow.

In Zimbabwe, ZINATHA Enterprises Private Limited (ZEPL) formed a public–private partnership to manufacture traditional drugs. ZEPL propagates that industry standardization provides more accurate and hygienic doses than can healers. In this way, ZEPL uses standardization to delegitimize medicines created directly through practitioners. Further, decoctions and balms were transformed into pills to make a more easily usable product; and unscientific native medicines like love potions were never manufactured.[17] Thus, drug companies significantly diminished the vast diversity of indigenous pharmaceuticals in order to match a rational and somewhat biomedical trajectory.

In India, international pharmaceutical companies started selling Ayurvedic pharmaceuticals directly to patients. Banerjee demonstrates a change in Dabur's customer base through the company's advertising strategies over time.[21] Originally, Dabur's advertisements featured traditional vaids asserting that the company's prepackaging improved the ability of vaids to provide medicines to their patients. Interestingly, initial adverts portrayed Dabur products as sustaining the traditional aspects of Ayurveda. However, recent adverts focus on the ability of Dabur to modernize Ayurveda, showing, for example, women using Dabur traditional Ayurvedic products to attain a modern image of beauty and health. By changing marketing strategies, companies like Dabur and Himalaya now provide off-the-shelf Ayurvedic products directly to patients.

In both Zimbabwe and India, the direct interaction between pharmaceutical companies and patients has slowly decreased the need of the traditional medical practitioner. Moreover, forms of medicine that cannot be directly pharmaceuticalized like bone-fixing are deeply marginalized.[15]

Intellectual property

The global era has also led to a new interplay between pharmaceutical companies and national governments. Indigenous medicines have become international commodities driven by both market and cultural nationalism. Building on the concept of national medicines developed in the post-colonial era, medicines are redefined along nationalist lines and non-textual knowledge is moulded into a property that must be protected by the government.

Various international and national initiatives have sought to prevent erroneous patents on traditional medicines. One key example is the Traditional Knowledge Digital Library created by the Council of Scientific and Industrial Research (CSIR), the Ministry of Science and Technology, and the Ministry of Health and Family Welfare in India.[22] The Library documents traditional medicinal practices in India, and presents the information in such a way that it can be checked by international patent offices, thereby preventing the granting of erroneous patents on traditional medicines.

However, as discussed above, the process of commoditization in our global economy reduces the power of traditional practitioners. Often, local practitioners using traditional medicine knowledge are not given their due credit,[23] a situation recognized by the 2002 National Policy on Indian Systems of Medicine and Homeopathy. While it is essential to place traditional medicine in a global context, local medicinal practitioners should be given rightful credit and financial benefit for their work.

CONCLUSION

In both India and Zimbabwe, the government and private pharmaceutical companies function as hegemonies that sap the ownership of indigenous medicine from native practitioners. During the post-colonial era, nations started to regulate and professionalize indigenous medicine to create a sense of national identity and unity. The globalized era accelerated this sense of ownership, as both pharmaceutical companies and national patent systems commoditized fluid knowledge into property. While organizations like WHO laudably support traditional medicine through regulation, such agendas may tie the hands of native practitioners to the point that true indigenous medicine can no longer exist. It is therefore important to strike a balance so that regulation and globalization of traditional medicine do not eliminate native traditional healers – the very source of traditional medicine.

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Review

Why women do not utilize maternity services in Nepal: a literature review

Rajendra Karkee[1,2], Andy H Lee[2], Colin W Binns[2]

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ABSTRACT

The structure and provision mechanism of maternity services in Nepal appears to be good, with adequate coverage and availability. Utilization of maternity services has also improved in the past decade. However, this progress may not be adequate to achieve the Millennium Development Goal to improve maternal health (MDG 5) in Nepal. This paper reviews the factors that impede women from utilizing maternity services and those that encourage such use. Twenty-one articles were examined in-depth with results presented under four headings: (i) sociocultural factors; (ii) perceived need/benefit of skilled attendance; (iii) physical accessibility; and (iv) economic accessibility. The majority of the studies on determinants of service use were cross-sectional focusing on sociocultural, economic and physical accessibility factors. In general, the education of couples, their economic status and antenatal check-ups appeared to have positive influences. On the other hand, traditional beliefs and customs, low status of women, long distance to facilities, low level of health awareness and women's occupation tended to impact negatively on service uptake. More analytical studies are needed to assess the effectiveness of the Safer Mother Programme, expansion of rural birth centres and birth-preparedness packages on delivery-service use. Moreover, it is important to investigate women's awareness of the need of facility delivery and their perception of the quality of health facilities in relation to actual usage.

Key words: Millennium Development Goal 5, safe motherhood, utilization, maternal health service, Nepal

INTRODUCTION

Safe motherhood has been a national priority programme in Nepal since formulation of the National Safe Motherhood policy in 1998. The National Safe Motherhood plan (2002–2017), revised in 2005, formed the basis of the current Safe Motherhood and Newborn Health Long Term Plan (2006–1017).[1] This Safe Motherhood Programme has attracted international support for programmatic activities, policy formulation and infrastructure development to improve maternal health in line with Millennium Development Goal (MDG) 5.

As a result of these programmes, there is good coverage of maternity services across most of Nepal. The Safe Motherhood Programme provides essential maternity services to all women through an extensive four-tiered district health system: (i) sub-health post; (ii) health post; (iii) primary health care centre; and (iv) district hospital. In addition, there are outreach mobile clinics and female community health volunteers at the peripheral level. At the sub-health posts, maternal and child health workers provide antenatal and postnatal care and assist in home deliveries. Auxiliary nurse midwives provide antenatal and postnatal care at health posts, some of which have birthing facilities. The primary health care centres and district hospitals provide antenatal, postnatal and delivery care as well as emergency obstetric services. There has been a substantial growth in primary health care facilities that reach out to peripheral areas.

The Government of Nepal – in partnership with Jhepigo and other nongovernmental organizations – has incorporated birth preparedness and complication readiness packages into the Safe Motherhood Programme. The Government also launched the *Aama Surakchhya Karyekram* (Safer Mother Programme), which includes two components: the safe delivery incentive programme (initiated in July 2005) and free delivery care for uncomplicated, complicated and caesarean section births at all health facilities capable of providing these services (initiated in January 2009). The incentive programme provides cash to women as well as payment to the health facility.

There has been an increase in the utilization of maternal services over the past decade. For example, antenatal visits, the use of skilled birth attendants and contraceptive usage increased from 9%, 10% and 28.5% in 1996 to 29%, 19% and 48%, respectively, in 2006.[2] An indicator of MDG 5 is to achieve 60% of births by skilled birth attendants by 2015[3]; in 2011 this figure was 36% in Nepal.[4] Utilization of skilled birth attendants varies by place of residence, family income and ethnicity.[5] Delivery at a health facility linked to a referral hospital remains the core strategy of the Safe Motherhood Programme to reduce maternal mortality,[6] since the majority of maternal deaths result from pregnancy-related complications such as haemorrhage, infections, hypertensive disorders and obstructed labour.[7] Therefore, the low utilization of maternity services in Nepal is of great concern.

Three major reviews on factors associated with maternity service use have been published. Thaddeus and Maine[8] reviewed the determinants of maternal mortality and proposed the "three delays". They classified the factors that account for these delays into four broad categories: sociocultural, distance, cost and quality. Say and Raine[9] investigated inequalities in the use of maternal health care. They found wide urban–rural and rich–poor variations and concluded that such variations were usually framed by contextual issues relating to funding and organization of health care, as well as social and cultural issues. Based on these two reviews and more than 80 original research articles, Gabrysch and Campbell[10] identified 20 potential determinants associated with maternity service usage. These previous reviews also indicated that the impact of determinants is context specific, such that a particular factor significant in one geographical setting might not be relevant in another. The aim of this paper is to review the factors that impede or encourage the use of maternity services in Nepal.

METHODS

Search strategy and inclusion criteria

The electronic databases Medline, EMBASE, Science Direct, PubMed, CINAHL, and BioMED Central were searched for relevant articles. Key words used to identify the four main concepts were: (i) maternal health care (matern*/ obstetric*/ reproduct*/ delivery/ antenatal/ postnatal/ postpartum/ newborn); (ii) health service use (utilization/access*/ health service/ use); (iii) determinants or influencing factors (factor/ determinant/ barrier/ quality/ decision); and (iv) geographical area (Nepal). First, a search was conducted by combining the first two concepts in the title and abstract fields using Boolean terms, word truncation and wildcards. A further search then included the other two concepts. All articles were exported to EndNote for criteria analysis. Inclusion criteria of the articles were: (i) published during 1990–2012; (ii) quantitative or qualitative study; (iii) reported in English; (iv) related to Nepal and published in peer-reviewed journals; and (v) antenatal, delivery or postnatal factors as outcomes. The full texts of the potentially relevant articles were retrieved and quality assessment and data extraction were then undertaken.

Conceptual framework on determinants of maternal service use

Since the determinants of maternal service use are context specific, study methodologies vary and thus a formal systematic review of this broad topic was impractical.[10] The results of this review are therefore presented in a narrative form, organized according to the four themes: (i) sociocultural factors; (ii) perceived need/benefit of skilled attendance; (iii) physical accessibility; and (iv) economic accessibility.

Search outcomes

The search of the first three concepts (maternal health care, health service use, and influencing factors) in the title and abstract field yielded 19 036 articles (Figure 1). When the geographical region (Nepal) was added, the result narrowed to 151 articles. These articles were screened for relevance. Only 21 articles, which are summarized in Table 1, satisfied the inclusion criteria. The majority of studies were carried out in and around the Kathmandu valley. One study used qualitative methods; some studies employed a combination of qualitative and quantitative methods; others applied quantitative methods including an analysis of secondary data derived from national surveys.

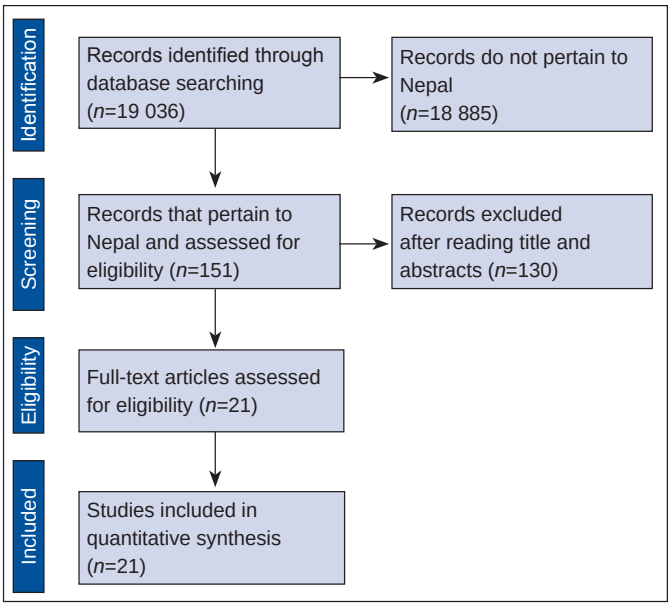

Figure 1: Selection process for the literature review

Table 1: Summary of studies on determinants of maternity service use in Nepal

Author(s)	Study design	Independent variables	Sample	Year; location	Findings
Acharya and Cleland[29]	Cross-sectional	Distance, quality	592 women	1994; western and mid-western Nepal	High structural quality of the nearest health posts had a positive effect on service uptake
Bolam et al.[13]	Cross-sectional survey with community follow-up	Maternal education, maternal age, parity, poverty indicators	357 Pregnant women	1996; Kathmandu	Poor maternal education and multiparity increased the likelihood of home delivery
Brunson[23]	Household survey, participant observation, case studies	Woman's social position, custom	250 households and 30 case studies	2003–2005; Kathmandu	Women were not in a position to demand biomedical care
Chaudhary[31]	Cross-sectional hospital-based	Cost, distance, availability of transport, antenatal check-up, obstetric factors	45 women who delivered on the way to hospital	2004; Kathmandu	Delivery on the way to hospital was caused by (i) lack of ability to recognize onset of labour and (ii) transport delay
Dhakal et al[17]	Cross-sectional community-based	Women's and husband's occupation and education, ethnicity, parity, antenatal check-ups	150 mothers	2006; Kathmandu	Wealth, husband's education and antenatal check-ups positively influenced postnatal care
Furuta and Sakway[11]	Nepal Demographic Health Survey data analysis	Women's position: decision-making, working, control over earnings; education; spousal discussion of family planning	8400 ever-married women	2001; Nepal	Spousal discussion, working plus control of earnings and women's secondary education increased antenatal care and delivery-service use
Hodgins et al.[27]	Pre- and post-intervention surveys	Birth-preparedness package (antenatal counselling on danger signs and preparation activities)	900 recently delivered women in each of the two districts	2005 (baseline) and 2007 (endline); Jhapa and Banke districts	Delivery in a health facility increased only marginally
Hotchkiss[30]	Analysis of Nepal Living Standard Survey data	Age, education, birth order, religion, women's employment, household characteristics, physical accessibility	1434 women	1996; Nepal	Improved physical access has significant impact but further physical increase would have modest impact
Matsumura and Gubhaju[14]	Analysis of National Family Health Survey data	Education, work status, job type, income, decision-making, family structure, region	1388 women	1996; Nepal	Women's education, good economic status and extended households had positive influences while women's employment had a negative influence
McPherson et al.[26]	Pre- and post-intervention survey	Birth preparedness: antenatal-care visit, financial preparations, transport preparations, knowledge of danger signs (prolonged labour and excessive bleeding)	300 mothers of infants younger than 1 year	2002 (baseline) and 2004 (endline); Siraha district	No increase in skilled birth attendance but increase in postnatal care
Mesko et al.[21]	Cross-sectional, case studies, focus groups	Traditional beliefs, information availability, health knowledge, cost	8798 women; 30 case studies; and 43 focus groups	2001; Makawanpur district	Cultural requirement for maternal seclusion; poor health knowledge of danger signs; and perceived expense delayed care-seeking
Mullany et al.[18]	Randomized controlled trial	Husband's health education	442 women seeking antenatal services	2004; Kathmandu	Husband's antenatal health education had a positive impact on birth preparedness and postpartum visits
Neupane and Doku[19]	Analysis of Nepal Demographic and Health survey data	Sociodemographic variables: age, place of residence, education, parity, occupation, religion, smoking status, wealth index, sufficiency of advice	4136 women aged 15–49 years	2006; Nepal	Maternal age, education, parity, wealth and sufficiency of advice were associated with skilled attendance at birth

Neupane and Doku[20]	Analysis of Nepal Demographic and Health survey data	Sociodemographic variables: age, place of residence, education, parity, occupation, religion, smoking status, wealth index	4136 women aged 15-49 years	2006; Nepal	Maternal age, education, parity and wealth were associated with timing and the number of antenatal-care visits
Pandey et al.[24]	Analysis of Nepal Demographic and Health survey data	Women's empowerment	7878 previously pregnant women	2006; Nepal	Women's age at birth of their first child, their education and knowledge about sexually transmitted diseases increased utilization of antenatal and delivery services
Sharma et al.[28]	Analysis of National Family Health Survey (1996) and Nepal Demographic Health Survey (2001) data	Women's status, information availability, household characteristics, region	8148 women for prenatal care; 8218 for delivery care; and 7788 for postnatal care	1996, 2001; Nepal	Health workers' visits, educational status and household economic status have a positive influence
Shrestha et al.[25]	Community-based cross-sectional study	Age, education, residence, ethnicity, parity, number of antenatal-care visits	732 married women of reproductive age	2011; Kavrepalanchok district	Multiparity, teenage pregnancy, few or no antenatal visits were likely to be associated with home delivery
Simkhada et al.[22]	In-depth interview	Sociocultural factors	30 mothers; 10 husbands and 10 mothers-in-law	2006; Kathmandu	Mothers-in-law frequently had a negative influence on uptake of antenatal care
Thapa et al.[16]	Household survey, focus group discussions, in-depth interviews	Custom and beliefs, level of knowledge, woman's education, husband's education, religion, ethnicity, parity, age, husband's occupation	657 women who gave birth during previous 5 years; 29 participants in 4 focus groups; and 14 key-informants	1996; Jumla district	Local customs, traditional beliefs and lack of knowledge caused high-risk delivery practices; husband's education level was positively associated with hygienic delivery practices
Tuladhar et al.[15]	Prospective hospital-based study	Education, parity, age, antenatal care	114 attempted home-delivery cases	2004–2008; Kathmandu	Low education, multiparity and young age were associated with complications of home delivery
Wagle et al.[12]	Cross-sectional	Distance, economic status, education, parity, antenatal-care visits, obstetric history, age of mother, ethnicity, family structure	308 postpartum women	2002; Kathmandu and Dhading district	Distance, low socioeconomic status, low education and not seeking antenatal care were significantly associated with home delivery

RESULTS

Sociocultural factors

Sociocultural factors include maternal age, marital status, ethnicity, religion, traditional beliefs, family composition, mother's education, husband's education and women's status. Most of the reviewed studies analysed at least one of these factors. Higher female education was found to be positively associated with facility use, while women who delivered at home had a lower level of education.[11-15] Higher male education also had a positive effect on service use.[16,17] The inclusion of husbands in antenatal health education appeared to improve birth preparedness and postpartum visits.[18]

An analysis of the national family health survey data suggested that women's education and economic status, and extended households, are positively associated with service use.[14] Moreover, sociodemographic factors including maternal age, education, parity and wealth were associated with delivery assisted by a skilled attendant,[19] as well as timing and number of antenatal care visits.[20] Thapa et al.[16] described traditional beliefs and customs in the remote western area of Nepal, which had a significant negative impact on the use of maternal health services. They found that many women used an animal shed for delivery, mainly due to cultural belief that the household deity would be angry if delivery took place inside the house, and that menstruation and childbirth were considered to be pollution. The cultural requirement of maternal seclusion up to 12 days after delivery might cause delays in seeking care for

postnatal complications in central Nepal.[21] However, ethnicity, age of the mother, ritual observance of menarche, type and size of family were not significantly associated with the place of delivery.[12] Mothers-in-law tended to have a negative influence on service use.[22]

An ethnographic study of childbirth[23] concluded that pregnant women lack the power to demand biomedical care, and that men remain largely uninvolved in the care-seeking process. In our review, few women participated in household decision-making, and even fewer had any control over their own earnings. Although involvement in decision-making had no significant impact on antenatal and delivery care, spousal discussion on family planning and earnings were linked to an increased likelihood of health service use.[11] Similarly, other indicators of women's empowerment, including age at birth of their first child and education and knowledge about sexually transmitted diseases, could significantly increase the use of maternal health services.[24]

Perceived need/benefit of skilled attendance

A range of factors such as knowledge of pregnancy and health risks, importance given to pregnancy, previous facility use, antenatal visits and pregnancy complications, can affect whether a women perceives the need for facility delivery. Some studies reported that multiparity was perceived as a significant risk factor for a home delivery,[12,13,25] and associated with use of postnatal care.[17] Having an antenatal check-up usually leads to subsequent health service use. However, birth-preparedness interventions that include antenatal counselling on danger signs and preparation activities appeared to exert no impact[26] or marginal impact on skilled attendance.[27] Based on a comparative analysis of the 1996 and 2001 Nepal Demographic Health Surveys, Sharma et al.[28] showed that the use of maternal health services increased during this period, partly because of improved dissemination of maternal health information through various mass media sources. Only one study[29] reported that the structural quality of the nearest health post had an important effect on the use of health services. (Structural quality was assessed in terms of physical infrastructure, number of staff, availability of drugs and provision of maternal and child health clinics.)

Physical accessibility

Physical accessibility includes place of residence, distance to the health facility and transport availability. Residence in rural and mountainous areas makes it difficult to access health facilities and may be responsible for not seeking maternal care.[12] Improved physical access may thus enhance the use of antenatal care and birth delivery by a trained health-care provider, but further physical advantage would offer only a modest impact.[30] Distance and availability of transport were also found to be important in urban areas for the timely utilization of emergency delivery services.[31]

Economic accessibility

Economic accessibility encompasses household socioeconomic status, husband and wife's occupation, family income and cost of facility delivery. The latter includes transportation and opportunity costs of travel time. Higher household economic status was found to be positively associated with facility use.[11,12] However, one study near Kathmandu found that poverty indicators were not a significant risk factor for home delivery.[13] No study investigated the effect of direct or indirect cost of delivery, and only one study identified "perceived cost" as a deterrent in seeking care beyond the household.[21] Women's employment or working status appeared to have a negative influence on the use of health services,[14] and women who work but have no control over the use of their earnings are least likely to receive antenatal and delivery services.[11]

DISCUSSION

Nepal is a culturally diverse country with 125 recorded ethnic groups.[32] Despite this, detailed investigation of the ethnic and cultural impact on the use of maternal services in the country is lacking. Many traditional beliefs and customs, linked with ethnicity and religion, can influence the effective use of maternity services, primarily the decision to seek care. The effects of ethnicity on the uptake of maternity services have been reported in Guatemala and China.[33,34] In Cambodia, professional midwives often act as "cultural brokers" because Khmer women use their own vocabulary to describe problems during pregnancy, birth and the postpartum period.[35] In Uganda, adherence to traditional birthing practices and belief that pregnancy is a test of endurance are responsible for insufficient use of maternal services.[36] The main reason for home delivery in slums in Mumbai, India, and in Ethiopia is custom.[37,38] The mother-in-law usually makes decisions about a pregnant woman's workload, care-seeking and the delivery process in rural Nepal,[22] while husbands in Uganda and local healers or traditional birth attendants in Bangladesh influence care-seeking.[39]

It is unsurprising that the majority of studies conducted in Nepal and other countries have emphasized sociocultural and demographic factors.[10] On the other hand, emphasis on sociocultural factors can mask the relative importance of factors such as those related to service delivery, where communities may be accused of having poor pregnancy outcomes because of their cultural and social system.

Almost all studies found distance as a deterring factor in seeking maternity care in Nepal. The effect of distance is exacerbated by poor roads and limited availability of transportation vehicles. For these reasons, the expansion of birth centres and maternity services in lower-level health posts may lead to increased service uptake. Such birth centres have increased in numbers[40] but it remains unclear whether they are adequately used for antenatal care and delivery or provide a quality obstetric service. In Uganda, women often bypass local facilities to deliver at a hospital that is further away.[41] Various options of transportation, maternity waiting rooms, together with the combined impact of distance and perceived quality of facility delivery, deserve further investigation.

Economic factors also deter the use of maternal health services, especially in low-income and marginalized communities. In Viet Nam, even with compulsory health insurance, poor women are less likely to deliver in a facility than middle- and high-income women.[42] The provision of free maternity services or reduction in user fees may encourage women with a low income to use appropriate health services. However, there may still be substantial "hidden costs" involved, such as transport and provider fees[43] and costs associated with caesarean section.[44]

Nepal's Safer Mother Programme has resulted in increased use of maternity services.[45] Elsewhere, initiatives that have significantly increased facility-based deliveries can be seen in Kenya, which implements a voucher programme that enables access to four antenatal care visits, a facility-based delivery including caesarean section, and treatment of delivery complications,[46] and in China, where a cooperative medical insurance scheme includes a maternal health-care benefit package.[47]. Nevertheless, even when free services are available nearby, there is no guarantee that they will be utilized unless deemed by mothers to be beneficial. Further research is therefore required to understand the impact of Nepal's Safer Mother Programme on the use of maternal services, especially with respect to different castes and economic groups.

Few studies have attempted the complex task of assessing women's perceived need for health-facility delivery. This can be influenced by pregnancy-related factors as well as distance, cost and quality. A positive perception of the added value of delivery in a facility is usually the motivating factor for women and families to seek maternity care.[48] On the other hand, since pregnancy and childbirth are often considered normal events, if this value is not perceived, professional care is unlikely to be sought.[49]

Birth-preparedness and awareness-raising programmes may help mothers to seek and demand care. Perceived complications and health knowledge,[39,50] and women's intention about where to deliver,[51] were associated with use of professional medical care in Bangladesh. Antenatal counselling, use of a birth plan and access to a social network reduced delays in seeking care for an obstetric emergency in Afghanistan.[52] Unlike Nepal, birth-preparedness packages increased skilled delivery care in Bangladesh,[53] Burkina Faso[54] and the United Republic of Tanzania.[55] Further studies are needed to assess the effect of birth-preparedness packages on skilled attendance at birth in Nepal.

CONCLUSION

The majority of the studies relating to determinants of maternal service use in Nepal were cross-sectional focusing on sociocultural, economic and physical accessibility factors. In general, increased educational and economic status of couples and antenatal check-up attendance appeared to have a positive influence on the use of maternity services. On the other hand, traditional beliefs and customs, low status of women, long distance, low level of health awareness and women's occupation tended to have a negative impact on service uptake. However, the relative importance of these factors should be examined in the changing context of culture, values and the health system. More analytical studies are also needed to assess the effectiveness of Nepal's Safer Mother Programme, expansion of rural birth centres and birth-preparedness packages in delivery-service use. Finally, it is important to investigate women's awareness of the value of facility delivery and the relation between their perception of the quality of health facilities and actual usage.

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Original research

Appropriate anthropometric indices to identify cardiometabolic risk in South Asians

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ABSTRACT

Background: South Asians show an elevated cardiometabolic risk compared to Caucasians. They are clinically metabolically obese but are considered normal weight based on current international cut-off levels of several anthropometric indices. This study has two main objectives: (i) to predict the most sensitive anthropometric measures for commonly studied cardiometabolic risk factors, and (ii) to determine optimal cut-off levels of each of the anthropometric indices in relation to these cardiometabolic risk factors in South Asians.

Methods: The study was conducted on a random sample of 1178 adults of 20–80 years of age from an urban population of eastern India. Obesity, as evaluated by standard anthropometric indices of BMI (body mass index), WC (waist circumference), WHpR (waist-to-hip ratio) and WHtR (waist-to-height ratio), was individually correlated with cardiometabolic risk factors. Receiver operating characteristic (ROC) curve analyses were performed which includes: (i) the area under the receiver operating characteristic curve (AUROC) analysis to assess the predictive validity of each cardiometabolic risk factor; and (ii) Youden index to determine optimal cut-off levels of each of the anthropometric indices.

Results: Overall, AUROC values for WHtR were the highest, but showed variations within the sexes for each of the cardiometabolic risk factors studied. Further, WHpR cut-offs were higher for men (0.93–0.95) than women (0.85–0.88). WC cut-offs were 84.5–89.5 cm in men and 77.5–82.0 cm in women. For both sexes the optimal WHtR cut-off value was 0.51–0.55. The optimal BMI cut-offs were 23.4–24.2 kg/m^2 in men and 23.6–25.3 kg/m^2 in women.

Conclusion: WHtR may be a better anthropometric marker of cardiometabolic risks in South Asian adults than BMI, WC or WHpR.

Key words: obesity, abdominal obesity, BMI, waist circumference, waist-to-height ratio, South Asians, Asian Indians.

INTRODUCTION

The prevalence of overweight and obesity has been rapidly increasing in countries of the South Asian region, with adverse consequences on health.[1-3] But there is a dearth of accurate nationwide data from these countries.[4] Various anthropometric indices such as body mass index (BMI), waist circumference (WC), waist-to-hip ratio (WHpR), and waist-to-height ratio (WHtR) are often used to evaluate adiposity levels.[5] Both general and abdominal obesity have been associated with several cardiometabolic abnormalities. However, studies show potential ethnic differences in such associations.[6,7]

Most studies examining obesity with cardiovascular risk have been based on data from high-income countries. For example, several epidemiological studies of South Asian populations have shown that they have higher levels of body fat content for a given BMI and WC than western populations, thus resulting in an increased cardiometabolic risk at a lower BMI level.[8,9] However, the prevalence of overweight and obesity is based on World Health Organization (WHO) criteria for Caucasian populations, based on high sensitivity and specificity profiles against cut-off values of BMI (25 kg/m² for overweight and 30 kg/m² for obesity) and WHpR (0.95 for men and 0.80 for women) for both categories in adult European populations. Moreover, these BMI limits, against which the waist

circumference sensitivity and specificity information were calculated, have been shown to underestimate the true burden of obesity in South Asian populations for whom lower cut-offs are proposed (BMI ≥ 23 kg/m² for overweight and ≥ 25 kg/m² for obesity).[8,9]

It is well known that obesity is associated with diabetes mellitus, hypertension, dyslipidemia, and cardiovascular disease (CVD).[10] Epidemiological surveys use BMI as an indicator of generalized obesity and WC, WHpR or WHtR as a measure of central, or abdominal obesity. Abdominal obesity, which suggests unwarranted deposition of intra-abdominal fat, is a significant predictor of cardiometabolic risk. WC has been proposed as an easy measure for both intra-abdominal fat mass and total fat. However, a limitation is that WC measurement does not take into account differences in body height, and hence the WHtR value is preferred as a predictor of cardiometabolic risk factors.[11-13]

Controversy remains regarding the best anthropometric indices for CVD risk. There is ongoing debate regarding which adiposity measure best represents health risks associated with excess body weight both at individual and community level.[14] Even though BMI is the most commonly used index, it does not correspond to fatness uniformly in all populations, and inter-ethnic extrapolations are not possible.[15]

This study had two main objectives: (i) to predict the most sensitive anthropometric measure for commonly studied cardiometabolic risk factors; and (ii) to determine the optimal cut-off levels of each anthropometric index in relation to these cardiometabolic risk factors in South Asians.

METHODS

Study design and sampling method

This epidemiological, population-based study was conducted in Berhampur city of Odisha state in eastern India. Based on an estimated prevalence (p) of hypertension of 25% with an allowable error (L) of 10%, the sample size was calculated as 1200 by use of the formula $n=4pq/L^2$, where $q = 100 - p$. Details of the survey methodology are published elsewhere.[16] The sample was obtained by means of a multi-stage random sampling technique among residents of Berhampur Municipal Corporation spread across 37 electoral wards, of which 30 were chosen at random to spot the sampling unit: a household. Each ward of the city comprises 12–14 streets and each street contains two rows of households. Two rows of households were randomly selected and the sampling unit household was selected by simple random sampling to enrol approximately 40 subjects who were ≥ 20 years of age from each ward. Of the 1200 subjects invited to participate in the study, 1178 subjects ≥ 20 years of age were enrolled.

The study proposal was in line with the Indian Council of Medical Research guidelines on bioethics,[17] and was approved by the institutional review board of the Kalinga Institute of Medical Sciences, Bhubaneswar, Odisha. Written informed consent was obtained from all subjects.

Definitions of cardiovascular risk factors used

Diabetes mellitus and intermediate hyperglycaemia: based on WHO/IDF Consultation. Geneva: World Health Organization; 2006.[18,19]

Diabetes: based on physician diagnosis and antidiabetic treatment or those who had fasting plasma glucose level of ≥ ≥ 126 mg/dl (≥ 7.0 mmol/L) or 2-h plasma glucose ≥ 200 mg/dL (11.1 mmol/L).[18,19]

Obesity and overweight: based on the revised criteria specific for Asian/Pacific populations.[8] Value of BMI ≥ 23 kg/m² used to define overweight and ≥ 25 kg/m² to define obese.[20]

Hypertension: based on physician diagnosis and antihypertensive treatment or systolic blood pressure ≥ 140 or diastolic blood pressure ≥ 90 mmHg.[21,22]

Dyslipidemia: based on the Third Report of the National Cholesterol Education Program (NCEP).[23] Hypercholesterolemia: serum cholesterol > 200 mg/dL; hypertriglyceridemia: serum triglycerides > 150 mg/dL; low high-density lipoprotein cholesterol (HDLC): males ≤ 40 mg/dL, females ≤ 50 mg/dL.

Metabolic syndrome: We followed a recent unified definition of various international medical bodies.[24,25]

The presence of any three of the following five conditions was essential: waist circumference ≥ 90 cm for males and ≥ 80 cm for females; hypertriglyceridemia ≥ 150 mg/dL; low HDL (males < 40 mg/dL, females < 50 mg/dL); elevated blood pressure (systolic blood pressure ≥ 130 mmHg and/or diastolic blood pressure ≥ 85 mmHg or drug treatment for hypertension) and elevated blood sugar (fasting blood sugar ≥ 100 mg/dL or drug treatment for diabetes mellitus).

Clinical profile and anthropometric measurements: All relevant individual-level data pertaining to blood pressure and anthropometric parameters (height, weight, and waist and hip circumferences) available to the study were abstracted.[16] Details of these clinical and anthropometric measurements were published earlier.[16]

Biochemical measurements: Fasting blood glucose levels and lipid profiles, total cholesterol (TC), triglycerides (TG), and HDLC were estimated or measured according to previously described methods.[16] Low-density lipoprotein cholesterol (LDLC) levels were calculated using the Friedewald formula.[26]

Statistical analysis: Data were analysed using SPSS for Windows (SPSS, Inc, Chicago IL, USA). Continuous variables were expressed as mean, and categorical variables were expressed as frequencies and proportions. Comparisons between groups were performed using the Student's t-test for continuous variables and the chi-square test for categorical data. $P < 0.05$ was considered to be statistically significant. Pearson's correlation coefficient estimations were computed to quantify correlations between anthropometric indices and cardiometabolic risk factors.

Further receiver operating characteristic (ROC) curve analyses were performed to compare predictive validity and to determine optimal cut-off levels for each of the anthropometric indices against the cardiometabolic risk factors. The predictive validity was assessed using the area under the ROC curve (AUROC), while the optimal cut-off levels were determined using the Youden Index.[27] AUROC were plotted using measures of sensitivity (true-positive rate) on the *y*-axis against 1-specificity (true-negative rate) on the *x*-axis. In general the discriminatory power of a diagnostic test is established by AUROC over the whole range of testing values. AUROC is a measure of the diagnostic power of a test. A perfect test will have an AUROC of 1.0, and an AUROC equal to 0.5 means the test is a poor discriminator. The Youden index intuitively corresponds to the point on the curve farthest from chance.[27]

RESULTS

Basic characteristics of the study subjects

The characteristics of the study population and the prevalence of CVD risk factors, stratified by gender, are shown in Table 1. The mean age of the study population was 47.6 years in men and 44.2 years in women. The mean BMI was 24.1 kg/m² in men and 25.0 kg/m² in women. The mean WC, WHpR and WHtR in men were 86.4, 0.93 and 0.53 cm respectively. For women, the values were 81.2, 0.87 and 0.54 cm, respectively.

Table 1: Demographic and anthropometric/biochemical profile

Variables (mean ± SD or % (*n*))	Males *n*=590	Females *n*=588	*P*-value
Age group (years)	47.6 ± 14.4	44.2 ± 13.2	< 0.001**
Height (metres)	1.6 ± 0.1	1.5 ± 0.06	< 0.001**
Weight (kg)	64.0 ± 11.2	56.2 ± 11.3	< 0.001**
BMI (kg/m²)	24.1 ± 3.8	25.0 ± 4.79	< 0.001**
WC (cm)	86.4 ± 11.6	81.2 ± 12.4	< 0.001**
HC (cm)	92.2 ± 9.2	93.1 ± 11.3	0.148
WHpR	0.93 ± 0.08	0.87 ± 0.08	< 0.001**
WHtR	0.53 ± 0.07	0.54 ± 0.08	0.015*
SBP (mmHg)	133.4 ± 14.2	130.3 ± 14.5	< 0.001**
DBP (mmHg)	84.6 ± 8.2	83.5 ± 8.7	0.018*
FBS (mg/dL)	98.8 ± 36.8	95.3 ± 34.4	0.103
PGBS (mg/dL)	140.7 ± 59.9	133.8 ± 53.7	0.037*
TC (mg/dL)	182.3 ± 33.8	181.3 ± 36.3	0.633
TG (mg/dL)	162.5 ± 67.4	152.9 ± 51.8	0.006*
LDLC (mg/dL)	103.7 ± 30.1	104.4 ± 31.8	0.717
HDLC (mg/dL)	46.0 ± 4.5	46.2 ± 4.3	0.412
Diabetes mellitus (% (*n*))	17.8 (105)	13.6 (80)	0.048*
Hypertension (% (*n*))	38.5 (227)	34.7 (204)	0.178
High TC (% (*n*))	21.7 (128)	24.7 (145)	0.228
High TG (% (*n*))	39.3 (232)	36.1 (212)	0.247
Low HDLC (% (*n*))	9.5 (56)	84.5 (497)	< 0.001**
Overweight (% (*n*))	21.4 (126)	15.5 (91)	0.009*
Obesity (% (*n*))	39.7 (234)	48.0 (282)	0.004*
Metabolic syndrome	34.2 (202)	52.2 (307)	< 0.001*

**$P < 0.001$; *$P < 0.05$: values are expressed as mean standard deviation (SD) or % (*n*).

BMI: body mass index; DBP: diastolic blood pressure; FBS: fasting blood sugar; HC: hip circumference; HDLC: high-density lipoprotein cholesterol; LDLC: low-density lipoprotein cholesterol; PGBS: postglucose blood sugar; SBP: systolic blood pressure; TC: total cholesterol; TG: triglycerides; WC: waist circumference; WHpR: waist-to-hip ratio; WHtR: waist-to-height ratio.

Correlations between anthropometric indices and cardiovascular risk factors

Pearson's correlation coefficients, as measured among the anthropometric indices and CVD risk factors, are shown in Table 2. In general, WHtR has relatively higher correlation coefficients with cardiovascular risk factors analysed for both men and women, except for LDLC compared with other anthropometric indices.

Overall AUROC curve results

The AUROC curves of various anthropometric indices and CVD risk factors are shown in Table 3. Overall, WHtR had highest AUROC for all the cardiovascular risk factors studied, although there were variations between men and women.

Cut-off points to predict CVD risk factors

Table 4 summarizes the cut-off points for the various anthropometric indices to predict CVD risk factors using AUROC analysis. The ROC curves in Figures 1–6 show the AUROC from which the values in Table 4 were derived. The optimal BMI cut-off values for men were 23.4–24.2 kg/m², while the range for women was wider at 23.6–25.3 kg/m². WC cut-off values were higher for men (84.5–89.5 cm) than women (77.5–82.0 cm). WHpR cut-offs were also higher for men (0.93–0.95) than women (0.85–0.88). For both sexes the optimal WHtR cut-off value was 0.51–0.55, i.e. WHtR > 0.5 correlated well with cardiometabolic risk parameters.

DISCUSSION

Main findings

Based on the two primary study objectives, the following are the main study findings.

First, WHtR may be considered the most sensitive anthropometric index for the several cardiometabolic risk factors under investigation in an urban population in eastern India. However, variations within sexes – e.g. WC for triglycerides in men and for hypertension in women – were observed. Such analyses were based on the AUROC outputs (Table 3). Second, this study identified optimal cut-off levels for each anthropometric index against individual cardiometabolic risk factors. In general in both sexes, lower cut-off levels were determined to be optimal for BMI and WC, while relatively higher cut-off levels were found to be optimal for WHtR and

Table 2: Pearson's correlation coefficients of anthropometric indices and cardiovascular risk factors

	Men (*n*=590)				Women (*n*=588)			
	BMI	WC	WHpR	WHtR	BMI	WC	WHpR	WHtR
SBP (mmHg)	0.324	0.348	0.260	0.362	0.364	0.366	0.163	0.395
DBP (mmHg)	0.282	0.321	0.248	0.330	0.327	0.348	0.143	0.369
FBS (mg/dL)	0.111	0.162	0.120	0.182	0.247	0.320	0.215	0.348
PGBS (mdL)	0.116	0.175	0.139	0.193	0.252	0.317	0.218	0.347
TC (mg/dL)	0.126	0.173	0.109	0.160	0.210	0.169	0.053	0.179
LDLC (mg/dL)	0.093	0.093	0.033	0.085	0.149	0.098	0.017	0.104
TG (mg/dL)	0.163	0.269	0.218	0.258	0.279	0.297	0.157	0.323
HDLC (mg/dL)	–0.108	–0.126	–0.058	–0.146	–0.071	–0.094	–0.076	–0.116

BMI: body mass index; DBP: diastolic blood pressure; FBS: fasting blood sugar; HDLC: high-density lipoprotein cholesterol; LDLC: low-density lipoprotein cholesterol; PGBS: postglucose blood sugar; SBP: systolic blood pressure; TC: total cholesterol; TG: triglycerides; WC: waist circumference; WHpR: waist-to-hip ratio; WHtR: waist-to-height ratio.

Table 3: AUROC curves for various anthropometric indices and cardiometabolic risk factors in men, women and overall[a]

Men (*n*=590)	**BMI**	**WC**	**WHpR**	**WHtR**
Diabetes mellitus	0.603 (0.544–0.661)	0.640 (0.587–0.693)	0.632 (0.580–0.683)	0.660 (0.607–0.714)
Hypertension	0.626 (0.580–0.672)	0.660 (0.615–0.705)	0.627 (0.582–0.672)	0.725 (0.682–0.767)
High TC	0.575 (0.520–0.629)	0.605 (0.552–0.658)	0.571 (0.518–0.625)	0.602 (0.547–0.656)
High TG	0.620 (0.575–0.665)	0.660 (0.616–0.704)	0.627 (0.582–0.672)	0.652 (0.608–0.697)
Low HDLC	0.486 (0.408–0.565)	0.526 (0.448–0.605)	0.546 (0.468–0.624)	0.552 (0.471–0.632)
OCVRF	0.642 (0.594–0.690)	0.677 (0.630–0.724)	0.648 (0.598–0.697)	0.684 (0.638–0.731)
Women (*n*=588)				
Diabetes mellitus	0.700 (0.645–0.756)	0.741 (0.689–0.794)	0.687 (0.628–0.746)	0.765 (0.715–0.814)
Hypertension	0.686 (0.641–0.730)	0.694 (0.650–0.738)	0.611 (0.565–0.658)	0.666 (0.621–0.710)
High TC	0.604 (0.551–0.657)	0.583 (0.531–0.635)	0.530 (0.476–0.583)	0.585 (0.533–0.637)
High TG	0.652 (0.606–0.698)	0.671 (0.626–0.716)	0.594 (0.546–0.641)	0.682(0.638–0.727)
Low HDLC	0.540 (0.473–0.607)	0.556 (0.491–0.621)	0.524 (0.455–0.593)	0.566(0.501–0.632)
OCVRF	0.607 (0.514–0.700)	0.632 (0.542–0.722)	0.547 (0.460–0.635)	0.645(0.555–0.736)
Overall (*n*=1178)				
Diabetes mellitus	0.644 (0.603–0.683)	0.692 (0.654–0.729)	0.665 (0.627–0.703)	0.703 (0.666–0.741)
Hypertension	0.654 (0.621–0.686)	0.676 (0.645–0.708)	0.618 (0.586–0.651)	0.693 (0.662–0.723)
High TC	0.594 (0.556–0.632)	0.586 (0.548–0.624)	0.538 (0.500–0.576)	0.592 (0.554–0.629)
High TG	0.633 (0.601–0.665)	0.666 (0.635–0.697)	0.611 (0.578–0.643)	0.666 (0.634–0.697)
Low HDLC	0.546 (0.513–0.580)	0.424 (0.392–0.457)	0.352 (0.321–0.384)	0.549 (0.516–0.582)
OCVRF	0.633 (0.594–0.672)	0.591 (0.552–0.631)	0.527 (0.486–0.568)	0.662 (0.623–0.700)

[a]area under curve (95% confidence interval).

BMI: body mass index; HDLC: high-density lipoprotein cholesterol; LDLC: low-density lipoprotein cholesterol; OCVRF: any one of the cardiovascular risk factors; TC: total cholesterol; TG: triglycerides; WC: waist circumference; WHpR: waist-to-hip ratio; WHtR: waist-to-height ratio.

Table 4. Cut-off points for anthropometric indices predictive of cvd risk factors

	BMI			WC			WHpR			WHtR		
	Cut-off (kg/m^2)	Sens (%)	Spec (%)	Cut-off (cm)	Sens (%)	Spec (%)	Cut-off	Sens (%)	Spec (%)	Cut-off	Sens (%)	Spec (%)
Men (*n*=590)												
Diabetes mellitus	24.2	61.9	55.2	89.5	63.8	62.8	0.945	62.8	57.5	0.540	66.6	58.9
Hypertension	24.0	63.4	55.6	86.9	66.9	58.9	0.940	63.4	56.7	0.530	67.4	59.7
High TC	24.2	57.8	54.9	88.0	62.5	56.3	0.943	57.8	53.8	0.534	60.1	54.9
High TG	23.9	42.8	34.4	87.0	68.1	60.0	0.940	63.3	56.9	0.531	65.5	59.7
Low HDLC	23.8	50.0	45.1	86.0	53.5	47.9	0.946	55.3	55.2	0.538	55.3	54.6
OCVRF	23.4	65.3	59.0	84.5	68.1	62.1	0.926	65.0	58.5	0.520	68.8	65.1
Women (*n*=588)												
Diabetes mellitus	25.3	70.0	60.0	82.0	78.7	58.4	0.882	70.0	62.7	0.552	76.2	62.5
Hypertension	24.8	68.1	59.6	80.0	74.5	53.9	0.859	60.7	55.2	0.532	72.5	57.2
High TC	25.2	60.6	59.3	80.0	62.7	46.2	0.863	53.1	52.1	0.533	60.0	49.4
High TG	24.7	65.0	59.6	79.8	71.6	52.9	0.860	60.8	55.8	0.535	68.8	59.3
Low HDLC	24.4	54.4	45.5	79.9	57.7	53.8	0.857	53.3	52.7	0.526	57.7	56.0
OCVRF	23.6	60.9	60.4	77.5	63.1	60.4	0.853	55.4	53.4	0.506	67.9	55.8
Overall (*n*=1178)												
Diabetes mellitus	24.7	65.4	56.4	85.0	72.9	56.8	0.910	66.4	57.1	0.545	70.8	60.4
Hypertension	24.4	65.4	58.3	83.0	68.4	54.7	0.899	61.7	56.0	0.531	69.3	58.5
High TC	24.5	59.7	55.0	83.5	43.2	43.5	0.900	55.6	51.1	0.534	58.9	53.2
High TG	24.1	64.4	54.3	83.5	66.8	59.8	0.898	61.2	55.5	0.533	67.5	59.1
Low HDLC	24.2	54.6	51.3	84.0	43.2	43.5	0.903	35.0	39.6	0.532	54.9	52.1
OCVRF	23.4	63.6	58.5	81.5	59.7	53.1	0.895	52.5	51.4	0.514	66.2	59.7

BMI: body mass index; HDLC: high-density lipoprotein cholesterol; OCVRF: any one of the cardiovascular risk factors; Sens: sensitivity; Spec: specificity; TC: total cholesterol; TG: triglycerides; WC: waist circumference; WHpR: waist-to-hip ratio; WHtR: waist-to-height ratio.

WHR (Table 4). Such computations were based on Youden Index derivations of ROC analyses. In addition, several ROC graphs clearly illustrate the representations of each index against individual cardiometabolic risk factors.

The study findings suggest that the proposed cut-offs of various organizations to define overweight and obesity are not appropriate for Indians, who are at risk of developing obesity-related cardiometabolic morbidities at lower levels of BMI and WC. Table 5 compares the optimal cut-off points derived from this study with current international recommendations.[23,24,28-30] Our findings also suggest that, unlike standard BMI cut-off levels for identifying obesity, AUROC values indicated that WHtR was consistently a better indicator for the majority of cardiometabolic risk factors except for high TC where BMI is a better predictor overall and in women, and WC is a better predictor in men. These observations are consistent with recent studies[11-13] as well as studies from the mid 1990s.[31,32]

Strengths of the study

Strengths of this study include a broad baseline of available adiposity parameters and metabolic disease data from a large population-based cohort. Other strengths are representative sampling methodology, the use of standardized data collection protocols, in-depth assessment of multiple cardiometabolic risk factors, and a high response rate to the survey (98.1%). Furthermore, this is the first study from eastern India comparing all four adiposity measures – BMI, WC, WHpR and WHtR – with cardiometabolic risk factors.

Limitations of the study

One limitation of our study is that it relates cardiovascular risk to BMI, WC, WHpR and WHtR in a cross-sectional setting using established cardiometabolic risk factors as a proxy estimate rather than clinical end-points or mortality data. Thus, the cross-sectional design does not allow cause–effect relationships to be made.

Given that individuals were approached at home, it is possible that the sample was biased towards home-based or more sedentary individuals rather than a more active professional workforce. Finally, we had no data on body fat mass, and further studies may be needed to assess body fat mass and its relationship with surrogate anthropometric indices. Prospective

Table 5: Obesity cut-off points: comparison between published guideline and results of this study

Obesity index and source of guideline	Defined cut-off points	Cut-off points for South Asians derived from this study
Body mass index		
WHO, 1999[28]	30 kg/m^2 for both sexes	23.4 kg/m^2 in men 23.6 kg/m^2 in women
API, 2009[30]	25 kg/m^2 for both sexes	
Waist circumference		
WHO, 2008[29]	94 cm in men 80 cm in women	84.5 cm in men 77.5 cm in women
NCEP: ATPIII, 2001[23]	102 cm in men 88 cm in women	
IDF/NHLBI/AHA/WHF/IAS/IASO, 2009[24] *	90 cm in men 80 cm in women	
API, 2009[30]	90 cm in men 80 cm in women	
Waist–hip ratio		
WHO, 1999,[28] 2008[28,29]	0.90 in men 0.85 in women	0.93 in men 0.85 in women
Waist–height ratio		
Ashwell and Hsieh, 2005[11]	0.50 for both sexes	0.52 in men 0.51 in women

Note: Superscript numbers are references cited in the main text.

*Joint Interim Statement of the International Diabetes Federation Task Force on Epidemiology and Prevention; National Heart, Lung, and Blood Institute; American Heart Association; World Heart Federation; International Atherosclerosis Society; and International Association for the Study of Obesity.

AHA: American Heart Association; API: Association of Physicians of India; IAS: International Atherosclerosis Society; IASO: International Association for the Study of Obesity; IDF: International Diabetes Federation; NCEP: National Cholesterol Education Program; NHLBI: National Heart, Lung, and Blood Institute; WHF: World Heart Federation; WHO: World Health Organization.

studies are also required that relate anthropometric indices to clinical CVD mortality and all-cause mortality in South Asians.

CONCLUSIONS

It is evident from the present study findings that, despite overlap in 95% confidence intervals, WHtR is a relatively superior indicator of obesity-related cardiometabolic risk in adult Indians in terms of AUROC values compared with other relevant anthropometric indices studied. Our study indicates that the cut-off values for BMI, WC, or WHpR to define obesity could be much lower in South Asia than in western countries. Based on these conclusions and those of similar findings elsewhere,[13] we suggest that WHtR is a better screening tool to identify obesity-associated cardiometabolic risks among adult Indians, and probably across other ethnic communities. Nevertheless, further studies are required for such a population-based screening tool prior to its universal adoption in both clinical and community health settings.

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Diabetes in rural Pondicherry, India: a population-based study of the incidence and risk factors

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ABSTRACT

Background: For India, the 'diabetes capital' of the world, it is essential to know the incidence of type 2 diabetes mellitus (T2DM) and its key determinants. As two thirds of Indians live in rural areas, a study was undertaken to assess the incidence and risk factors of T2DM in rural Pondicherry, India.

Methods: In a population-based cohort study initiated in 2007, a sample of 1223 adults > 25 years of age from two villages of Pondicherry were selected using cluster random sampling. Data on risk factor exposure were collected using a structured questionnaire, anthropometric tests and fasting blood glucose assessment. During house visits, 1223 of 1403 invited subjects participated. Of these, 71 (5.8%) were found to have diabetes. In 2010–2011, 85% of the non-diabetics (979/1152) were followed up using the same protocol. We calculated the risk of T2DM per annum standardized by age and sex. Population estimates of the risk factors associated with T2DM were analysed using the Generalized Estimating Equation model and the Population Attributable Risk (PAR) for T2DM calculated.

Results: During 2937 person-years (PY) of follow-up, 63 new cases of T2DM occurred, giving an incidence rate of 21.5/1000 PY. Almost one third (31.7%) of cases occurred in people aged below 40 years. The incidence was double among males (28.7/1000 PY; 95% confidence interval (CI): 21.0–38.7) compared with females (14.6/1000 PY; 95% CI: 9.4–21.7). Applying these rates to rural populations, it is estimated that each year 8.7 million people develop T2DM in rural India. Nearly half of the T2DM incidence was attributed to overweight/obesity and alcohol usage.

Conclusion: T2DM incidence was 2% per year in adults in rural Pondicherry, India, with the rate increasing twice as fast in men. Increasing age, obesity, alcohol use and a family history of T2DM independently predicted the development of diabetes. As half of T2DM incidence was attributed to overweight/obesity and alcohol use, health promotion interventions focusing on maintaining an optimal weight and decreasing alcohol consumption may be effective in reducing the rise in T2DM cases.

Key words: type 2 diabetes, incidence studies, risk factors, rural population, India

INTRODUCTION

According to the International Diabetes Federation (IDF), the number of people globally with type 2 diabetes mellitus (T2DM) will increase to 552 million by 2030, over twice the number in 2000.[1] Nearly 21% of these new cases will be from India, which has the highest number of cases in any country.[1] India currently has 61.3 million diabetics, a figure that is projected to increase to 103 million by 2030.[2]

Several studies from different regions of India have shown that prevalence of T2DM is increasing – from 8.2% in 1992 to 18.6% in 2008 for urban areas, and from 2.4% in 1992 to 9.2% in 2008 in rural areas.[3-5] Accurate knowledge on incidence of

T2DM and its determinants is key to controlling a potential T2DM pandemic in India.[6] A T2DM incidence of 20–22/1000 person-years (PY) has been reported by two studies on the urban population of Chennai, south India.[7,8]

Though 72% of Indians reside in rural areas, T2DM incidence and its determinants among rural residents has not been studied to date. We followed a population-based sample of adults aged > 25 years for three years with the aim to describe the incidence and risk factors for T2DM in rural Pondicherry, India.

MATERIALS AND METHODS

The research protocol for this study was approved by the Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER) Institute Ethics Committee. All participants gave verbal informed consent.

Study setting

Pondicherry is a Union Territory situated on the Coromandal Coast, 170 km south of Chennai. The total population as per the 2011 census was 1.25 million with a sex ratio of 1038 females to 1000 males, and literacy levels of 92% in men and 81% in women.[9]

Study population

This population-based cohort study on T2DM started in 2007 in a rural population of Pondicherry. Sample size was calculated using a freely available open source software, Open Epi Version 2.3.[10] With a 95% confidence interval (CI) and 80% power for a ratio of normal to prediabetics of 1:11, and incidence of diabetes within each group at 13% and 41%, respectively,[8] a minimum sample of 171 was to be followed for eight years, i.e. 1368 PY. Taking into account a design effect of 2[1] and a non-response rate of 35%[2] (including refusals and individuals who could not be reached), the cohort was to be followed for 4209 PY, that is, 1403 individuals were to be followed over three years (1368*2)/([1–0.35]*3)=1403.

The study was carried out in two of the four villages under the Rural Health Centre, namely Ramanathapuram and Pillaiyarkuppam, with a population of 2165 and 2412 respectively. The sampling frame comprised individuals aged above 25 years (*n*=2608). Single stage cluster random sampling was carried out. Using streets as the primary sampling unit, four streets in Ramanathapuram and six streets in Pillaiyarkuppam were chosen by lot method. From the houses of selected streets, all participants (*n*=1403) aged more than 25 years (*n*=1403) were invited to take part in the baseline study in 2007–2008 (Figure 1). Unavailability of subjects during home visits on three separate days and pregnant women were excluded. Of the 1223 subjects (87%) who participated in the baseline survey, 71 subjects (5.8%) were diagnosed with T2DM. In 2010–2011,

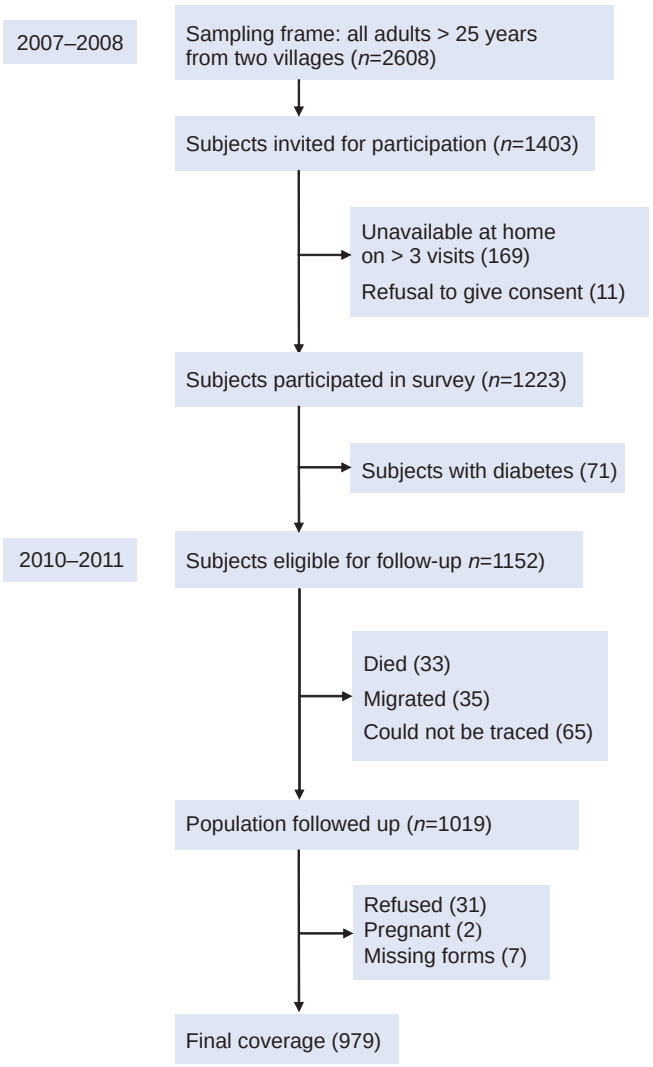

Figure 1: Population flow chart showing participant recruitment and follow-up

a follow-up survey was carried out using the same protocol. All participants except those with T2DM at baseline (*n*=1152) were called for assessment. A total of 979 individuals (85%) completed the follow-up.

Survey procedure

The methodology was the same in both the baseline and follow-up surveys. It consisted of questionnaire-based assessments of lifestyle behaviours, a physical examination and blood collection. Two interviewers were trained and collected the data during house visits. After obtaining informed consent and ensuring adequate privacy, individuals were interviewed face-to-face using the pretested questionnaires. Details regarding sociodemographic factors, predisposing biological factors like family history of T2DM, and behavioural components (physical activity, smoking and alcohol consumption) were collected. Anthropometric measurements (height, weight and waist circumference) were taken.

1 Based on: Designing Household Survey Samples: Practical Guidelines [Internet]. 2005 [cited 2009 Jan 20]. Available from: unstats.un.org/unsd/demographic/sources/surveys/Handbook23June05.pdf.

2 Based on values from Bai et al[7] and Mohan et al.[8]

The Accu-CheK® Advantage glucometer was used to measure fasting blood glucose (FBG). The instrument was standardized with the Olympus AU400 automatic analyzer in the Department of Biochemistry, JIPMER. Sixty blood samples from patients of JIPMER's outpatient department were assessed for blood glucose values. The correlation coefficient was 0.84 ($P < 0.001$). Indian Council of Medical Research Guidelines for Management of Type 2 Diabetes, 2005[11] were used for diagnosis and classification of diabetes. On the basis of FBG, subjects were classified as having normal glucose tolerance (NGT): < 110 mg/dL; prediabetes: 110–125 mg/dL; and suspected T2DM: > 125 mg/dL. For those with suspected T2DM, an oral glucose tolerance test (OGTT) was carried out on a separate day. Subjects with FBG of > 125 mg/dL and/or postprandial blood glucose of > 200 mg/dL were labelled as diabetic. An incident T2DM was defined as an individual with no T2DM at the baseline survey but with T2DM during the follow-up survey. In both surveys, diabetics were informed about their condition, given health education, and were referred to the health facility for further management.

Risk factors

Education was classified using International Standard Classification of Education as (a) no formal schooling and (b) attended school.[12] Work status was categorized as unemployed and employed (economically productive occupations in both formal and informal sectors) as per the Government of India Census 2001.[13] Socioeconomic status (SES) was measured as per capita income in Indian rupees (Rs) and graded as per Prasad's classification; modifying for Consumer Price Index for 2006–2007, the social classification value was determined as 486.[14] Per capita income per month was grouped as Rs ≥ 2400 (Class 1) and Rs < 2400 (other classes). Family history of T2DM in first- or second-degree relatives was obtained. Physical activity was measured using the International Physical Activity Questionnaire[15] (short version). Total metabolic equivalents/week (MET/wk) were calculated and individuals grouped as physically inactive (< 600 MET/wk) and physically active (≥ 600MET/wk). Smoking was defined as the current use of any tobacco product (cigarettes, bidis, chewing tobacco or snuff) on a regular basis for at least the previous six months.[16] Individuals who said they had not smoked during the survey period were classified as non-smokers. Alcohol use was defined as the consumption of any type of alcohol in the past 12 months.[16] Body mass index (BMI) was calculated and classified as per BMI classification for Indians (< 23 kg/m^2 as normal and ≥ 23 kg/m^2 as overweight and obese).

STATISTICAL ANALYSIS

Data were analysed using the SPSS statistical package version 19.0 for Windows (SPSS Inc., Chicago, United States of America). The significance level was set at a two-sided $P < 0.05$. BMI was not calculated for five individuals as height could not be measured due to kyphosis morbidity. Variables with missing data were excluded from the analysis. Using the Chi-squared test, proportions for categorical variables compared characteristics of the participants and non-participants in the follow-up survey. Incidence was reported as rates per 1000 PY (95% CI) for the overall population and for individuals with NGT and prediabetes.

Age-specific incidence rates were calculated separately for men and women. Incidence rates and crude odds ratios (OR) (with 95% CI) were calculated across the sociodemographic and health-related variables, with each explanatory variable expressed using binary categories. The generalized estimation equation (GEE) model was used to account for changes in noncommunicable disease (NCD) risk factors of the study cohort during the follow-up period. GEE with an independent link function was used to calculate the adjusted OR of developing T2DM for the independent variables.

Population attributable risks (PAR) for the risk factors were estimated using the formula $PAR=P*(AOR-1)/[1+P*(AOR-1)]$ where P is the prevalence and AOR is the adjusted odds ratio of the modifiable risk factors of obesity, alcohol usage and physical inactivity. Age-standardized rates were calculated for the rural Pondicherry and rural Indian populations using population characteristics from the Census of India, 2011.[9]

RESULTS

In the baseline survey, the prevalence of T2DM was found to be 5.8%. After three years, a follow-up survey was conducted on the original non-diabetic cohort, 85% (979/1152) of whom were re-examined. Respondents and non-respondents differed in terms of age, gender, physical activity, family history of T2DM, smoking and alcohol consumption, with non-respondents being more likely to be male, physically inactive, smokers and alcohol users and less likely to have a family history of T2DM ($P < 0.05$) (Table 1). Among the responders, differences were found across the sexes, with a higher proportion of men having attended school, being employed, physically inactive and overweight . None of the participating women reported smoking or consuming alcohol.

Incidence rate of T2DM

There were 63 incident T2DM cases in the follow-up of 2937 PY with a crude incidence rate of 21.5 (16.6–27.3) per 1000 PY. Among the follow-up sample (n=979), 44 (5.5%) of the 801 participants with NGT at baseline were diagnosed with T2DM, while 19 (10.7%) of the 178 prediabetics developed T2DM. The incidence rates of T2DM in NGT and prediabetics were 18.3 (13.5–24.4) and 33.3 (22.1–54.5) per 1000 PY respectively. Almost two thirds of the incident cases (n=44) occurred in subjects < 50 years of age. The incidence rate was twice as high in males (28.7/1000 PY; 95% CI: 21.0–38.7) compared with females (14.6/1000 PY; 95% CI: 9.4–21.7), the highest incidence rate being in the 35–50 year age group (38.0/1000 PY). In women, the rate rose sharply with increasing age, with the greatest T2DM incidence of 21.7/1000 PY in those above 50 years old.

Table 1: Characteristics of the population cohort during baseline survey in 2007–2008

Variable	Respondents				Non-respondents	
	Women (*n*=503) (%)	Men (*n*=476) (%)	*P* value*	Total (*n*=979) (%)	Total (*n*=173) (%)	*P* value†
Age in years						
< 35	165 (32.8)	175 (36.8)		340 (34.7)	64 (37.0)	
35–50	214 (42.5)	175 (36.8)		389 (39.7)	51 (29.5)	
> 50	124 (24.7)	126 (26.5)	0.176	250 (25.6)	58 (33.5)	0.021
Schooling						
No schooling	221 (43.9)	78 (16.4)		299 (30.5)	61 (35.3)	
Attended school	282 (56.1)	398 (83.6)	< 0.001	680 (69.5)	112 (64.7)	0.218
Work status						
Unemployed	323 (64.2)	45 (9.5)		368 (37.6)	60 (34.7)	
Employed	180 (35.8)	431 (90.5)	< 0.001	611 (62.4)	113 (65.3)	0.466
PCI in Rupees						
< 2400	460 (91.5)	437 (91.8)		897 (91.6)	160 (92.5)	
≥ 2400	43 (8.5)	39 (8.2)	0.841	82 (8.4)	13 (7.5)	0.704
Physical activity						
Active	428 (85.1)	364 (76.5)		792 (80.9)	121 (69.9)	
Inactive	75 (14.9)	112 (23.5)	0.001	187 (19.1)	52 (30.1)	< 0.001
BMI[a] in kg/m^2						
< 23.0	349 (69.8)	299 (63.1)		648 (66.5)	118 (68.2)	
≥ 23.0	151 (30.2)	175 (36.9)	0.026	326 (33.5)	55 (31.8)	0.817
Family history of T2DM						
Absent	428 (85.1)	396 (83.2)		824 (84.2)	156 (90.2)	
Present	75 (14.9)	80 (16.8)	0.417	155 (15.8)	17 (9.8)	0.044
Smoking						
Absent	503 (100.0)	365 (76.7)		868 (88.7)	142 (82.1)	
Present	0 (0.0)	111 (23.3)	NA	111 (11.3)	31 (17.9)	0.017
Alcohol intake						
Absent	503 (100.0)	297 (62.6)		800 (81.7)	117 (67.6)	
Present	0 (0.0)	179 (37.4)	NA	179 (18.3)	56 (32.4)	< 0.001

BMI: body mass index; NA: not applicable; PCI: per capita income in Indian Rupees; T2DM: type 2 diabetes mellitus.

**P* value for differences in female and male respondents.

†*P* value for differences in respondents and non-respondents.

[a]BMI was not calculated for five subjects.

Risk factors for T2DM

Table 2 shows the incidence rates and OR of developing T2DM by each of the selected sociodemographic and health-related risk factors. Univariate analysis showed that the risk of T2DM differed significantly across sex, age group, educational status, per capita income, family history of T2DM, overweight and obesity, and alcohol use. In multivariate analysis, no interaction between sex and other variables; hence no separate analysis was performed for men and women. Gender, educational status and per capita income were no longer significant after adjustment for other risk factors ($P > 0.05$). The risk of T2DM was higher for individuals aged 35–50 years (OR: 2.9; 95% CI: 1.4–5.9) and those aged > 50 years (OR: 3.5; 95% CI: 1.6–7.6) compared with the risk in the younger age group. In addition, positive family history of T2DM and overweight or obesity more than doubled the chance of developing diabetes. One third of men consumed alcohol in the study cohort. Drinkers had 2.3 times higher risk of T2DM than those who did not (Table 4). One third of incident cases of T2DM in our population were attributed to overweight/obesity (PAR=34.3%). In addition, PAR for alcohol intake and physical inactivity were 19.5% and 1.4% respectively.

DISCUSSION

This was the first report of its kind on rural population-based incidence of T2DM in a country of the South-East Asian Region. Overweight/obesity and alcohol use were important modifiable factors that were attributed to more than half of the T2DM incidence. Among non-modifiable factors, older age and positive family history of T2DM predicted the development of diabetes.

Table 2: Incidence rates and the risk of T2DM as stratified by risk factors

Risk factor	Number	Incident diabetes	Incidence/1000 PY	OR (95% CI)	*P* value*	Adjusted OR (95% CI)	*P* value†
All	979	63	21.5 (16.6–27.3)				
Non-modifiable risk factors							
Sex							
Female	503	22	14.6 (9.4–21.7)	1.0		1.0	
Male	476	41	28.7 (20.9–38.6)	2.1 (1.2–3.5)	0.007	1.5 (0.7–3.2)	0.269
Age in years							
< 35	340	13	12.7 (7.1–21.3)	1.0	0.026	1.0	
35–50	260	31	39.7 (27.5–55.7)	2.2 (1.1–4.2)	0.022	2.9 (1.4–5.9)	0.002
> 50	379	19	16.7 (10.4–25.6)	2.1 (1.0–4.3)	0.049	3.5 (1.6–7.6)	0.005
Education							
No schooling	299	10	11.2 (5.7–19.9)	1.0		1.0	
Attended school	680	53	26.0 (19.7–33.7)	2.4 (1.2–4.8)	0.011	1.9 (0.9–3.9)	0.080
Work status							
Unemployed	368	21	19.0 (12.1–28.6)	1.0		1.0	
Employed	611	42	23.0 (16.7-30.7)	1.2 (0.7–2.1)	0.471	0.5 (0.3–1.1)	0.054
PCI in Rupees							
< 2400	897	53	19.7 (14.9–25.6)	1.0		1.0	
≥ 2400	82	10	40.7 (20.7–72.5)	2.2 (1.1–4.5)	0.030	2.0 (0.9–4.3)	0.057
Family history of T2DM							
Absent	824	43	17.4 (12.8–23.2)	1.0		1.0	
Present	155	20	43.0 (27.0–65.3)	2.7 (1.5–4.7)	0.001	2.1 (1.2–3.8)	0.016
Modifiable risk factors							
BMI[a]							
< 23.0	648	24	12.3 (8.1–18.1)	1.0		1.0	
≥ 23.0	326	38	38.9 (27.9–52.8)	3.4 (2.0–5.8)	< 0.001	2.6 (1.4–4.6)	0.002
Physical activity							
Active	792	47	19.7 (14.7–26.1)	1.0		1.0	
Inactive	187	16	28.5 (16.9–45.3)	1.4 (0.8–2.7)	0.191	1.1 (0.5–2.4)	0.866
Smoking							
Absent	868	54	20.7 (15.7–26.9)	1.0		1.0	
Present	111	9	27.0 (13.2–49.6)	1.3 (0.6–2.8)	0.574	0.9 (0.5–1.8)	0.803
Alcohol intake							
Absent	800	46	19.2 (14.2–25.3)	1.0		1.0	
Present	179	17	31.7 (19.1–49.7)	1.9 (1.1–3.3)	0.064	2.3 (1.2–4.6)	0.014

BMI: body mass index; CI: confidence interval; OR: odds ratio; PCI: per capita income; PY: person-years; T2DM: type 2 diabetes mellitus.

**P* value for OR of the risk factors.

† *P* value for adjusted OR of the risk factors.

[a]BMI was not calculated for 5 subjects

Crude odds ratio *p* value* 0.007 PCI Table 4: Adjusted odds ratio (AORs)

Comparison with other studies

The 5.8% prevalence of T2DM in the baseline study population was comparable to the prevalence of 6.4% reported for rural south Indians.[4] Two studies in India, both from Chennai, described the incidence of T2DM. One of these, a study among staff of the Indian Institute of Technology and their relatives in 1992, showed that in an urban population, the incidence of T2DM was 22/1000 PY over one year.[7] The second study in India in 2005 reported an incidence of 20.2/1000 PY over eight years in subjects > 20 years of age.[8]

Asian ethnicity is a known risk factor for T2DM[1] and within Asia , the incidence in the Indian population is the highest. Examples of studies from neighbouring countries and regions reporting T2DM incidence are from Taiwan (3.6/1000 PY)[17], Japan (8.8/1000 PY)[18], China (5.1-9.5/1000 PY)[19,20], Islamic Republic of Iran (10.6/1000 PY)[21] and Thailand (11.4-13.6/1000 PY)[22,23]. In the literature, a few of the highest incidences have been found in small subgroups of populations like Micronesian Nauruans (22.5/1000 PY), rural Papua New Guineans of Australia[24] (24.0/1000 PY) and the Pima Indians from USA[25] (26.5/1000 PY). The 'Indian phenotype' for T2DM may have contributed to its high incidence in India, and to the country's status as the diabetes capital of the world.

Incidence rates for India's rural populations were similar to its urban counterparts. It is emphasized that a third of men consumed alcohol and one in three adults in the community were overweight or obese. The effects of socio-technological transition – a shift from traditional diet, improved transport facilities etc. – has increased susceptibility of the rural population to develop T2DM.[26] It is pertinent to note that the incidence rates in rural Pondicherry were similar to those of the metro city population. Diminishing differences in the NCD risk factor profile of rural and urban groups have been reported in India.[26,27] The present study also points to a similar trend for the incidence of diabetes.

Age and sex standardized incidence rates of T2DM for adults of rural Pondicherry and the rural Indian population were 22.1/1000 PY and 21.8/1000 PY respectively (Table 3). The incidence rate for men are higher than that for women. Extrapolating standardized annual incidence rates to rural adults of Pondicherry, it is estimated that each year around 3500 individuals develop T2DM. At the national level for rural India, it is estimated that 8.7 million individuals develop T2DM each year, of whom two thirds are men.

In the present study, older age, positive family history of T2DM, overweight/obesity and alcohol use were associated with T2DM incidence. Two thirds of the new cases of diabetes were aged 50 years or less. This supports the view of IDF that the age of onset of diabetes has dropped.[1] Similar to results from other regions,[28-30] our study found that positive family history strongly predicted the risk of developing T2DM. Among alcohol drinkers, the odds of T2DM incidence were 2.3 times greater when compared with non-drinkers. The associations were stronger than the finding from the systematic review[31] where as compared with no alcohol use, heavy consumption (>3 drinks/d) was associated with up to 1.4 times higher incidence of T2DM. Obesity was confirmed as a risk factor for the development of T2DM. This concords with the meta-analysis of cohort studies from the Asia-Pacific region which concluded that 2 kg/m^2 lower BMI was associated with 25% lower risk of T2DM .[32]

In the present study, the prevalence of alcohol use in men and the prevalence of overweight/ obesity in both sexes increased by 12% (from 37.4% to 49.6%) and 8% (33.5% to 41.3%) respectively. The stronger effects of these two modifiable risk factors on T2DM incidence and their rising prevalence may have contributed to higher incidence in our study. Similar conclusions from PAR showed that overweight/obesity and alcohol consumption accounted for 53.8% of the T2DM cases. This implies that half the burden of incident T2DM could be addressed by supporting populations to maintain a healthy weight and minimize alcohol consumption. Another study from the Asian region attributed more than half of the T2DM incidence to overweight and obesity in Iranians .[21]

Evidence shows the feasibility of implementing lifestyle interventions for weight reduction in different settings.[33,34] As highlighted by public health practitioners in 2010 in a call for action to tackle the diabetes epidemic,[35] there is a need to focus on social and lifestyle factors that can reverse the epidemic trend.

Strengths and weakness

The response rate in the follow-up population-based sample was strong at 85%. The GEE model was used to account for changes in the risk factor profile over the study duration. However, our study had some limitations. The comparison of risk profiles of non-respondents and respondents at baseline showed that non-respondents comprised a higher proportion of men, physically inactive individuals, smokers and alcohol users, and who were less likely to have a positive family history of T2DM. Second, OGTT was done to confirm diabetes status only in subjects with above normal fasting glucose. Both limitations suggest that our incidence rates may be underestimated. Finally, other important risk factors like diet, central obesity, stress, lipid profile, and blood pressure were not considered for logistic reasons.

CONCLUSION AND RECOMMENDATIONS

This population-based, longitudinal study indicates that T2DM incidence was 2% per year in adults of rural Pondicherry, India. Increasing age, overweight or obesity, alcohol use and positive family history of T2DM independently predicted the future development of diabetes. Identifying individuals with these risk factors may be the initial approach to address the problem. As half of the T2DM incidence was attributed to obesity and alcohol usage, interventions focusing on promoting a healthy weight and low alcohol consumption in populations may be an effective strategy to control the diabetes epidemic in rural Indians.

Table 3: Age and sex standardized incidence rates and estimates of T2DM for rural Pondicherry and rural India

Variable	Study population		Rural Pondicherry			Rural India		
	Number of cases/PY of follow-up	Incidence rate (CI) per 1000 PY	ASIR/ 1000 PY	Population > 25 years old	Expected new cases/ year	ASIR/ 1000 PY	Population > 25 years old	Expected new cases/ year
Female	22/1509	14.6 (9.4–21.7)	16.0 (10.3–23.8)	85 587	1292	15.0 (9.6–22.3)	202 602 469	2 866 589
Male	41/1428	28.7 (21.0–38.7)	29.0 (21.1–39.0)	82 415	2249	29.1 (21.2–39.1)	213 941 362	5 862 588
Total	66 /2937	21.5 (16.6–27.3)	22.1 (17.1–28.1)	168 002	3541	21.8 (16.8–27.7)	416 543 831	8 729 177

ASIR: age and sex standardized incidence rates; CI: confidence interval; PY: person-years; T2DM: type 2 diabetes mellitus.

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Effects of education and income on cognitive functioning among Indians aged 50 years and older: evidence from the Study on Global Ageing and Adult Health (SAGE) Wave 1 (2007–2010)

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ABSTRACT

Objectives: Relatively little is known about socioeconomic predictors of cognitive health among middle-aged and elderly Indians. The primary objective of this study was to examine the extent to which education and income influence cognitive functioning after adjusting for demographic characteristics, health risk factors and transgenerational factors such as parental education. The study also examined gender disparities in cognitive functioning across geographic regions in India.

Methods: Using cross-sectional data from the World Health Organization Study on Global Ageing and Adult Health (SAGE) Wave 1 (2007–2010) in a national sample of adults aged 50 years or older, a generalized linear model was used to examine the impacts of education and per-capita income on overall cognitive functioning. The generalized estimating equation approach was utilized to quantify these impacts on respondents' overall cognitive performance score. This technique accounted for any correlation of responses of individuals within the same household.

Results: Respondents with primary or secondary education and those with education above secondary level scored 3.8 and 6 points ($P < 0.001$) respectively more than respondents who had no formal education. In a similar vein, individuals in higher per-capita income quartiles scored 0.4, 1.0 and 1.8 ($P < 0.001$) more than respondents in the lowest income quartile. Although respondents in northern states scored 1.8 points higher than those from other geographic locations ($P < 0.001$), females in northern states had the worst cognitive performance (1.9 points lower) compared with females in other Indian states. In addition, early and adult life characteristics such as parental education, physical activity and a history of depression were found to be significant predictors of overall cognitive functioning.

Conclusion: Education and income play important roles in influencing overall cognitive performance among middle-aged and elderly Indians. In addition, cognitive performance scores varied across geographic regions, and female disadvantage was observed in northern Indian states. Policies directed towards greater educational opportunities, particularly for women in northern Indian states, or promotion of physical activity programmes, have potential to improve cognitive performance and enhance cognitive health among middle-aged and older adults in India.

Key words: education and cognitive status, older Indians, parental education, geographic disadvantage, gender disparities, lifestyle factors.

INTRODUCTION

Population ageing is becoming a global issue and will have a major impact on health-care systems worldwide. According to the World Health Organization (WHO), three quarters of the estimated 1.2 billion people aged 60 years or older will be living in developing countries by the year 2025.[1,2] With the ageing of the world's population, age-related diseases, including dementia, are increasingly prevalent in the developing world and are affecting more than 50% of the global elderly population. India is one of the developing countries experiencing a rapid demographic and epidemiologic transition. The proportion of India's population aged 60 or older is projected to increase from 7.7% in 2010 to 18.3% in 2050, according to the United Nations Department of Economic and Social Affairs Population Division.[3] Therefore, the risk of dementia should also increase.[4-6] Poor cognitive status is a risk factor for dementia, yet we have limited knowledge about factors that trigger poor cognitive functioning among older adults in India.[1] Most studies on cognitive ageing in India have included small community-based samples, which raises the question of generalizability of the findings. Therefore, there is a need for larger nationally representative population-based studies for a better understating of the predictors of cognitive functioning among older Indians. Using the WHO Study on Global Ageing and Adult Health (SAGE) data, this study aims to address this gap.

Research in developed countries has emphasized the role of education and wealth on cognitive health among older adults.[7-10] More importantly, these studies consistently find strong positive relationships between higher education and improved cognitive functioning. These associations were observed regardless of the outcome measures of cognitive functioning. Other socioeconomic factors such as income and wealth are also found to be strong predictors of cognitive functioning among older adults in developed countries.[7,10-12] This study sought to examine the cognitive health of older Indians using cross-sectional data from the SAGE Wave 1 (2007–2010).

The objectives of the present study are to investigate (a) if a higher level of education and per-capita household income would each be associated with a greater overall cognitive score, adjusting for other socioeconomic factors, early life factors, health risk behaviours, and chronic ill-health; (b) whether or not there are gender disparities in cognitive functioning; and (c) how geographical differences affect cognitive functioning in India.

METHODS

Data sources

The analysis was performed using data from Wave 1 of SAGE.[13] The SAGE was implemented as a face-to-face household survey using a stratified multistage cluster design to allow each household and respondent to be assigned a known nonzero probability of selection. SAGE was designed to be a longitudinal panel survey to collect information on the health and well-being of middle-aged and older adults and on the ageing process. SAGE collects data on individuals aged 50 years or older from nationally representative samples of six countries: China, Ghana, India, Mexico, Russia Federation and South Africa. The SAGE survey instruments were adapted from those used by WHO and other surveys on ageing, including the United States Health and Retirement Survey (HRS) and the United Kingdom English Longitudinal Study of Ageing (ELSA). The description of the SAGE survey and a detailed discussion are available elsewhere.[14] The current analysis focused on the SAGE Wave 1 survey from India that was conducted during 2007–2010. The survey was fielded in six states (Assam, Karnataka, Maharashtra, Rajasthan, Uttar Pradesh and West Bengal) selected to capture geographic variations as well as socioeconomic and cultural differences across India. The primary sampling units (PSU) were stratified across urban and rural areas in each state to capture socioeconomic differences and lifestyle behaviours. SAGE randomly sampled 10 424 households from the stratified PSUs and collected data primarily on individuals aged 50 years or older within the household.

The SAGE multi-country survey includes questions about demographic, economic, social, behavioural as well as physical and cognitive health. Face-to-face interviews were conducted in India (2007–2008). The sample in India was representative of subnational and substate levels for the six selected states. The survey consisted of two sets of questionnaires: the household questionnaire and the individual questionnaire. The household questionnaire collected information on household income, expenditure, consumption, assets and debts. It was considered that any household member over the age of 18 would be able to provide this information. The response rate for the household questionnaire was 77%. The individual questionnaire included only age-eligible (aged 50 or above) household members and their spouses. The individual questionnaire also included proxy respondents with the response rate of 88%. A total of 7750 individuals aged 50 years or older from 4473 unique households were included in the target sample. The individual sample was then further reduced by excluding the proxy as well as missing respondents (n=264). The final study sample included 6786 adults (3423 males, 3363 females) aged 50 or above.

Measures

Outcome variable: measures of cognitive function

The SAGE Wave 1 survey administered tests to measure cognitive performance against objective indicators of various aspects of cognition. The cognitive tests described below were intended to measure the cognitive domains most affected by impairment, i.e. immediate memory, concentration and attention.

Episodic memory

Episodic memory was tested by the immediate and delayed verbal recall method where respondents were read 10 words which were repeated three times to saturate the learning curve.

To test delayed recall, respondents were asked to recall the words after some time. Episodic memory as measured by verbal recall was defined as the average number of words recalled, and assessed learning capacity, memory storage and memory retrieval.[15,16]

Global cognitive function

Two tests were administered to assess global cognitive function: digit span subtests[17] and a verbal fluency test.[18] The digit span test was utilized to measure working memory. A series of number sequences was presented and the respondent was asked to reproduce the exact same sequence. In the second portion, the respondent was asked to repeat the sequence backwards. Following a correct recall, longer sequences were given until failure. The maximum score for the forward digit count was 9 with a range of 0–9; the score for the backward digit count ranged from 0–8 and a summary score, created by adding forward and backward counting scores, ranged from 0–17. Respondents were given a maximum of two trials; if they failed to specify correctly the number sequence after two trials, the interviewer stopped asking questions regarding digit counting and the respondent received a score of zero.

The verbal fluency test measured respondents' ability to retrieve information from semantic memory. This was a one-minute assessment in which respondents were asked to name as many animals as they could. The verbal fluency score was defined by the number of correctly named animals. Repeated names were not counted.

The overall cognitive score was obtained by adding scores of verbal recall, digit counting and verbal fluency tests, converted to a scale of 0 (worst cognition) to 100 (best cognition).

Main explanatory variables

The primary independent covariates of interest were years of completed education and per-capita household income. Education was measured using the following categories: no formal education, primary or completed secondary school, and completed high school or above. Per-capita household income was used as a measure of economic status. In the SAGE survey, household income information could be provided by any age-eligible respondent (i.e. 18 years or older) and this information was included only in the household questionnaire, not in the individual questionnaire. For the purpose of the current study, per-capita income was constructed by dividing the total household income by the number of individual members who depended on that income.[19]

Additional explanatory variables

Chronic ill-health and health behaviour

Several measures of chronic ill-health and health behaviours were considered in the analysis. These measures included: (1) indicators of underweight based on body mass index (BMI) that have been consistently used in developing countries; (2) physical activity, tobacco and alcohol use, and consumption of fruit and vegetables; (3) self-reported measures of subjective health, cardiovascular status based on self-reported medical conditions and biomarker assessments to capture variances in health among respondents.

Respondents with BMI < 18.5 were classified as underweight; 18.5–24.9 as normal weight; 25–29.9 as overweight; and BMI of 30 or over as obese.

Self-reported subjective health was based on the responses of very good, good, moderate, bad and very bad health status. A binary variable indicating self-reported good health status (very good and good health) was included in the analysis. A binary variable indicating self-reported diagnosis by a health professional for heart disease, stroke, high blood pressure and diabetes was created to measure cardiovascular health status. These self-reported measures were based on the following question: "Have you ever been told by a health professional that you had [a stroke, angina (heart disease), diabetes, or high blood pressure]?" Whenever possible, biomarker information was supplemented to define the presence or absence of certain chronic conditions in the sample. For example, systolic and diastolic blood pressure readings were taken three times for each respondent in addition to the self-reported information on hypertension diagnosis. Based on the biomarker measure, if respondents had average systolic readings over 140 mmHg and average diastolic readings over 90 mmHg, they were considered to have hypertension (or high blood pressure).[19] In the regression model, a binary variable indicating the presence of any of the self-reported conditions (stroke, angina, diabetes) or a biomarker measure of hypertension, was defined as poor cardiovascular status.

Health behaviour was measured by tobacco and alcohol use, physical activity and diet. The current smoking status was based on the self-report of smoking behaviour. The majority of respondents who reported ever-smoking also reported smoking currently and thus limited the inclusion of past smoking status in the analysis. Smoking activity included the use of tobacco, cigarettes, chewing tobacco, pipes, or cigars. Alcohol drinking was measured by a binary variable indicating whether the respondent currently drank alcohol.

Physical activity was measured using the General Practice Physical Activity Questionnaire.[20] The instrument captures information on physical activity on three domains: activity at work, travel to and from places, and recreation. For the purpose of this study, physical activity at work and for recreation were considered since the questionnaire assessed vigorous and moderate activities in these two areas. The number of days in a week on different activities as well as time spent on each activity were recorded. To classify the level of physical activity, total minutes of activity and activity volume weighted by energy requirement in metabolic equivalents (MET) for each type of activity were calculated. Total MET activity volume per week was calculated by multiplying the time spent on each activity during the week by the MET values of each level of activity. MET values of 4 for moderate physical activity and 8 for vigorous physical activity were used to calculate MET energy consumption.[20]

Total physical activity was calculated by the sum of total moderate and vigorous activities at work and for recreation per week. Respondents were categorized into low, medium and

high levels of physical activity based on the number of days and total physical activity MET minutes per week. Respondents were classified into the high physical activity group if vigorous intensity activity on ≥ 3 days achieved 1500 MET minutes per week; or if ≥ 7 days of any combination of moderate or vigorous intensity activities achieved ≥ 3000 MET minutes per week. Moderate intensity was defined as not meeting the criteria for 'high' intensity, but meeting any of the following: ≥ 3 days of vigorous intensity activity of ≥ 20 minutes per day; ≥ 5 days of moderate intensity activity of ≥ 30 minutes per day; or ≥ 5 days of any combination of moderate or vigorous intensity activities, achieving ≥ 600 MET minutes per week. Finally, respondents were categorized into the low physical activity group if they did not meet criteria for high or moderate activity levels.

Healthy diet was measured by determining the number of servings of fruit or vegetables in a typical day that the respondent had eaten over the past 12 months of the survey.

Although evidence suggests that cognitive performances tend to decline after hospitalization,[21] this was not controlled in the analysis because there was no significant bivariate relationship between overnight hospitalization and cognitive performance scores among sample members.

Geographic residence

Respondents were grouped based on the geographic location of the states where they lived: southern (Karnataka), northern (Uttar Pradesh, Rajasthan), western (Maharashtra) and eastern (Assam and West Bengal). To examine gender disparity across states, interactions between gender and state variables were also included in the model since there is evidence that females in northern Indian states face socioeconomic disadvantages and experience poor health outcomes.[22]

Early life characteristics

The SAGE survey captures the characteristics of respondents' early life that are associated with cognitive performance in later life. Examples of these are parental education and occupation, and the area where they lived. This study used two early life conditions: parental education (both father's and mother's completed education) and where they lived. Due to a high proportion of missing values for the father's occupation, this variable was not used in the analysis. While a father's education is an indicator of a respondent's childhood socioeconomic status (as education is associated with occupation and hence income), a mother's education is assumed to influence health in later life through positive health-seeking behaviour. Parental education was grouped into three categories: no formal education; completed primary education, and secondary education.

The second variable that captured early life disadvantage was whether respondents lived in a rural or urban area during childhood.[23] Due to limited access to health-care services, children living in rural areas are likely to have poorer health status, which may have a long-term impact on cognitive health in later age.

Demographic and other socioeconomic characteristics

A set of demographic variables such as age, gender, caste and marital status was included in the analyses. Castes were grouped according to respondents who belonged to scheduled castes, scheduled tribes, or any other caste affiliation. Caste was measured based on respondents' self-identification of affiliation. Scheduled castes and scheduled tribes are considered the most disadvantaged in traditional Indian society. Scheduled castes are socially segregated and economically disadvantaged by their lower status in the traditional Hindu caste hierarchy.[24] Scheduled tribes are geographically isolated with limited economic and social interaction with the rest of the population. Other cases, known as backward classes, are less stigmatized than scheduled castes or tribes, but these individuals also are in lower socioeconomic groups due to barriers in education and earning opportunities.[24]

In the empirical analysis, an indicator variable of whether respondents were from a scheduled caste was included. Social engagement was measured by asking respondents how often they had engaged in various social activities in the preceding 12 months (e.g. attended any group, club, society, union or organizational meeting). Response options ranged from 1 (never) to 5 (daily). For the purpose of the study, responses were recoded to 0 (never) and (4) daily. The total score for this variable was obtained by accumulating individual scores with the range from 0–35, where a higher score indicates better social engagement.

Finally, respondents' occupation was classified into three categories: professional, sales or clerical, and manual labour, based on the International Standard Classification of Occupation code ISCO-88 used in the SAGE survey.[25] The analysis included a binary variable to indicate if information on the respondent's occupation was missing in the study sample. All explanatory variables except per-capita household income came from the individual questionnaire.

ANALYSIS

Multivariate linear regression models were used to examine the impacts of education and income influencing cognitive functions among older Indians. Because of the clustered design of the sample, robust variance estimates (Huber-White sandwich estimator) are reported for the correction of standard errors to adjust for the correlation among responses within the same household.[26] The generalized estimating equation technique was used to estimate the regression model accounting for correlation of responses within the same household as described by Liang and Zegar.[27,28]

RESULTS

Sample characteristics

Table 1 outlines the characteristics of the study sample by gender. The sample of 6786 Indians aged ≥ 50 years comprised 49.5% women and 51.5% men. The educational level of most

Table 1: Descriptive statistics of the study sample

Variables	Male (*N*=3423) Mean (SD)/ frequency (%)	Female (*N*=3363) Mean (SD)/ frequency (%)
Age (50–100)	62 (9)	61 (9)
Education		
No formal education	1090 (33)	2279 (68)
Primary/secondary	1522 (45)	798 (24)
HS/college	688 (20)	175 (5)
Per-capita income		
Median	Rs.7154	Rs.7142
IQR(Q3-Q1)	Rs.10342	Rs.10396
Chronic health		
Diabetes	260 (7)	217 (6)
Hypertension (biomarker measure)	488 (14)	659 (19)
Stroke	90 (3)	57 (2)
Depression	171 (5)	122 (4)
Angina (heart disease)	184 (5)	137 (4)
Cardiovascular problem	854 (25)	754 (22)
BMI		
Underweight	1157 (34)	1074 (32)
Normal weight	1703 (50)	1496 (44)
Over-weight	288 (8)	431 (12)
Obese	275 (8)	362 (10)
Health and lifestyle behaviour		
Self-rated health-v.good/ Good	1122 (34)	822 (25)
Self-reported health-moderate/bad/v.bad	2169 (65)	2427 (74)
Physical activity		
High	1319 (38)	1413 (42)
Medium	558 (16)	674 (20)
Low	1546 (45)	1276 (38)
Current smoking	2115 (67)	982 (30)
Current alcohol drinking	422 (12)	62 (2)
Diet		
Fruit–vegetable servings	3 (1.7)	2.7 (1.5)
Food insecurity		
Not having enough food	399 (0.11)	378 (0.11)
Not afford to buy food	488 (0.14)	499 (0.14)
Geographical region		
North	1409 (41)	1342 (40)
South	422 (12)	505 (15)
East	990 (29)	924 (27)
West	602 (17)	592 (18)
Living areas		
Urban	841 (24)	946 (28)
Rural	2582 (76)	2415 (72)
Cognitive performance score		
Overall (0–100)[a]	29.4 (9.4)	25.6 (9)
Verbal fluency	10.5 (4.1)	9.3 (4.0)
Digit counting (0–17)	7 (2.7)	5.3 (2.5)
Early-life characteristics		
Parental education		
Father's education		
No formal education	2086 (61)	2033 (60)
Primary	837 (24)	653 (19)
HS	500 (15)	677 (20)
Mother's education		
No formal education	3023 (88)	2965 (88)
Primary	291 (8)	265 (7)
HS	109 (4)	133 (4)
Childhood residence		
Rural	2573 (75)	2472 (73)
Other	850 (25)	891 (27)
Other demographic characteristics		
Marital Status		
Currently married	3007 (87)	2034 (60)
Widowed/never married/ separated/divorced	416 (12)	1329 (39)
Caste		
Scheduled caste	769 (23)	713 (22)
Other caste	2508 (77)	2518 (78)
Occupation		
Professional	391 (11)	84 (2)
Sales/clerk	353 (10)	71 (2)
Manual labour	2378 (69)	1383 (41)
Missing	301 (9)	1825 (54)
Social engagement (0–35)	10 (5.4)	6.8 (4.3)

Note: Ranges of the continuous variables are given by the variable names. Mean (SD) are for continuous variables and proportions of indicator variables are shown in the table.

Since there is no meaningful change in the denominator (i.e.sample '*N*' remains same for each one except occupation variable and missing data information for this variable was also shown here), only frequency and %s are shown in the table.

[a]Overall cognitive score was the sum of verbal recall, verbal fluency and digit counting.

participants (84%) was lower than secondary school and a large proportion of individuals in the northern region (69%) had no formal school education compared with other regions. A significantly higher proportion of females (67%) than males (33%) had no formal education, which may indicate gender disparity in accessing formal education in India. Almost three quarters (75%) lived in rural areas. On average, males had a higher cognitive performance score than females (29 versus 25) and the mean difference of overall performance was statistically significant based on one-way analysis of variance analysis. More men than women were current alcohol and tobacco users, but a higher proportion of women (62%) engaged in high and medium levels of physical activity than men (54%). The prevalence of chronic health conditions were quantitatively similar in both groups, except a higher percentage of women (19%) than men (14%) were diagnosed with hypertension, and 25% of men had depression compared with 22% of women. No difference in average per-capita income was observed between men and women in the sample.

Predictors of cognitive functioning

In the bivariate analysis, a higher overall cognitive performance score was positively associated with the following indicators: primary/secondary level education or higher, per-capita income, male gender, younger age, being married, having a professional occupation, residing in an urban area and in a northern region, high or moderate physical activity, high fruit and vegetable consumption, optimal weight, no history of depression, self-report of a good or very good subjective health status, high social engagement, and having parents with primary education.

In the multivariate analysis, higher overall cognitive functioning was positively correlated with primary/secondary level education or higher, per-capita income, male gender, younger age, being married, high or moderate physical activity, no history of depression, normal weight, high fruit and vegetable consumption, high social engagement, and having a mother with primary education.

Table 2 presents bivariate associations of education and per-capita income on the overall cognitive performance score, and the multivariate regression results after accounting for confounding factors that might significantly influence the relationship of education and per-capita income with cognitive function. The QIC (quasi-likelihood under the independence model criterion) statistic proposed by Pan[29] was used to assess the 'goodness of fit' of all regression models. The QIC is similar to Akaike's Information Criteria for likelihood-based models. Adjusting for important individual characteristics, education significantly predicted the overall cognitive performance score. Compared with no formal education, respondents with primary or secondary education, and higher secondary or college education scored 3.8 and 6 points higher respectively.

Per-capita household income was positively associated with the overall cognitive performance score. For example, respondents in per-capita income quartiles above 75%, 50–75% and 25–50% scored 1.8, 1.0 and 0.4 respectively higher than respondents in the lowest per-capita income quartile (below 25%).

Among chronic health conditions, respondents with depression had a lower performance score (1.3 point less) than individuals with no history of depression. Regular physical activity, BMI, and fruit and vegetable consumption were found to be significantly associated with overall cognitive performance. For example, individuals engaged in a high or medium level of regular physical exercise scored 1.6 and 1.2 points more respectively on overall cognitive functioning compared with those engaged in low physical activity. Being underweight or obese scored 0.9 and 4.4 points respectively less in cognitive functioning than those who had normal weight. Finally, higher fruit and vegetable consumption was associated with an increased points score of 0.3 in the overall cognitive performance test.

Among early life characteristics, parental education was found to be a significant predictor of overall cognitive functioning in the national sample of adults aged ≥ 50 years. For example, respondents whose father had no formal education scored 1.2 points less than those whose father had at least secondary education, and respondents whose mother had completed primary education scored 1.3 points higher in the overall cognitive functioning test.

Gender disparities and regional differences in cognitive functioning were observed. For example, individuals residing in northern regions scored 1.9 points more than individuals in other regions, while women scored 0.5 points less than men in the overall cognitive performance test. Furthermore, women in northern states performed the worst (scored 1.9 points less) compared with women in other regions.

Among other demographic characteristics, marital status and occupation were significantly correlated with overall cognitive functioning. For example, married individuals had 0.8 points higher than those who were never married, divorced, widowed or separated, and those engaged in a professional occupation scored 1.6 points more than respondents in other occupations. Finally, respondents engaged in many social activities performed better in overall cognitive functioning.

DISCUSSION

In a national sample of middle-aged and older adults, the current study found that higher education and higher per-capita income were independently associated with a greater cognitive functioning score. Consistent with other studies,[7,10,20,30-31] the current article found that education had a strong and significant impact on cognitive performance in later life. After adjusting for a set of individual characteristics such as current income, it is suggested that education and socioeconomic measures are not interchangeable in regard to overall cognitive functioning. Advantages of education are that it may support brain reserves and contribute to understanding and mentally stimulating activities throughout life.

Table 2: Bivariate and multivariate analyses of cognitive performance score (*N*=6786)

Variables	Bivariate estimates	Multivariate estimates
Education		
Primary/secondary	7.0 (<0.001)	3.7 (3.3–4.2; <0.001)
HS/college	11.8 (<0.001)	5.9 (5.2–6.8; <0.001)
Per-capita Income		
Lowest quartile (Q1)		
Second quartile (Q2)	1.2 (<0.001)	0.49 (–0.03, 1; 0.06)
Third quartile (Q3)	2.9 (<0.001)	0.98 (0.45, 1.50; <0.001)
Fourth quartile (>Q3)	1.3 (<0.001)	1.7 (1.2, 2.3; <0.001)
Chronic health		
Cardiovascular problem	2.8 (<0.001)	0.22 (–0.18,0.63; 0.28)
BMI		
Underweight	–2.5 (<0.0001)	–0.83 (–1.2, 0.45; <0.001)
Overweight	1.8 (<0.0001)	0.41 (–0.14, 0.97; 0.14)
Obese	–14.8 (<0.0001)	–4.4 (–5.1, –3.7; <0.001)
Health and lifestyle behaviour		
Self-rated good/v. good health	2.1(<0.0001)	–0.10(–0.47–0.26; .57)
Physical activity		
High	5.1 (<0.0001)	1.6 (1.2, 1.9; <0.001)
Medium	4.8 (<0.0001)	1.2 (0.77, 1.7, <0.001)
Current smoking	2.4 (<0.0001)	–0.06 (–.43, .32; 0.76)
Current alcohol drinking	1.3 (0.002)	–0.68 (–1.3, –0.01; 0.04)
Diet		
Fruit & vegetable servings	0.86 (<0.0001)	0.28 (0.17, 0.4; <0.001)
Food insecurity		
Not having enough food	–0.17 (0.32)	-
Not afford to buy food	–0.92 (0.06)	-
Geographical region		
North	1.2 (<0.001)	1.9 (1.5, 2.5; <0.001)
South	0.39 (0.33)	0.02 (–0.92, 0.96; 0.96)
East	–0.41 (0.39)	–1.0 (–1.7, –0.23; 0.01)
Living areas		
Urban	1.5 (<0.0001)	0.42 (–0.2,1.0; 0.17)
Early-life characteristics		
Parental education		
Father's education		
Primary	5.8 (<0.0001)	–0.44 (–1.0, 0.15; 0.15)
No education	2.4 (<0.0001)	–1.2 (–1.8, –0.62; <0.001)
Mother's education		
Primary	2.1 (0.004)	1.3 (0.26, 2.3; 0.01)
No formal education	–4.1 (<0.0001)	0.30 (–0.65, 1.3; 0.53)
Childhood residence		
Rural	–1.3 (<0.001)	0.21 (–0.37, 0.8; 0.47)
Other demographic characteristics		
Age	–0.17 (<0.0001)	–0.01 (–0.11, –0.06; <0.001)
Female	–3.9 (<0.0001)	0.51 (0.33, 1.2; <0.0001)
Marital status		
Currently married	3.5 (<0.0001)	0.76 (0.33, 1.2; <0.001)
Caste		
Scheduled caste	–2.1 (0.0001)	–0.27 (–0.71, 0.16; 0.22)
Occupation		
Professional	6.4 (<0.0001)	1.65 (0.91, 2.4; <0.0001)
Sales/clerk	3.6 (<0.0001)	0.95 (0.24,1.6; 0.009)
Missing	–4.8 (<0.0001)	–0.41 (–0.88, 0.05; 0.08)
Social engagement	0.69 (<0.0001)	0.11 (0.07, .15; <0.0001)
Constant	-	29.1 (27, 31.3; <0.0001)

Notes: 95% confidence intervals and associated p-values are shown in parentheses.

Examining correlates of cognitive functioning such as father's education or respondents' occupation, this study provides strong evidence of the unique contribution of education and current per-capita income towards a positive cognitive status in later life in Indians. However, the mechanism by which education contributes to cognitive health still needs further investigation. This mechanism may be the educational process, mental stimulation, a healthy lifestyle, or a combination of these factors that helps to maintain cognitive health in later life.[32] Furthermore, the magnitude of the impact of education and per-capita income highlights the leading role that education plays in influencing cognitive function in later life.

Gender disparities in overall cognitive functioning are evident in the growing body of literature on cognitive health in developing countries, which shows that women perform worse than men on a variety of cognitive measures.[33-34] This contrasts the observation in developed countries that women outperform men.[35-36]

Consistent with other studies, the current study found evidence that parental education made a significant independent contribution to respondents' overall cognitive functioning.[37-38] Modifiable lifestyle-related factors such as physical activity and fruit and vegetable consumption also contributed to overall cognitive functioning. The rate of respondents' acknowledgement of depression indicates that poor psychological and mental health experienced by middle-aged and older Indians may sap cognitive reserves required for good memory functioning.[39]

Limitations

The current study has some limitations that merit discussion. First, the SAGE survey relied on the self-reporting of health variables such as chronic disease (depression, self-rated health, and cardiovascular conditions) and lifestyle-related behaviours (tobacco or alcohol use, physical activity). These variables should be interpreted with caution. Second, information

on per-capita income was obtained only from age-eligible members in the household and therefore may be subject to reporting bias. This bias could be due to the fact that household income earners might not necessarily be those who reported income in the household survey. However, given that income and asset information in the SAGE survey are available only at the household level, these variables had to be converted to the individual level to account for the number of household members for the individual-level analysis. About 35% of household members who reported household income were the main income earners; therefore, the per-capita income variable might also be subject to a reporting bias. Finally, given that the present study was based on data collected in a cross-sectional survey, causality cannot be ascribed to any of the associated factors in the study.

Despite these limitations, the current study makes a positive contribution to the emerging literature on effects of education and per-capita household income on cognitive function in older Indians. While previous findings on cognitive functioning in this age group were limited to small and geographically restricted samples,[15,16] this study expands our understanding of how education and income impact different dimensions of cognitive functioning among older Indians. It also examines the extent to which results can be compared with similar studies in high-income countries using population-based data sources such as the United States Health and Retirement study[40] and the English Longitudinal Study on Ageing.[41] Finally, this study takes advantage of a large nationally representative sample from economically and geographically diverse Indian states to quantify the relative importance of education and income on cognitive functioning among middle-aged and older adults in India. Further studies utilizing longitudinal data and focusing on factors over the life span could help us better understand mechanisms by which education and income influence not only current cognitive function but cognitive trajectory over time. Policies directed towards greater educational opportunities, particularly for women in northern Indian states, or wellness programmes promoting regular physical activity, may have potential to improve cognitive well-being among middle-aged and older Indians.

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Integrating adolescent-friendly health services into the public health system: an experience from rural India

Sunil Mehra, Ruchi Sogarwal and Murari Chandra

ABSTRACT

Background: Although India's health policy is directed toward improving adolescent reproductive health, adolescent-friendly health services are scarce. The intervention for "integrating adolescent-friendly health services into the public health system" is an effort to improve the health status of adolescents in rural areas of the Varanasi (Arajiline) and Bangalore (Hosakote) districts in India. The purpose of this article is to describe the features of the intervention and investigate the impact on improving awareness and utilization of services by adolescent, as well as quality of ARSH services in the intervention districts.

Methods: Data from project monitoring, community survey (737 adolescents), exit interviews (120 adolescents), assessment of adolescent sexual and reproductive health clinics (n = 4), and health service statistics were used. Descriptive analyses and paired t-tests were used to compare the two intervention districts.

Results: Overall, the percentage of adolescents who were aware of the services being offered at a health-care facility was higher in Hosakote (range: 56.2% to 74.7%) as compared to Arajiline (range: 67.3% to 96.9); 23.3% and 42.6% of adolescents in Arajiline and Hosakote typically sought multiple services at any one visit. A large percentage of clients (Arajiline: 81.7%; Hosakote: 95.0%) were satisfied with the services they received from the facility. The relative change in uptake of services from the first quarter (January to March 2009) to the last quarter (October to December 2010) was significantly higher in Arajiline (7.93, P = 0.020) than in Hosakote (0.78, P = 0.007).

Conclusion: The intervention had positive results for the public health system and the services are being scaled up to different blocks of the districts, under a public–private partnership.

Key words: Adolescent, India, reproductive sexual health.

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INTRODUCTION

Adolescence is a critical phase in young people's development. Their health situation in this phase is central in determining scenarios of health, mortality, morbidity and population growth.[1,2] India's National Family Health Survey-III (2005–2006) showed that 44.5% of women aged 20–24 years are married by the age of 18 years, and 16% of women aged 15–19 years are already mothers or pregnant. Among women who are currently married, the unmet needs for methods of family planning are highest in the age group 15–19 years (27%).[3] Data from India's National AIDS Control Organization show that among all cases of new HIV infection, almost 50% are young people, especially adolescent girls.[4] Three out of four men know that the risk of HIV/AIDS can be reduced by condom use and by limiting sexual intercourse to one uninfected partner; however, fewer than half of women know about these means of HIV/AIDS prevention.[3] Experiences from different countries have shown that investments in adolescent health will yield dividends in terms of delaying the age of marriage, reducing the incidence of teenage pregnancies, meeting unmet needs for contraception, reducing the number of maternal deaths, reducing the incidence of sexually transmitted infections (STIs), and reducing the proportion of HIV-positive cases in the age group 10–19 years.[5–7] Thus, there is a broad public health rationale for making such investments.

Given that young people tend not to use existing reproductive health services, some of the specific concerns expressed by young people are a belief that the services are not intended for them, concern that the staff will be hostile or judgemental, fear of medical procedures and contraceptive methods, concern over lack of privacy and confidentiality, fear that their parents might learn of their visits, embarrassment at needing or wanting reproductive health services, and shame, especially if the visit follows coercion or abuse.[8–14] After the World Health Organization (WHO) global consultation in 2001, and subsequent discussions, it was agreed to establish specialized approaches to attract, serve, and retain young clients and that these should have a greater emphasis on information, psychosocial support, and promotional and preventative health services.[15] The provision of youth-friendly health services is one such strategy to influence the health-care-seeking behaviour of adolescents/youths and, in turn, impact their health indicators positively. The term "youth-friendly health services" generally refers to programmes that seek to improve the access to and quality of existing health services, specifically by making them more acceptable to adolescents.[8–10] Among the efforts being made to improve the health status of adolescents in India, one is the inclusion of appropriate strategies under the National Rural Health Mission of the Government of India, to emphasize the establishment of adolescent-friendly health services within the existing public health system.[6,11,12] The main features of the services are: competent health-care provider; accessibility and affordability; privacy and confidentiality; community involvement; outreach; and peer-to-peer activities to improve coverage and sensitivity to gender issues.[6]

Available evidence from various interventions conducted with young people indicates that integrated services, delivered through the health-care system, constitute one of the most effective ways of delivering reproductive health services.[14–18] This is a huge challenge in low- and middle-income countries such as India, because of various cultural and social barriers. Thus, it is important that this service integration is done in a careful manner without disrupting the available system. The MAMTA Health Institute for Mother and Child (MAMTA),[19] with support from the Ministry of Foreign Affairs of Finland, began a project[1] on "integrating adolescent-friendly health services into the public health system in rural India", with the primary aim to improve the utilization of services by adolescents, which was consistent with the goal set by the Government of India and the Millennium Development Goals.[20] The project was implemented from January 2008 to December 2012 in the Arajiline block of Varanasi district (state – Uttar Pradesh, North India) and the Hoskote block of Bangalore rural district (state – Karnataka, South India). Besides the willingness of the government leadership, a composite index based on reproductive health indicators (Varanasi: 38%; Bangalore rural: 73%) was considered for selection of two different areas for intervention.[3,21]

Strategies for the project were focused to (i) create a supportive environment for sexual and reproductive health (SRH) services for adolescents; (ii) strengthen the capacity of the public health system to offer adolescent-friendly health services; (iii) increase awareness among members of the community about HIV/AIDS, STIs, contraception, and adolescent sexual and reproductive health (ASRH) services. The direct beneficiaries of the intervention were males and females in the age group 10–24 years. Indirect beneficiaries included district-level officials in the Department of Health and Family Welfare; block-level health officials; members of local government, such as village heads and members of the Village Health and Sanitation Committee; medical service providers; frontline workers, including auxiliary nurse midwives (ANMs), accredited social health activists (ASHAs), anganwadi workers, school teachers and parents; and community members.[22–24] By enhancing the capacity of existing health-care facilities to reach adolescent- and community-based processes, the project aimed to create a functional model of service provision that would lead to increased use of the services.

Under MAMTA's programme, a total of six training sessions were conducted and 308 service providers (eight doctors, 70 paramedical staff and 230 frontline functionaries) of respective ASRH clinics were trained using standard modules developed by the Government of India.[6] In addition, 26 youth information centres (YICs; Varanasi: 12; Bangalore: 14) were established in the community, with support from village gatekeepers, with an intended coverage of 5000 population per YIC. A YIC is a community-based process at the village level to raise awareness and sensitivity among adolescents with respect to ASRH services, in an engaging and entertaining manner, improving their health-seeking behaviour. Key activities conducted at YICs are: (i) counselling on the issues of adolescent health, growth and puberty, early marriage, contraception, HIV/AIDS, reproductive tract infection (RTI)/STI, nutrition and mental health; (ii) "infotainment" and entertainment activities such as indoor games, exhibitions, competitions, debates and discussions on the issues of adolescent SRH and rights. Similar to other interventions,[7,25,26] sensitization of community gatekeepers, involving young people directly in community mobilization, person to-person counselling, participatory learning, and action approaches were used in the outreach component that was found to be effective to improve service utilization.

The purpose of this article is to describe the features of MAMTA's intervention and investigate the impact on improving awareness and utilization of services by adolescent, as well as quality of ARSH services in the selected rural districts of India during the period January 2008 to December 2010.

METHODS

Data collection

Multiple sources of data were used to evaluate the implementation of the project.

- **Project monitoring data:** a monitoring information system was prepared by MAMTA to review quarterly programmatic data for feedback, and to make the project more responsive to district needs. Data were routinely collected by programme managers and outreach workers.

1 Project details are available from the authors on request.

Monitoring indicators in the project are mainly process oriented. Some of the indicators are: the number of YICs established; the number of adolescents visiting YICs; the number training sessions for health-care providers conducted; the number of health-care providers reporting on ASRH; and the number of community gatekeepers who are sensitized to adolescents' needs.

- **Health service statistics from the ASRH clinics:** during the intervention period, health-care providers were helped to establish separate record of the uptake of services in ARSH clinics. Before the intervention period, no record was available separately for adolescents. These data were used to assess the uptake of services.
- **Data from two primary studies conducted by MAMTA**:
  - from December 2010 to April 2011, a cross-sectional study was conducted to measure the utilization of and level of satisfaction with adolescent-friendly health services. Respectively, 18 out of 217 villages and 17 out of 333 villages in Arajiline and Hosakote were selected, based on a method of probability proportional to the population size. From a list of adolescents in each village, 12 girls and 12 boys aged 10–19 years were selected, using a systematic circular sampling method. The actual sample coverage during the survey was 737 adolescents (383 males; 354 females), with a response rate of 88%. Data were collected using a close-ended quantitative questionnaire based on the WHO tool on adolescent-friendly health services.[27] In the questionnaire, information was collected on utilization of services by adolescents; reasons for visiting ASRH clinics; perception regarding the attitude of service providers; privacy and confidentiality; and satisfaction with the services;
  - from January to April, 2012, a cross-sectional study was undertaken at the intervention sites to assess the ASRH clinic from the clients' perspectives and the role of the outreach community-based approach in improving access to services;
  - an exit interview of 120 clients (equal number of males and females, aged 10–19 years) who received services at clinics was selected using a consecutive sampling technique from the four ASRH clinics (30 clients in each clinic). A semi-structured quantitative questionnaire developed for the exit interviews covered many domains, including demographic characteristics, time spent on client–provider interaction, perception about privacy and confidentiality, the role of YICs, and the level of satisfaction;
  - four ASRH clinics (two clinics in each district) were selected purposively to obtain information on staffing, training, infrastructure, supplies, and the package of services offered, using a structured questionnaire;[28]—

Both of these studies were designed and conducted by the Research Unit of MAMTA head office, Delhi, in partnership with the programme-management teams. Trained research investigators were deployed for data collection, and analysis was performed by the senior researchers. The senior management team was involved throughout, to ensure the quality of the data generated. Institutional Review Board approval was obtained on the use of data for the research purpose only.

Data analysis

Programme-monitoring data were analysed to compare the planned intervention activities with the achievements. A descriptive analysis of data collected through community survey, exit interviews and facility assessment was done to assess the awareness and quality of the services. Service statistics of ASRH clinics were used to present the quarterly uptake of services by adolescents, in terms of the relative change from January 2009 to December 2010. As baseline data on intervention are not available, data from the first few months at the start of the intervention were compared with those from later in the intervention. The paired *t*-test was used for comparison and *P*-values of less than 0.05 were considered to be significant.

RESULTS

Table 1 shows the main activities and outputs of the intervention during the implementation phase (year 2008–2010) in the two intervention districts. Overall, it appears that most targets were met, and some were surpassed in both districts (e.g. establishment of ASRH clinics and YICs and sensitization meetings). However, some activities, such as the number of health-care providers trained and the number of gatekeepers sensitized, did not meet the targets set.

Awareness

Table 2 indicates that 82.3% of the adolescents in Arajiline and 97.2% of those in Hosakote had ever heard of the ASRH clinic. Out of these, a majority of the adolescents in both districts were aware of the site of clinic. Overall, the percentage of adolescents who were aware of the services being offered at a health-care facility was higher in Hosakote (range: 56.2 to 74.7%) as compared to Arajiline (range: 67.3% to 96.9%). Further, in Arajiline, outreach workers of YICs played a key role in spreading information on adolescent-friendly health services (86.4%), while in Hosakote, in addition to outreach workers of the YIC (78.3%), doctors (66.2%), ANMs (60.4%) and ASHAs (53.2%) also played a noteworthy role in spreading information.

Results from the exit interviews illustrated that 88.3% of adolescents in Arajiline and all adolescents in Hasokote had accessed the YIC at least once. In addition, out of those adolescent who had visited the YIC at least once, the majority of (Arajiline: 92.7%; Hasokote: 84.9 %) reported that the YIC staff/activities had motivated them to seek services at the ASRH clinic. Respectively, 41.7% and 56.7% of the adolescents in Arajiline and Hasokote perceived "positive change" in the attitude of adults towards their reproductive and sexual health concerns during the last 2 years (see Table 2)

Table 1: Target and achievement of main project activities conducted in Arajiline and Hosakote during 2008–2010

Main project activities	Arajiline			Hosakote		
	Target	Achievement	% Achieved	Target	Achievement	% Achieved
Number of advocacy meetings conducted with district functionary	9	8	88.9	9	9	100.0
Number of ASRH clinics established at the primary health centres	2	2	100.0	2	2	100.0
Number of health-care providers trained	179	144	80.5	193	164	84.9
Number of ASRH clinics reporting monthly on uptake of services by adolescents	2	2	100.0	2	2	100.0
Number of sensitization meetings organized with community gatekeepers	72	171	237.5	72	223	309.7
Number of community gatekeepers sensitized	397	286	72.0	436	369	84.6
Number of YICs established	6	6	100.0	6	8	133.3
Number of special events celebrated in the community (e.g. street theatre, folk art)	27	18	66.7	27	27	100.0

Source: routine monitoring data of the intervention.

ASRH: adolescent sexual and reproductive health; YIC: youth information centre.

Table 2: Awareness about the adolescent sexual and reproductive health clinic and perceived change in attitude of adults towards sexual and reproductive health concerns in Arajiline and Hosakote

	Arajiline		Hosakote	
	n	%	*n*	%
Ever heard of ASRH clinic[a]	312	82.3	348	97.2
Aware about place of ASRH clinic[a]	272	87.2	346	99.4
Awareness about services offered in ASRH clinic[a]				
Treatment for general illness	233	74.7	337	96.9
Treatment of menstrual problems/irregularities	175	56.2	234	67.3
Treatment of sexually transmitted infections	178	57.0	294	84.6
Pregnancy care and prevention	182	58.3	307	88.3
Advice/information on SRH concerns	191	61.2	286	82.1
Source of information about adolescent-friendly health services[a]				
Outreach worker of YIC	270	86.4	272	78.3
Volunteers/peer educators of YIC	40	12.9	161	46.2
Accredited social health activist	39	12.5	185	53.2
Auxiliary nurse midwife	5	1.5	210	60.4
Doctor	12	3.7	230	66.2
Counsellor	10	3.3	66	19.1
Relatives	6	1.8	7	2.0
Others	15	4.8	96	27.7
n	379		358	
Ever visited YIC[b]	53	88.3	60	100
Motivated by YIC activities to visit ASRH clinic[b]	45	84.9	51	92.7
Perceived change in the attitude of adults towards adolescent's SRH concerns[b]				
Positive change	25	41.7	34	56.7
Partially change	33	55.0	10	16.7
No change	2	3.3	16	26.7
n	60		60	

ASRH: adolescent sexual and reproductive health; SRH: sexual and reproductive health; YIC: youth information centre.

[a]Community survey. [b]Exit interview.

Utilization of services

From the community survey, it was found that 43.5% of adolescent in Arajiline and 84.4% in Hosakote had visited an ASRH clinic in the last 12 months (see Table 3). Out of these, 75.0% of adolescents had multiple visits to the clinic in Arajiline, whereas in Hosakote, 53.3% of adolescents reported multiple visits. Furthermore, in Arajiline, adolescents reported three key health reasons to visit the clinic in the last 12 months, i.e. general illness (13.3%), SRH (51.7%) and STI (35.0%); however, there was little variation reported with regard to the health reasons in Hosakote. Results from exit interviews indicate that, for the majority of clients in Hosakote, the services received were counselling (96.7%) and medical examination (91.7%), whereas in Arajiline, these proportions were only 38.3% and 18.3% respectively. In addition, 23.3% and 42.6% of adolescents in Arajiline and Hosakote, respectively, typically sought multiple services at any one visit (see Table 3).

Figures 1 and 2 portray the quarterly uptake of services by adolescents in ASRH clinics from January 2009 to December 2010, based on the service statistics in both intervention sites. The results show that the relative change in uptake of services from the first to last quarter was significantly higher in Hosakote (7.93, $t = 3.76$, $P = 0.007$) than in Arajiline (0.78, $t = 2.99$, $P = 0.020$).

Quality of services

Table 4 shows various indicators of the quality of services, obtained by facility assessment, community survey and exit interviews. It was found that the sanctioned position of doctors was available in two clinics in Hosakote, whereas in Arajiline a position for one female doctor in a clinic was vacant at the time of the survey. However, at both the intervention sites, all the available doctors were trained on adolescent-friendly health services. Further, there were separate rooms available for clinical examination and counselling in both the clinics in Hosakote, but in only one clinic in Arajiline.

A wide variation was observed in the clinics pertaining to the provision of clean toilets (Arajiline: 15.2%; Hosakote: 68.9%), provision of a clean waiting area (Arajiline: 29.7%; Hosakote: 97%) and availability of drinking water (Arajiline: 42.4%; Hosakote: 88 .1%). Moreover, most of the adolescents (Arajiline: 76.7% and Hosakote: 96.7%) indicated that educational materials (books, magazines, posters, pamphlets) on reproductive and sexual health issues were available in the waiting area during their visit to the clinic (see Table 4)

A total of as 88.3% of adolescents in Arajiline and 86.7% in Hosakote stated that the timings and days of the ASRH clinic were convenient for them to seek the services. The results indicated a "welcoming" attitude of the health-care provider (Arajiline: 65.0%; Hosakote: 76.7%) and an "appropriate" amount of time spent by doctors during interactions (Arajiline: 55.0%; Hosakote: 86.7%). It was also reported that 65.0% and 91.7% adolescent clients in Arajiline and Hosakote, respectively, felt comfortable in talking about SRH-related issues with the doctor in the clinic. The majority of the adolescent clients in Hosakote (96.7%) said that no one else was present during their consultation with doctor. In contrast, 51.7% of adolescent from Arajiline spoke of the presence of support staff/other patients during their consultation with the doctor. Overall, the majority of clients (Arajiline: 81.7%; Hosakote: 95.0%) were satisfied with the services they received from the facility, and the difference was significant ($P < 0.05$; see Table 4)

Table 3: Adolescent visits and type of services availed in adolescent sexual and reproductive health clinics of Arajiline and Hosakote

	Arajiline		Hosakote	
	n	%	*n*	%
Number of adolescent visited ASRH clinic in last 12 months[a]	165	43.5	302	84.4
Number of visits by adolescent in ASRH clinic in last 12 months[b]				
Single visit	15	25.0	28	46.7
Multiple visits	45	75.0	32	53.3
Reasons for adolescent to visit ASRH clinic[b]				
General illness	8	13.3	18	30.0
SRH problems	31	51.7	20	33.3
Sexually transmitted infections	21	35.0	22	36.7
Type of services availed by adolescents in ASRH clinic[b]				
Counselling	23	38.3	58	96.7
Medical examination	11	18.3	55	91.7
Nutrition supplementation	15	25.0	33	55.0
Others (referral)	11	18.3	3	5.0
Multiple services availed by adolescents to ASRH clinic[e]	43	71.7	54	90.0
Multiple services availed by adolescents at single visit to ASRH clinic[b]	10	23.3	23	42.6
n	60		60	

ASRH: adolescent sexual and reproductive health; SRH: sexual and reproductive health.
[a]Community survey. [b]Exit interview.

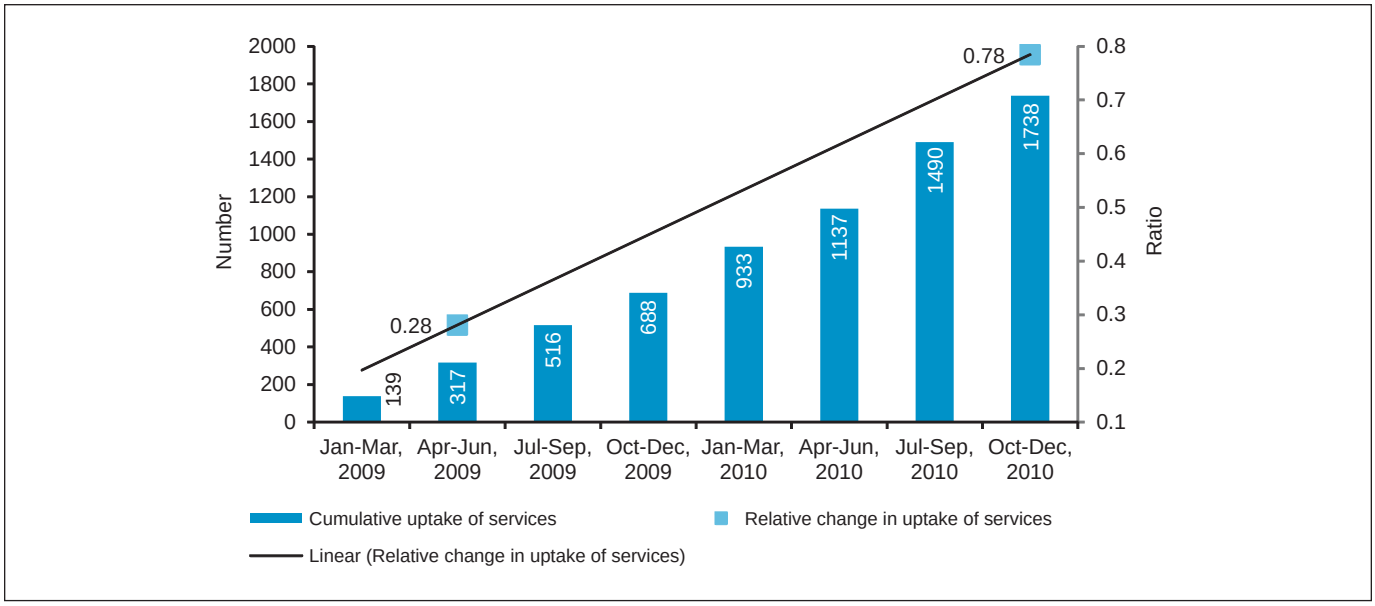

Figure 1: Quarterly uptake of adolescent-friendly health services in Arajiline during 2009–2010

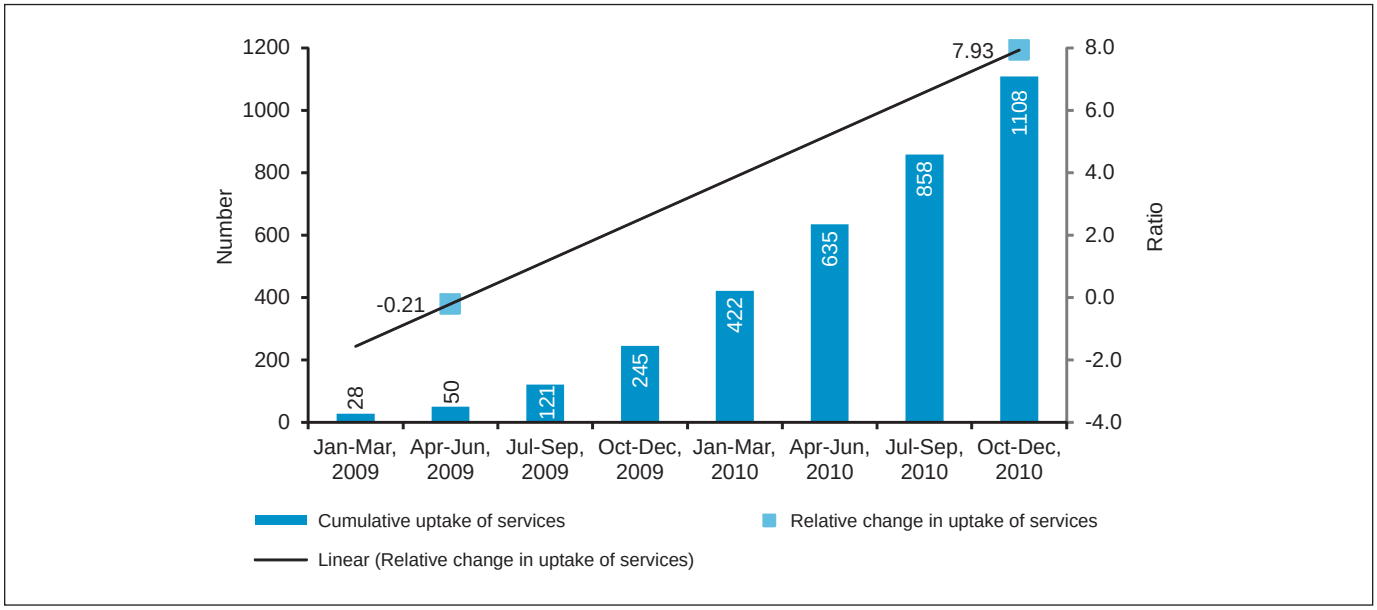

Figure 2: Quarterly uptake of adolescent-friendly health services in Hosakote during 2009–2010

DISCUSSION

The MAMTA intervention started at a time when the public health system did not have an adequate understanding of adolescent-friendly health services and was struggling to reach out to adolescents. Therefore, the intervention activities were undertaken in a very specific context, laid out by national guidelines, so that the public health system could evolve strategies to improve its reach and enhance service utilization. The present study is one of the pioneers in exploring the impact of the intervention on awareness, utilization and quality of services for adolescent in the Arajiline and Hosakote blocks of Varanasi and Bangalore rural districts of India, using multiple sources of data. With the support of the public health system in Arajiline and Hosakote, integrated adolescent-friendly health services were established within primary health care. The levels of most of the intervention activities were organized according to the targets set during the planning phase, with some variation by district and depending on the activity. This may be a result of frequent changes of community volunteers in the project and vacant positions for health-care providers.

Table 4: Quality of services in adolescent sexual and reproductive health clinics of Arajiline and Hosakote

	Arajiline		Hosakote	
	n	%	*n*	%
Facility assessment				
Availability of sanctioned staff[1]	2	100.0	2	100.0
Availability of staff trained on adolescent-friendly health services	1	50.0	2	100.0
Availability of separate room for clinic	1	50.0	2	100.0
Signage of ASRH clinic available	2	100.0	2	100.0
n	2		2	
Community survey				
Cleanliness in toilet	25	15.2	208	68.9
Cleanliness in waiting area	49	29.7	293	97.0
Availability of drinking water	70	42.4	266	88.1
Adequate light and ventilation	142	86.1	297	98.3
Availability of education materials on sexual and reproductive health in clinic	127	76.7	292	96.7
n	165		302	
Exit interviews				
Timings and days are convenient to seek services	53	88.3	52	86.7
Welcoming attitude by health-care providers	39	65.0	46	76.7
Comfortable in talking about SRH-related issues with medical doctor	39	65.0	55	91.7
Time spent with doctor was appropriate	33	55.0	52	86.7
No one else was present in the room during the consultation with doctor	29	48.3	58	96.7
Denied services by the doctor at ASRH clinic	0	0.0	3	5.0
Satisfaction with the services received at the clinic	49	81.7	57	95.0
n	60		60	

ASRH: adolescent sexual and reproductive health; SRH: sexual and reproductive health.

The responses of the exit interviews reveal a high level of satisfaction with the services among adolescents in the intervention districts, indicating effective service delivery, including "convenient" time of the clinic, "welcoming" attitude of the service providers, and an "appropriate" amount of time spent by doctors during interactions. However, some concerns were reported by adolescents, particularly relating to the physical environment at health facilities in Arajiline, for instance cleanliness in the toilet and waiting area. Another concern that emerged is privacy and confidentiality for the adolescents during their visits to the clinic. In Arajiline in particular, facilities need to provide privacy to adolescent clients during their visits, either by separating counselling and clinical spaces, or by other means. This is important, as most of the adolescent clients reported the presence of support staff or other patients during their consultation with the doctor. This experience was in disagreement with other intervention,[25,29,30] which found that efforts to make clinical services "youth friendly" have not brought increased use by adolescents. As evident from the study, the findings are in accordance with other studies[31] that identified an adequate physical environment in the facility, receipt of adequate information about the facility, and a private facility (i.e. so that other people do not know what services the client receives) as key determinants for a high level of satisfaction by adolescent.

The data from this study illustrate that adolescents typically seek multiple services at any one visit, with counselling being the most popular service, followed by medical examination in both the intervention sites. During the intervention period, less than two fifth of adolescents approached the ASRH clinic to seek treatment on SRH and STIs in the intervention sites, with significant difference by districts. Hence, there is a need to further focus on the reasons for visiting adolescent-friendly health services, keeping in mind the literacy and cultural context of the district. By comparison, the adolescent-friendly health service system is more complex, as there are many factors beyond the health system that influence utilization by adolescents. This is evident from the analysis that the community-based process (e.g. YIC) has contributed to an increased uptake of services by adolescents. The focused efforts have made a noteworthy change in the attitude of adults towards adolescents' SRH concerns, in a sociocultural environment where the term "sex" is considered "taboo" and

not to be discussed with the adolescent. Moreover, adults in the community played a proactive role, by providing a space for establishment of the YIC.

Successful linkages with the Government Health Department, locally and at the state level, supported MAMTA to upscale the project to the next level under the public–private partnership. During 2011, MAMTA increased the intervention in both states, applying the strategy of strengthening the existing programme environment on ASRH at the district level, through advocacy with the key stakeholders identified. This scaling-up phase continues to create demand for adolescent-friendly health services, through engagement of existing cadres of frontline health personnel in the public health system.

Limitations

The health service statistics for adolescents were not available prior to the intervention period. Hence, it was not possible to compare the results before and after the intervention. The sample size per health facility for exit interview was inadequate to provide analysis by sex. One limitation of the study is that confounding factors related to utilization of services by adolescents were ignored, owing to inadequate data, so the findings cannot easily be generalized to similar settings in the country. Despite the limitations, triangulation of information from various sources has provided adequate evidence on successful programmatic efforts to improve the awareness, utilization and quality of health services among young people.

CONCLUSIONS

The MAMTA intervention has improved the youth-friendliness of services in facilities, as well as their uptake. Although the majority of young people were satisfied with the services at adolescent-friendly health services, there is still a need to strengthen the privacy and confidentiality components and to improve the physical environment at the clinics. The intervention was well integrated with the public health system and the services are being scaled up to further blocks in the districts, under a public–private partnership.

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Knowledge and opinion about smoke-free laws and second-hand smoke among hospitality venue managers in Gujarat and Andhra Pradesh, India

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ABSTRACT

Background: India's Smoke-Free Law (SFL) was implemented in 2004 and reinforced on 2nd October 2008. This research attempts to understand the knowledge and opinion of hospitality venue (HV) managers about second-hand smoke (SHS) and SFL as well as self-reported compliance with SFL in two Indian states.

Methods: A survey was conducted among 804 randomly sampled HVs from project STEPS (Strengthening of tobacco control efforts through innovative partnerships and strategies) in Gujarat and Andhra Pradesh, India. Four hundred and three HVs from two districts in Gujarat and 401 HVs from six districts in Andhra Pradesh were selected. The owner, manager or supervisor of each HV was interviewed using a pre-tested structured interview schedule. Association of opinion scales with respondents' background characteristics was assessed through the analysis of variance (ANOVA) method.

Results: Out of the 403 respondents in Gujarat and 401 in Andhra Pradesh, 56.1% and 84.3% had knowledge about SFL respectively. Compliance of HVs with SFL was 21.8% in Gujarat and 31.2% in Andhra Pradesh as reported by the managers. Knowledge about SHS was noted among 39.7% of respondents in Gujarat and 25.4% in Andhra Pradesh. Bivariate results indicated that more educated HV managers showed higher support for smoke-free public places ($P < 0.001$) and were more concerned about the health effects of SHS exposure ($P = 0.002$).

Conclusion: Complete self-reported compliance with, and knowledge of SFL as well as SHS was not found in Gujarat and Andhra Pradesh. The education level of HV managers is an important determinant to ensure compliance with SFL in public places.

Key words: Smoke-free law, second-hand smoke, public places, awareness, opinion, tobacco

INTRODUCTION

Exposure to second-hand smoke (SHS) is a major public health hazard accounting for more than 600 000 global deaths annually.[1] Smoke-free laws (SFL) eliminate smoking from public places, reduce exposure to SHS[2] and protect non-smokers from its harmful effects.[3] SFL are based on mounting scientific evidence that there is no risk-free or safe level of exposure to SHS.

Recent studies have shown that, of all public places, restaurants and bars have the highest SHS concentrations.[4-6] Restaurants and bars are frequently visited by the public for entertainment. Supportive attitudes and good awareness of hospitality venue (HV) managers are important for ensuring compliance with SFL, not only for their customers but for their own staff. Previous studies have highlighted that awareness levels among restaurant and bar owners about SHS is associated with prohibition or restricted smoking in their venues.[7,8] Those

not in support of SFL in their venues were more concerned that legislation would reduce revenue, and felt that adequate ventilation systems were sufficient to reduce SHS, rather than implementation of SFL.[9]

In line with global statistics, the highest levels of SHS exposure in Indian cities are found in entertainment venues and restaurants.[9] According to the Global Adult Tobacco Survey (GATS) conducted in India in 2010, 29% of adults (aged ≥ 15 years) are exposed to SHS at any public place and about one in nine (11%) adults who visit restaurants are exposed to SHS.[10] In Gujarat and Andhra Pradesh, 31.7% and 33.5% of adults are exposed to SHS in public places, respectively, and 84.7% and 63.2% believe that exposure to SHS causes serious illness in non-smokers.[10]

India enacted comprehensive tobacco control legislation – Cigarettes and Other Tobacco Products (Prohibition of Advertisement and Regulation of Trade and Commerce, Production, Supply and Distribution) Act in 2003.[11] Section 4 of the Act prohibits smoking in all public places, except hotels with 30 or more rooms, restaurants with 30 or more seats and in airports. These venues are allowed to have a designated smoking area or a space, adhering to the prescribed ventilation and placement guidelines.[12] The rules for SFL were implemented in India in 2004, and revised and enforced by a Supreme Court ruling on 2nd October 2008.[13]

Despite the Supreme Court orders, compliance with SFL in India is low. HV managers' attitude and awareness are likely to impact how well such laws are obeyed and enforced, and thus how well they achieve the health goal of reducing SHS exposure in these venues. This study aims:

- to describe the characteristics of HVs and their owners/managers/supervisors (respondents) and to document their practices with regard to SFL;
- to assess the level of knowledge among respondents and their opinion on SHS and SFL;
- to assess the association between knowledge and opinion of the respondents regarding SHS and SFL.

METHODS

Ethical approval for this study was obtained from the Institutional Ethics Committee of the Public Health Foundation of India. Written informed consent was obtained from all the participants, who were free to opt out at any stage of the study.

Study design and setting

Project STEPS (Strengthening of tobacco control efforts through innovative partnerships and strategies), a three-year multicomponent intervention, was implemented in Gujarat and Andhra Pradesh as they are leading tobacco-producing states in India. A survey was conducted in randomly selected HVs as a baseline from two districts implementing STEPS in Gujarat (Rajkot and Surat) and six districts in Andhra Pradesh (East Godavari, Karim Nagar, Kurnool, Mahabub Nagar, Prakasam and Vishakhapatnam). The sampling frames were urban mandals in Andhra Pradesh and urban talukas in Gujarat (mandals and talukas are third and fourth level administrative units in India, respectively).

The primary sampling units were municipal wards that were chosen through probability proportion to size from selected mandals and talukas. A census was carried out in these wards to list all HVs. The sample size was based on the formula for cluster randomized control trials[14] at 95% confidence level and 80% power to detect 12% reduction (effect size) in the proportion of venues not adhering to SFL. According to GATS conducted in India in 2009–2010, baseline compliance with SFL was 50%. Thus, 1209 venues were randomly selected (out of a census list of 2477 venues), of which 804 were HVs (403 in Gujarat and 401 in Andhra Pradesh) and 405 were other public places (202 in Gujarat and 203 in Andhra Pradesh). In this paper, only the results of HVs are presented. In the selected HVs, either the owner, manager or supervisor was interviewed. The authors use the term manager uniformly to represent owner, manager or supervisor. There were five refusals in Gujarat and seven in Andhra Pradesh. Also, 11 venues in Gujarat and 14 in Andhra Pradesh were dropped due to non-availability of managers.

Data collection

Six teams were trained for data collection in each state and each team was led by one investigator and one supervisor. Investigators explained the purpose and background of the study to the managers of the venues to seek their consent. In the case of refusals, the next venue on the list was selected. In addition, on-site observation was also conducted by the supervisors at each venue to assess the characteristics and compliance with SFL. Only self-reported results are discussed in this manuscript.

The survey among HV managers was carried out using a pre-tested structured interview schedule. The survey instrument was developed and translated into Gujarati and Telugu for administration in Gujarat and Andhra Pradesh respectively. After the training of the data collection team, a pilot exercise was conducted to test the survey tool as per the study protocol. The pilot test was conducted in the cities of Ahmedabad in Gujarat and Hyderabad in Andhra Pradesh. Ten HVs and 10 other public places from each state were selected for the pilot test. The questionnaire was finalized after incorporating edits from pilot results. The venues for the pilot study were different from those included in the main study. Details of the HVs such as type of establishment, room/seating capacity, separate smoking area or space and building characteristics were collected.

Measures

Knowledge about SFL and SHS: This was assessed using binary variables by asking the respondents whether they were aware of any policy or law that bans smoking in public places and whether they had ever heard about passive smoking/SHS. Source of information about SFL, specifications, and

Table 1: Description of opinion scales on SFL and SHS (*n*=804)[1]

Scales	Number of items	Range	Mean (SE)	Cronbach's alpha	Example
Opinion on smoke-free public places	5	0–20	17.5 (0.1)	0.60	A place being smoke free is good for its public image.
Health concern related to SHS exposure	4	0–16	12.7 (0.1)	0.65	Ban on smoking in public places will protect people from the hazards of passive smoking.
Overall supportive attitude to SFL	7	0–28	19.7 (0.2)	0.63	Ban on smoking in public places is unfair to smokers (reversely coded).

[1]Details of the scales are available from the authors.

SE: standard error.

respondents' understanding about SHS and its effects on health were also assessed.

Opinion scale on SFL and SHS: Sixteen statements were used to assess the opinion of the respondents on SFL and SHS. Each statement was based on a five-point Likert scale varying from strongly disagree coded as '0' to strongly agree coded as '4'. These statements were categorized according to three specific issues: opinion on smoke-free public places, health concern related to SHS exposure, and overall supportive attitude to SFL. Reliability of the scales was checked through Cronbach's alpha. The scores for statements related to "overall supportive attitude to SFL" were initially negative (i.e. high score tends to negative opinion) and later reverse coding was done (i.e. strongly disagree coded as '4' to strongly agree coded as '0') to make the statements positive. Short descriptions of the scales are provided in Table 1.

SHS-related health effects: Knowledge about SHS-related health effects was also assessed from HVs managers. The responses were either spontaneous or aided. The proportion of respondents who spontaneously provided the correct answer for each health-related effect is presented here.

Data analysis

Descriptive statistics such as frequency distribution and proportion were provided for the characteristics of respondents as well as for HVs. Association of opinion scale scores with respondents' background characteristics and their knowledge about SFL and SHS were assessed through the ANOVA test. All the analyses were undertaken using STATA 11.2.

RESULTS

Characteristics of the hospitality venues and respondents

Table 2 presents the characteristics of the HVs and the demographic profile of the respondents. The majority of HVs in both states were restaurants (Gujarat 61.5%, Andhra Pradesh 54.9%). As Gujarat is a state where sale, purchase and consumption of alcoholic beverages is banned by law, there were no bars and pubs in the study sample whereas in Andhra Pradesh, bars/pubs constituted 15.2% of the total sample.

In Gujarat, 21.8% of the HVs had a policy that prohibits smoking while in Andhra Pradesh this was 31.2%. In Gujarat, tobacco products were sold inside 3.0% of the establishments while in Andhra Pradesh they were sold in 6.5%. Smoking was allowed inside 7.4% of the venues in Gujarat and in 27.2% of venues in Andhra Pradesh. Neither of the two restaurants in Gujarat that allowed smoking and had a seating capacity of more than 30 had a designated smoking room (DSR); in Andhra Pradesh, only 2 of the 42 restaurants with a seating capacity over 30 and where smoking was allowed had a DSR (data not shown).

More than half of the respondents in both states were in the age group of 31–45 years (Gujarat 55%, Andhra Pradesh 53%). The mean age of key informants was 37.3 years in Gujarat and 38.0 years in Andhra Pradesh. The proportion of female respondents was less than 1% in both states. Education for more than 10 years was found among 47.9% of respondents in Gujarat, and 70.6% in Andhra Pradesh. About three quarters (73.4%) of respondents were owners of the HVs in Gujarat but only about half (48.4%) in Andhra Pradesh (see Table 2).

Knowledge about SFL

Table 3 depicts the knowledge of HV managers regarding SFL and SHS. Awareness of SFL was shown in 56.1% of respondents in Gujarat and 84.3% in Andhra Pradesh. Television and newspapers were reported to be the major source of knowledge for the respondents in both states. Of those who were aware of the SFL, 66.8% in Gujarat and 59.5% in Andhra Pradesh reported that the law was enacted in 2008 in India. In addition, 76.1% of the respondents in Gujarat and 88.5% in Andhra Pradesh reported that their establishment came under the jurisdiction of SFL. It was observed that awareness of the penalty for violation of SFL (fine of up to INR 200 or US$ 3.3) was reported by 73.9% of the respondents in Gujarat and 88.5% in Andhra Pradesh.

Displaying 'No Smoking' signage inside the establishment was reported as the main responsibility of HV management by 60.2% and 70.5% of respondents in Gujarat and Andhra Pradesh respectively. Of respondents who reported that the management should put up 'No Smoking' signage, more than

Table 2: Characteristics of hospitality venues and respondents in Gujarat and Andhra Pradesh

	Gujarat *n* (%)	Andhra Pradesh *n* (%)
Total sample	**403**[a]	**401**[b]
Type of establishment		
Hotel/guest house	91 (22.6)	44 (11.0)
Coffee/tea shop	64 (15.9)	76 (18.9)
Restaurant	248 (61.5)	220 (54.9)
Bar/pub	0	61 (15.2)
Room capacity of hotels/guest house		
Less than 30 rooms	80 (87.9)	38 (86.4)
30 rooms or more	11 (12.1)	6 (13.6)
Seating capacity		
Less than 30 seats	273 (87.5)	214 (59.9)
30 seats or more	39 (12.5)	143 (40.1)
Smoking allowed inside the establishment	30 (7.4)	109 (27.2)
Alcoholic drinks served inside the establishment	13 (3.2)	73 (18.2)
Establishment has a policy that prohibits smoking in any way	88 (21.8)	125 (31.2)
Tobacco products are sold inside the establishment	12 (3.0)	26 (6.5)
"No smoking" signage displayed in the establishment	22 (5.5)	74 (18.5)
Sociodemographic profile of respondents		
Age group (years)		
18–30	108 (26.8)	112 (27.9)
31–45	222 (55.1)	212 (52.9)
46+	73 (18.1)	77 (19.2)
Sex		
Male	402 (99.8)	399 (99.5)
Female	1 (0.2)	2 (0.5)
Educational qualification		
No formal schooling	31 (7.7)	33 (8.2)
< 10 years of education	179 (44.4)	85 (21.2)
≥ 10 years of education	193 (47.9)	283 (70.6)
Job function		
Owner	296 (73.4)	194 (48.4)
Supervisor	57 (14.2)	72 (18.0)
Manager	50 (12.4)	135 (33.6)

[a] In Gujarat, out of 50 hospitality venues with more than 30 seats/30 rooms, none had a separate smoking area or space.

[b] In Andhra Pradesh, four hospitality venues had a separate smoking area or space, one of which was a hotel having less than 30 rooms and one was a restaurant having a seating capacity less than 30.

Table 3: Knowledge about SFL and SHS in Gujarat and Andhra Pradesh

	Gujarat *n* (%)	Andhra Pradesh *n* (%)
Total sample	**403**	**401**
Awareness of any policy of ban of smoking at public places	226 (56.1)	338 (84.3)
Source of knowledge about SFL		
Television	178 (78.8)	248 (73.4)
Newspaper	152 (67.3)	224 (66.3)
Posters/hoardings/billboards	62 (27.4)	54 (16.0)
Radio	53 (23.5)	54 (16.0)
Government officials	13 (5.8)	51 (15.1)
Circulars	8 (3.5)	23 (6.8)
Restaurant association	18 (8.0)	6 (1.8)
Knowledge of year of enactment of SFL in India (from 2008)	151 (66.8)	201 (59.5)
Awareness that establishment is under the jurisdiction of SFL	172 (76.1)	300 (88.5)
Awareness of penalty for violation of SFL	167 (73.9)	299 (88.5)
Management responsibility to implement SFL		
Create a smoking area/space	2 (0.9)	14 (4.1)
Create a no smoking policy	105 (46.5)	107 (31.6)
Put a no smoking signage	136 (60.2)	239 (70.5)
Others	0 (0.0)	14 (4.1)
Public places allowed to have a smoking area	11 (4.9)	37 (10.9)
Ever heard of "passive/second-hand smoking"		
Yes	160 (39.7)	102 (25.4)
No	228 (56.6)	281 (70.1)
Don't know/can't say	15 (3.7)	18 (4.5)
Understand "Passive/ second-hand smoking"	160	102
Inhalation of any kind of smoke	0 (0.0)	5 (4.9)
Smoke from lit cigarette/bidi/ other smoking product or smoke exhaled by smokers	160 (100.0)	97 (95.1)
Smoke has any effect on the people around		
Yes	293 (72.7)	381 (92.8)
No	47 (11.7)	22 (5.5)
Don't know/Can't say	63 (15.6)	7 (1.7)

half (Gujarat 55%, Andhra Pradesh 65%) felt that it should be put at the entrance of the venue (result not shown) (see Table 3).

Knowledge about SHS

Around 40% of respondents in Gujarat and 25% in Andhra Pradesh had heard of passive smoking/SHS (Table 3). Of these, all in Gujarat and 95.1% in Andhra Pradesh reported that this was smoke exhaled by smokers or smoke from a lit cigarette/ bidi/other smoking product. Interestingly, most respondents in both states (73% in Gujarat and 93% in Andhra Pradesh) believed that smoke exhaled by smokers can adversely affect people around them. Respiratory diseases were the most reported SHS-related health effect in both states. The other

major reported effects were lung cancer and heart diseases. The fact that smoking around children and pregnant women could be harmful was reported by a lower proportion of respondents in both states (Figure 1).

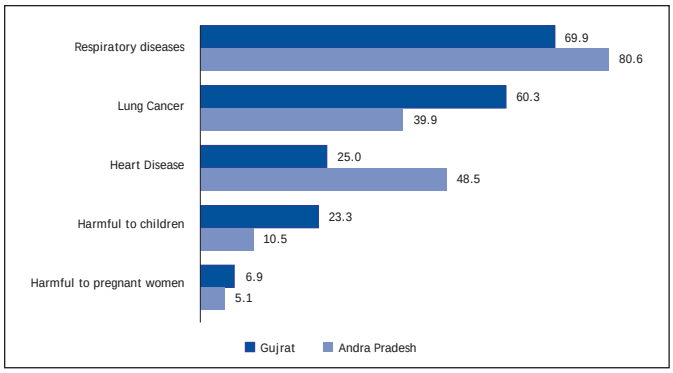

Figure 1: Percentage of hospitality venue owners, managers or supervisors aware of SHS-related health effects in Gujarat (*n*=403) and Andhra Pradesh (*n*=401)

Opinions on SFL and SHS

The mean opinion score on smoke-free public places was higher in Andhra Pradesh (18.1) than Gujarat (16.9), $P < 0.001$ (Table 4). Similarly, mean scores of health concerns related to SHS exposure and overall supportive attitude to SFL were also higher in Andhra Pradesh ($P < 0.01$).

The mean opinion score on smoke-free public places was significantly higher among managers with more than 10 years of education (17.8) compared with those with less than 10 years of education (17.1) and those with no formal schooling (17.0), $P < 0.001$. The score for health concern related to SHS exposure was also significantly higher among managers who had 10 years or more education (mean score 13.0). The mean score for overall supportive attitude to SFL was lowest among managers without formal schooling and highest among those who had less than 10 years of education.

Mean opinion scores on smoke-free public places and health concern related to SHS were significantly higher among those who had knowledge about SFL than those who did not ($P < 0.001$). Respondents in restaurants with more than 30 seats were more supportive of the SFL compared with those from restaurants with less than 30 seats ($P < 0.001$). Respondents who were employed in establishments that prohibited smoking had a higher mean opinion score on smoke-free public places than employees in establishments that did not prohibit smoking ($P < 0.001$) (see Table 4).

DISCUSSION

This study assessed the knowledge and awareness about SFL and SHS as well as self-reported compliance with SFL among managers of HVs, including restaurants, bars and hotels.

We observed that 43.9% HV managers in Gujarat and 15.7% in Andhra Pradesh were still not fully aware of SFL. Our findings are similar to those observed in developing countries such as Armenia and Mongolia, where only a third of HV workers are aware of SFL.[17,18] In our study, the majority of managers who were aware of SFL believed that 'No Smoking' signage is to be displayed wherever smoking is prohibited and that their establishment came under the jurisdiction of this law. We also highlight that knowledge of SFL among HV managers is less than optimal; at the same time, self-reported compliance with SFL was also low in both Gujarat and Andhra Pradesh. Sensitizing HV managers and providing them with pertinent information about the SFL is therefore of utmost importance. Strengthening the enforcement mechanism of SFL (including display of signs, smoke-free policies, penalties and inspection) may further improve compliance with legislation in India through changes in attitudes and norms about SHS exposure as observed in other developed countries.[17]

While data suggest that few managers had heard the term 'passive smoking' or 'second-hand smoke', among those who had, most understood its true meaning. However, most managers were unaware of the full harmful effects of SHS. Lung cancer and respiratory diseases were the most frequently reported health effects while other health conditions like heart and cardiovascular diseases, and harmful effects on pregnant women and children were the least reported. Studies in other settings have also revealed that respiratory diseases are more frequently associated with SHS exposure.[18] It may be that managers are more familiar with specific information about certain health hazards of SHS, but lack a full understanding of the risks of SHS. This highlights the need to sensitize the managers of HVs about SHS and SFL and the harm associated with SHS exposure.

Support towards smoke-free public places and health concern related to SHS exposure were significantly higher among managers who were more educated and who had knowledge of SFL. Targeted campaigns are therefore essential to inform and create awareness about the risks of exposure to SHS, among managers belonging to diverse educational backgrounds. SFL in India needs to be made comprehensive and should require all public places to be 100% smoke free. WHO states that: "[a]pproaches other than 100% smoke free environments, including ventilation, air filtration and the use of designated smoking areas (whether with separate ventilation systems or not), have repeatedly been shown to be ineffective and there is conclusive evidence, scientific and otherwise, that engineering approaches do not protect against exposure to tobacco smoke."[19] The provision of DSRs still exists in the Indian SFL, but is widely flouted as found in our study. Therefore 100% smoke-free public places are highly recommended for complete protection from SHS. In addition, it is proposed to conduct routine monitoring for SFL compliance as part of annual licence renewal of HVs.

This is the first study that analyses the knowledge and awareness about SFL and SHS as well as self-reported compliance with SFL among HV managers in India. Also, the current study has

Table 4: Opinion of respondents from Gujarat and Andhra Pradesh about SFL and SHS by demographic profile, knowledge and characteristics of hospitality venue

	Opinion scale[a]		
	Support for smoke-free public places	Health concern related to SHS exposure	Overall supportive attitude to SFL
	Mean score (95% CI)	Mean score (95% CI)	Mean score (95% CI)
State			
Gujarat	16.9 (16.6–17.1)	11.7 (11.5–12.0)	19.2 (18.6–19.7)
Andhra Pradesh	18.1 (17.9–18.3)	13.6 (13.3–13.8)	20.1 (19.8–20.5)
P value[b]	< 0.001	< 0.001	0.003
Education			
No formal schooling	17.0 (16.4–17.6)	12.4 (11.7–13.0)	18.9 (17.7–20.1)
< 10 years of education	17.1 (16.8–17.4)	12.2 (11.8–12.5)	20.0 (19.3–20.6)
≥ 10 years of education	17.8 (17.6–18.0)	13.0 (12.7–13.2)	19.6 (19.2–20.0)
P value[c]	< 0.001	0.002	0.245
Job function			
Owner	17.4 (17.2–17.6)	12.9 (12.6–13.1)	19.3 (18.9–19.8)
Supervisor	17.2 (16.7–17.7)	12.8 (12.2–13.3)	19.5 (18.8–20.2)
Manager	17.9 (17.6–18.1)	12 (11.6–12.5)	20.7 (20–21.3)
P value[b]	0.05	0.004	0.004
Awareness about SFL			
Yes	17.8 (17.6–18.0)	13.4 (13.2–13.6)	19.4 (19.0–19.7)
No	16.8 (16.4–17.1)	11.0 (10.5–11.4)	20.4 (19.8–21.0)
P value[b]	< 0.001	< 0.001	0.005
Knowledge about SHS			
Yes	17.3 (17.0–17.6)	13.7 (13.4–13.9)	19.2 (18.5–19.8)
No	17.6 (17.4–17.8)	12.2 (11.9–12.4)	19.9 (19.5–20.2)
P value[a]	0.091	<0.001	0.038
Type of establishment			
Hotel/guest house	17.3 (16.9–17.7)	12.6 (12.3–13.0)	19.2 (18.2–20.2)
Coffee/tea shop	17.6 (17.2–17.9)	13.0 (12.6–13.4)	19.9 (19.2–20.6)
Restaurant	17.5 (17.3–17.7)	12.4 (12.2–12.7)	19.6 (19.2–20.0)
Bar/pub	17.8 (17.1–18.5)	13.6 (12.9–14.3)	20.9 (20.2–21.7)
P value[c]	0.66	0.015	0.095
Room capacity of hotel/guest house			
Less than 30 rooms	17.3 (16.9–17.7)	12.5 (12.1–12.9)	19.1 (18.0–20.2)
30 rooms or more	17.5 (16.0–18.9)	13.8 (12.7–14.8)	19.6 (17.5–21.7)
P value[a]	0.784	0.024	0.755
Seating capacity			
Less than 30 seats	17.6 (17.4–17.8)	12.8 (12.5–13.1)	19.4 (19.0–19.9)
30 seats or more	17.3 (17.0–17.7)	12.2 (11.8–12.7)	20.6 (20.1–21.1)
P value[b]	0.24	0.03	0.003
Establishment has a policy that prohibits smoking in any way			
Yes	18.1 (17.8–18.4)	13.0 (12.6–13.4)	19.4 (18.9–19.9)
No	17.3 (17.1–17.5)	12.5 (12.3–12.8)	19.8 (19.4–20.2)
P value[b]	< 0.001	0.069	0.27
Is the "no smoking" signage displayed in the establishment?			
Yes	18.3 (17.9–18.7)	13.9 (13.5–14.4)	20.2 (19.5–20.9)
No	17.4 (17.2–17.6)	12.5 (12.3–12.7)	19.6 (19.2–19.9)
P value[b]	0.001	<0.001	0.21

[a] A higher score for all three opinion scales is supportive.

[b] *P* value is for the difference of mean score using t-test.

[c] *P* value is for the difference of mean score using one way ANOVA.

CI, confidence interval; SFL – smoke-free legislation; SHS – second-hand smoke.

strong policy implications for prevention of exposure to SHS in HVs. The study focused specifically on managers' knowledge and attitudes regarding SFL and SHS as well as self-reported compliance across two states in the country, which may not be representative of all states in India.

CONCLUSIONS

Complete self-reported compliance with SFL and knowledge of SFL and SHS was not found in Gujarat or Andhra Pradesh. The education level of HV managers is an important determinant to ensure compliance with SFL in public places.

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Research brief

Oseltamivir-resistant influenza A(H1N1) pdm09 virus: first reported case from India

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ABSTRACT

Background: Recent studies on antiviral susceptibiliy from South-East Asia, Europe and the United States have shown sporadic neuraminidase inhibitor (NAI) resistance in A(H1N1)pdm09 viruses. We undertook a study to evaluate NAI resistance in these viruses isolated in India.

Methods: Pandemic influenza viruses, isolated from 2009 to 2013, along with clincal samples were genetically analysed for known resistance markers in the neuraminidase (NA) gene. Clinical samples (*n*=1524) were tested for H275Y (N1 numbering; H274Y in N2 numbering) mutation by real time reverse transcriptase PCR (rRT-PCR). One hundred and ten randomly selected resistant and sensitive viruses were analysed by phenotypic assay.

Results: All but one of the 2013 A(H1N1)pdm09 isolates were sensitive to oseltamivir. Genetic analysis of this isolate as well as the original clinical material showed that the presence of H275Y mutation was responsible for reduced susceptibility to oseltamivir in the patient. This was confirmed by phenotypic assay.

Conclusion: The emergence of a pandemic influenza strain resistant to oseltamivir emphasizes the need for monitoring antiviral resistance as part of the National Influenza Programme in India.

Key words: pandemic influenza (H1N1) 2009, oseltamivir resistance, influenza surveillance, India

INTRODUCTION

During April 2009, a novel A(H1N1) virus was detected in epidemiologically unrelated cases of influenza-like illness in California, United States of America and Mexico. Its rapid spread prompted the World Health Organization (WHO) to declare a pandemic caused by this virus on 11 June 2009.[1] Given the overwhelming demand for testing, WHO guidance in June 2009 recommended a priority focus on reporting fatal and severe cases[2] and thus, when the pandemic was declared over in August 2010 the reported numbers of cases and deaths at <1 million and >184 497 respectively[3] were far below the real burden due to A(H1N1)pdm09.

The influenza A(H1N1)pdm09 virus was found to be susceptible to neuraminidase inhibitors (NAI) (oseltamivir and zanamivir) and resistant to adamantanes (amantadine and rimantadine).[1] NAI resistance in A(H1N1)pdm09 viruses is rare; nevertheless it was first reported in June 2009[4] and since then a total of 570 confirmed oseltamivir-resistant cases have been reported worldwide.[5] All these viruses have substitution H275Y (N1 numbering; H274Y in N2 numbering) in the NA gene, which is a known cause for clinical resistance to oseltamivir but not to zanamivir. In India, an enhanced surveillance system for A(H1N1)pdm09 was set up in April 2009 and continued until 2013. Clinical specimens from various states in India were referred to the National Influenza Center (National Institute of Virology), Pune for diagnosis.

At the start of the pandemic, antiviral drugs were given to all suspected cases in addition to all cases rRT-PCR-positive for A(H1N1)pdm09 virus and their contacts. In the post-pandemic period, the strategy was changed by the Government, and antiviral drugs were given only to symptomatic high-risk patients and severe hospitalized cases. Since antivirals were widely used, it was relevant to screen isolates and clinical samples for susceptibility to oseltamivir. We report one case of oseltamivir-resistant A(H1N1)pdm09 virus infection in Pune.

METHODS

All clinical samples were tested for A(H1N1)pdm09 virus using the United States Centers for Disease Control and Prevention (CDC) protocol.[6] The clinical history of all patients was recorded. Of the 50 232 referred specimens, 10 035 (19.98%) were positive for A(H1N1)pdm09. Of these, 1557 were processed for virus isolation in the MDCK cell line according to the WHO Manual on Animal Influenza Diagnosis and Surveillance;[7] A(H1N1)pdm09 was isolated from 530 of these samples.

Monthly representative A(H1N1)pdm09-positive clinical samples (*n*=1524) were selected and screened for the presence of H275Y mutation by allelic rRT-PCR.[8] These included severe, hospitalized recovered as well as fatal cases. Using published primers,[9] 496 isolates were processed for NA and haemagglutinin (HA) gene sequencing to evaluate other possible mutations. 50 ul of clinical specimens or isolates were used for viral RNA isolation using the Ambion MagMAX™ kit as per the manufacturer's procedures. DNA sequences of NA and HA genes were done using the BigDye® Terminator Cycle Sequencing Kit and an Applied Biosystems® 3730 DNA Analyzer. Sequences were analysed using the Mega Version 5 sequence analysis tool.[10] Whole genome sequence analysis of the resistant virus was done and compared with globally circulating resistant strains.

Phenotypic (neuraminidase inhibition) assay

A fuorescence-based NA inhibition assay was performed for 110 randomly selected pandemic viruses, including resistant strains, to determine the dose of oseltamivir required for 50% inhibition of NA activity (IC50 value). Oseltamivir carboxylate (GS4071) was provided by Hoffmann-La Roche, Basel, Switzerland. The reference viruses and WHO NAI standard operating procedures were provided by the WHO Collaborating Centre for Reference and Research on Influenza, Melbourne, Australia.

RESULTS

Only one clinical sample – from patient X – of the 1524 assayed was not susceptible to oseltamivir. Full NA gene sequencing of the patient X isolate with its companion clinical sample showed H275Y mutation; S182T, N/D248G and V453M were also present. Whole genome sequence analysis of this resistant virus revealed no major deviation in signature or pathogenicity markers. Other known amino acid changes responsible for drug resistance in vitro (D199N, I223R, N295S) were not detected in any of the isolates.

In the fluorescence-based NAI assays, oseltamivir susceptible A(H1N1)pdm09 viruses had an IC50 range between 0.5–1.18 nM, whereas the IC50 value of the oseltamivir-resistant A(H1N1)pdm09 virus isolated from patient X was 347 nM.

Patient X was a 42-year-old female resident of a slum area of Pune, with a history of hypertension with seizure disorder and a cerebrovascular event. She presented with high-grade fever for 5–6 days, rhinorrhea, cough, pain in throat, breathlessness, severe headache and was admitted in the hospital on 27 January 2013. A nasopharyngeal swab, obtained before oseltamivir treatment was initiated, was sent to the National Institute of Virology. She had an uneventful recovery and was dischared on 4 February 2013.

By way of proactive vigilance after the oseltamivir-resistant case was detected, hospital staff who had been in close contact with patient X, patients who shared the same ward, family members, and persons with influenza-like illness living in the neighbourhood of the patient, were investigated for pandemic influenza and all tested negative. Influenza patients admitted in other hospitals during the same time period were also investigated; all samples positive for influenza virus were sensitive to NAI.

DISCUSSION

Our findings show a sporadic case of oseltamivir resistance in a patient who recovered uneventfully. This is the first reported case from India. Genetic characterization of the clinical sample and isolate showed resistance to oseltamivir with H275Y substitution in NA and increased IC50 values in the phenotypic assay. This resistant virus could have been the result of a random process of viral drift or could have seeded from outside the country. The resistance observed cannot be attributed to drug-driven selective pressure as H275Y mutation was detected in the clinical specimen collected before administration of oseltamivir. No evidence of transmission of the resistant virus could be found. Whole genome analysis of the resistant virus showed no major deviation in signature/pathogenicity marker mutations. In addition to H275Y mutation, S182T, N/D248 G and V453 M were found in the NA gene. However, the relevance of these mutations in drug susceptibility is unknown.

Our findings demonstrate that oseltamivir-resistant A(H1N1) pdm09 viruses exist in sporadic situations. This suggests that continuous surveillance is required to evaluate the emergence and circulation of drug-resistant A(H1N1)pdm09 viruses and to identify possible potential mutations responsible for drug resistance.

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Research brief

Tetanus: still a public health problem in India — observations in an infectious diseases hospital in Kolkata

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ABSTRACT

Background: Tetanus is a major health problem in many developing countries, including India, with significant morbidity and mortality due to lack of environmental hygiene and health education, incomplete vaccination, high case prevalence and inadequate intensive care facilities.

Objectives: To observe the demography, clinical profile and outcomes of tetanus patients.

Materials and methods: A total of 282 tetanus patients were screened and closely observed prospectively from January 2010 to December 2011.

Results: The mean age of the study patients was 31.15 years (± 14.26) and the majority were unvaccinated or incompletely vaccinated against tetanus. Patients were mainly farmers (140, 49.64%) and children (102, 36.17%). The sources of infection identified were mainly thorn/pin prick in 129 cases (45.7%), cut/lacerated injury in 83 cases (29.4%) and ear infection in 47 cases (16.7%), while definite injury was not detected/remembered in 42 cases (14.8%). The average duration of hospital stay was 17.2 ± (4.7) days and autonomic nervous system dysfunction was the most common complication observed in this study. Death was the outcome in a total of 58 patients (20.6%) mostly due to aspiration pneumonia-induced sepsis, respiratory failure or cardiac complications.

Conclusion: Environmental hygiene, basic health education, increased in immunization coverage, proper wound care – even following minor injuries – and more facilities for intensive care units, may reduce the overall incidence of tetanus and mortality following onset of the disease.

Key words: tetanus, complications, outcomes.

INTRODUCTION

Tetanus is still a public health problem in many developing countries, including India, despite the availability of a highly effective vaccine. Moreover, mortality from tetanus remains high among neonates, pregnant and elderly populations. Worldwide, annual deaths due to tetanus were estimated to be 800 000 to 1 000 000 with a case–fatality rate of 20–50%.[1] Adults and the elderly are particularly susceptible to tetanus because of gradual waning of immunity with age along with a lack of booster vaccination; it has been reported that about 53% of healthy adults in New Delhi, India had no protective antibodies against diphtheria or tetanus.[2,3] In India, the case prevalence of tetanus is still high, probably due to lack of environmental hygiene and basic health education, inadequate vaccination (including boosters), ongoing unhygienic ritual practices (nose and ear pricks, shaving of heads, especially in neonates), septic abortion, improper wound care following injuries, as well as contamination of almost all roads and fields with animal excreta (cow dung).

Persistent high mortality from tetanus in developing countries is mainly due to delayed medical attention, limited access to an intensive care facility and associated comorbidity. By contrast, tetanus mortality has decreased strikingly in developed countries because of better environmental hygiene and health education plus high vaccination coverage and implementation

of appropriate health-care services. Notably, management of patients with tetanus in an intensive care unit significantly reduced mortality, with deaths mainly due to cardiovascular complications as a result of autonomic nervous system dysfunction.[4,5] Magnesium sulfate, a novel antispasmodic agent, is nowadays increasingly used as a part of multimodal therapy in the treatment of tetanus.[6] Magnesium sulphate can be used alone or in combination with benzodiazepines, not only to control spasm, but also to control autonomic instability, which continues to be a major cause of death even with the use of ventilation.[7,8]

The objectives of this study were to determine the demography, clinical profile and outcomes of tetanus patients in an infectious disease hospital in West Bengal.

PATIENTS AND METHODS

This prospective observational study was carried out in the Infectious Diseases Hospital, Beliaghata, Kolkata, India from January 2010 to December 2011. All tetanus patients/family members gave verbal informed consent to participate and data regarding their demographic profile, vaccination status, type of injury, complications and outcomes were recorded. Tetanus severity was classified according to the criteria reported by Ablett.[9] Patients were treated with either intravenous diazepam (for grade 1 and 2) or diazepam and magnesium sulfate in combination (for grade 3 and 4) to control spasms. Dosages were in line with guidance of the World Health Organization.[6]

RESULTS

A total of 282 patients (including two neonates) diagnosed with tetanus were enrolled. The mean age was 31.2 years (± 14.3) with a male:female ratio of 2.1:1. The study observed that 245 (86.9%) patients were from lower socioeconomic groups, 156 (55.3%) were illiterate and 148 (52.5%) had poor nutritional status. Regarding occupation, 140 (49.6%) patients were farmers, 102 (36.2%) were children, 30 (10.6%) were industrial workers and 10 (3.5%) patients were housewives. In respect to the vaccination status, only 25 children were able to produce an immunization card. This revealed that vaccination for tetanus/boosters was incomplete. The vaccination status of the remaining children was unknown, and not all of the adult patients received any tetanus vaccine within the past 10 years.

The source of infection observed was thorn, bamboo or stick/pin prick in the majority of cases (87, 30.8%). Other sources were cut/laceration injuries in 73 cases (25.9%); chronic suppurative otitis media in 47 (16.7%); unhygienic ritual practices (ear/nose pricking, scalp shaving and circumcision) in 29 (10.3%); septic abortion in 2 cases (0.7%); and no definite injury was detected or remembered by patients in 42 cases (14.9%).

The mean incubation period of tetanus cases was 8.2 (± 1.3) days whereas the mean onset time was 3 (± 1.3) days. Autonomic nervous system dysfunction was observed in 131 (46.5%) cases and observed sometimes in combination with sinus tachycardia in 80 cases (63%), hyperhydrosis in 78 (65%), excess trachea-bronchial secretion in 56 (44%), acute urinary retention in 25 (19%), persistent hypertension in 11 (8%) and cardiac arrhythmias in 6 cases (4.5%). Other major complications observed were aspiration pneumonia in 47 cases (17%), urinary tract infection in 38 (13.5%) and respiratory failure in 17 (6%) of cases (Figure 1). The mean duration of reflex spasm observed was 7.4 (± 2.3) days and the mean duration of hospital stay was 17.2 (± 4.7) days.

Deaths occurred in 58 patients (21%), mainly due to aspiration pneumonia-induced sepsis in 26 cases (45%), respiratory failure in 18 cases (33%) and acute cardiac complications in 14 cases (25%).

DISCUSSION

This study observed that about half of the tetanus patients were farmers, most of whom were malnourished and illiterate, and none of whom sought any medical advice (especially tetanus prophylaxis) even days after sustaining an injury. The next common group affected was children (36%), most of whom had a history of untreated ear infection in the form of chronic suppurative otitis media.

The most common type of injury observed was prick injuries (31%) and the most important observation was that in 15% of these cases, no definite injury was identified or could be remembered by the patient in the recent past. This was probably due to micro-injuries/trauma, unnoticed or ignored by the patient, but epidemiologically significant. Unsafe abortion practices were a source of tetanus in two patients observed in this study, both of whom died due to delayed presentation with severe tetanus and sepsis. Thus, female patients with a history of unsafe or illegal abortion practice should receive immediate

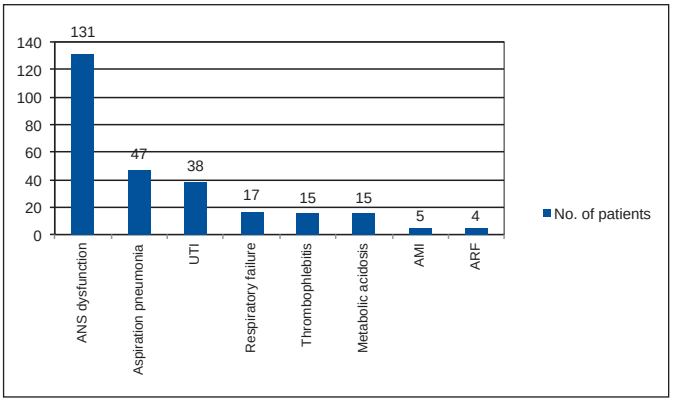

Figure 1: Complications in tetanus patients[a]

AMI: acute myocardial infection; ANS: autonomic nervous system; ARF: acute renal failure; UTI: urinary tract infection.

[a]Patients may have a combination of complications.

anti-tetanus immunoglobulin, including immunization and information on how to avoid getting tetanus. It must be remembered that pregnancy/abortion must be excluded in suspicious cases.

Our study observed that overall mortality due to tetanus was much lower compared with other Indian studies. This may be due to the use of magnesium sulfate in combination with diazepam in severe cases (which reduces both cardiovascular instability and the requirement of a high dose of diazepam) and good nursing care, though there was no significant decrease in the incidence of tetanus cases attending the hospital.[6,10,11] As the farming population and children were the main population groups observed in this study, it is suggested that they should be targetted for complete tetanus immunization. In addition, farmers should be discouraged to work bare foot, and school health programmes should be intensified to detect early ear infection in children so that tetanus can be prevented.

As per the Expanded Programme on Immunization (EPI), single tetanus booster is recommended in infants between 1and 6 years of age. However, because of the pervasive presence of cow/horse dung in the country, and the fact that many people still walk bare foot (with unnoticed minor injuries causing a significant number of tetanus cases), it may be efficient and cost–effective for a tetanus toxoid (TT) booster dose to be given every 5 years instead of the 10-year interval currently recommended.[12]

CONCLUSION AND RECOMMENDATIONS

As prevention is the only way to reduce the overall incidence of tetanus and subsequent deaths, the following measures are recommended: (1) Unhygienic ritual practices should be discouraged and all illegal/unsafe abortions strictly controlled; (2) Health education should be promoted regarding personal protection and proper wound care, including active and passive immunization against tetanus (in cases where the last dose of tetanus toxoid was given more than 5 years before); (3) Vaccination coverage should be increased and more emphasis given to completion of immunization schedules; and (4) Priority should be given to more intensive care facilities.

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Veterinary public health capacity-building in India: a grim reflection of the developing world's underpreparedness to address zoonotic risks

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ABSTRACT

Veterinary public health (VPH) is ideally suited to promote convergence between human, animal and environmental sectors. Recent zoonotic and emerging infectious disease events have given rise to increasing calls for efforts to build global VPH capacities. However, even with their greater vulnerability to such events, including their economic and livelihood impacts, the response from low- and middle-income countries such as India has been suboptimal, thereby elevating global health risks. Addressing risks effectively at the human–animal interface in these countries will require a clear vision, consistent policies, strategic approach and sustained political commitment to reform and refine the current VPH capacity-building efforts. Only then can the discipline serve its goal of disease prevention, poverty alleviation and support for sustainable livelihoods through improvements in human and animal health.

Key words: capacity-building, India, veterinary public health, zoonoses

INTRODUCTION

The importance of veterinary public health (VPH) capacity in effectively addressing issues on the human–animal interface has long been recognized. Different policy proclamations have highlighted the relevance of veterinary contribution to public health practice.[1] However, globally, VPH capacity-building efforts have focused largely on foods of animal origin and meat-inspection procedures. In addition to food safety, VPH has a direct role to play in ensuring food security, in public health nutrition, and in ensuring public safety in relation to endemic as well as emerging zoonotic diseases. But limited focus on the role of VPH in wider issues related to public health, trade and livelihood has led to limited involvement and consequent neglect of this discipline in public health practice. While there is variable discussion about the other domains of VPH, concerns about emerging infectious disease (EID) events since the early 1990s, has once again renewed interest in the role played by the discipline of VPH in dealing with diseases of the human–animal interface. This paper seeks to examine the status of VPH education in India, in relation to other countries, with reference to zoonoses and EIDs.

Global response to capacity-building in veterinary public health: a mixed bag

Over the last decade, veterinary schools in Europe and North America have changed their VPH training by introducing new topics and teaching methodologies to respond to the evolving demands of the sector. Accommodating increasing prominence of transboundary and trade-related issues, they have transitioned from local, country-specific approaches to more global ones.[2] For example, schools of veterinary medicine in the United States of America have developed formal collaboration with schools of public health, offering joint degree programmes (Doctor of Veterinary Medicine/Master of Public Health). Many veterinary schools in Canada have endorsed the concept of ecohealth in their Doctor of Veterinary Medicine and graduate training, in response to growing emphasis on transdisciplinary "One Health" principles.

On the other hand, the response of low- and middle-income countries has been variable. While Latin America has demonstrated more sophisticated collaborative mechanisms, such as the inter-country mechanism called Consejo

Panamericano de Educación en las Ciencias Veterinarias (COPEVET), which coordinates improvements in school accreditation, professional certification and curricular harmonization across the continent,[3] South-East Asian countries' focus on developing transdisciplinary responses to transboundary issues remains limited. While some (mainly local) zoonoses are discussed in the infectious disease programmes in veterinary curricula, linkages made to their public health dimension vary widely between programmes.[4]

India's response to veterinary public health: languishing in nascent stages

A useful framework to assess the development of VPH services has been proposed by Lipman and colleagues, who classify veterinary services into three stages of development, starting from areas with limited organized agriculture, to developing societies with legislations governing agricultural systems to developed societies with highly organized agricultural systems and evolved VPH systems.[2] The Indian response, seems to be lagging behind in the first two stages, as is evident from the current status of VPH capacity building efforts and the strategic vision guiding these efforts. The sub-optimal system capacities in VPH, have made local populations vulnerable to zoonoses and their impact, thus elevating health and economic risks in a globalized world, through the formation of disease "hotspots".[5] For example, India has the world's largest livestock population. The sector has been exhibiting an annual growth of 4.6%, and an ever increasing demand for and emphasis on livestock production. However, with nearly 80% of the sector being managed in small-holder farms operating in informal marketing conditions and close proximity to animals, the scenario exacerbates vulnerabilities on the human–animal interface, with wide-ranging implications and therefore the need for an adequate and appropriate VPH response. [6]

Evolution of veterinary public health capacity-building – major milestones

While VPH was a part of the veterinary curriculum in India even in the early days of veterinary education, like the veterinary training programme offered by the Indian Veterinary Research Institute, concerted efforts to systematize VPH capacity-building started in 1964, with the establishment of a Division of Zoonoses at the National Institute of Communicable Diseases. This was followed by institution of a master's degree course in VPH at GB Pant University in 1965, and at the All-India Institute of Hygiene and Public Health in 1970. A Division of VPH was established at the Indian Veterinary Research Institute in 1971. The Department of Agricultural Research and Education, under the Indian Council of Agricultural Research (ICAR), was created in 1973, to coordinate, guide and manage research and education in agriculture, including animal sciences in the entire country. The Veterinary Council of India was constituted in 1989, to establish state veterinary councils and maintain registers of veterinary practitioners and related matters. The Indian undergraduate veterinary curriculum underwent its most recent revision in 2008.

Currently, the undergraduate and postgraduate training in veterinary medicine is governed by the Veterinary Council of India and ICAR, respectively. As per their guidelines, each veterinary college has a department of VPH and Epidemiology. Postgraduate training in VPH includes a 2-year Master of Veterinary Sciences and VPH, with the second year dedicated to a master's dissertation. The PhD in VPH is a 3-year programme.

Opportunities in veterinary public health training and capacity building, few and far between

Within these existing frameworks, the structure of VPH capacity-building in India has been fraught with several weaknesses. India has 41 government veterinary schools, with an annual turnover of approximately 2100 veterinary graduates. Twenty-six institutes in the country provide VPH masters' degree and 15 offer a doctoral degree, with around 60–70 public health veterinarians successfully completing the course and 25 scholars awarded doctoral degrees every year.[7] From the perspective of long-term capacity building, for a country as large as India, this human-resource output is extremely limited, thus making the core capacity to support growing VPH needs grossly underplanned.

The curriculum in undergraduate and postgraduate VPH training includes various aspects of milk and meat hygiene; food safety and public health; veterinary epidemiology and zoonosis; environment and environmental hygiene; etc. However, the approach that is followed is largely pathogen based, with much emphasis on laboratory-based methods and limited focus on disease epidemiology, field epidemiology and study designs. This has led to duplication of efforts between VPH and veterinary microbiology disciplines, and underdevelopment of veterinary epidemiology capacity. Similarly, the focus of research at the postgraduate level is pathogen based, and involves laboratory research with limited focus on epidemiological research and field-based methods.

The extension/internship training opportunities, which are supposed to prepare the graduates to practice VPH in interdisciplinary settings, remain limited in imparting an understanding of cross-sectoral links between various disciplines in VPH, unlike some of the other models.[8,9] A near-zero interaction with medical colleges, their community medicine departments and schools of public health further compromises intersectoral linkages. The narrow focus also emanates, at least in part, from a limited exposure to programmatic settings. Contrary to the human health aspect, the absence of a mainstream surveillance programme does not allow the development of linkages of veterinary colleges and mainstreaming of VPH education into the broader public health paradigm.

Even the short-term training opportunities in specific domains, for in-service staff to continue their skill development, have been reactive in response to major catastrophic public health events, such as outbreaks of avian influenza, rather than having a strategic focus. Furthermore, from a policy-response

perspective, the inaction in spite of these serious shortcomings indicates a perception of "no unmet need for VPH specialists". As a result, the VPH community in India has largely remained on the periphery, in academic as well as programme settings, thus drawing graduate students away to tracks with a more secure and predictable career such as clinical sciences. Undoubtedly, the limitations in strategic vision have led to a lack of both quantity and substance of VPH capacity in India.

Urgent need for veterinary public health capacity-building in India: Policy and action

India, with high livestock density, a rapidly growing livestock sector, human population growth, deficient VPH services, weak surveillance and control apparatus, heightened risks for emerging zoonoses, and a much higher demand for veterinary capacity, is yet to realize the importance of VPH in assuring the health and well-being of animals, people and ecosystems. Recent reviews have also established strong associations between poverty, livestock keeping, neglected zoonoses and emerging infections.[10] With India leading on all these fronts, these deficiencies have enormous livelihood and economic implications, as is the case across most of the developing world.

If VPH in India were to attain its goal of disease prevention, poverty alleviation and sustainable livelihoods, through improvements in human and animal health, VPH training must be redefined. A shift in strategic priorities should begin with enunciation of a policy for human-resource development for the veterinary sector and VPH in particular.

Strategic vision through a policy for veterinary public health human-resource development

In the United States, following the Presidential Directive of 2004, "to support higher education and provide capacity-building grants to colleges of veterinary medicine for training in exotic animal diseases, and public health", the Association of American Veterinary Medical Colleges identified the need to scale up the output of veterinary graduates by 20% ; these graduates were expected to possess a broader set of competencies, including VPH.[11] This exercise was followed by an assessment from the National Research Council that recommended a fine-tuning of the policy, taking a longer perspective for defining strategic priorities for the veterinary workforce.[12] An exercise of a similar nature is yet to take place in current times in India.

A VPH human-resource development policy for India should provide the strategic vision and broad framework for building capacity for an effective VPH system in the country that is responsive to national and global health concerns. Catering to long-term core and short-term capacity-building, through a strong academic and continuing education programme, such a policy should be backed by systematic analysis and identification of capacity gaps and competency needs. Curricular reforms should then follow that make a clear distinction between the public health focus of VPH versus the laboratory focus of veterinary microbiology departments – a model that is well defined in medical schools.

Elevating the profile of veterinary public health: enhancing competencies, providing an enabling learning environment and mainstreaming

Globally, several calls have been made to revise veterinary curricula to meet the ever-changing needs of the sector and to ensure relevance of the discipline in a globalized world. The World Organisation For Animal Health (OIE) has responded to these calls by recommending a basic and advanced set of competencies for graduate "day 1 veterinarians", based upon the OIE *Performance of Veterinary Services Pathway*.[13,14] These minimum competencies aim to prepare veterinary graduates to promote global VPH, with applicability to both low- and middle-income countries and high-income countries. Moreover, using standardized frameworks such as these will facilitate collaborations with the human health sector in areas of mutual convergence.[15] Given the increasing integration of India with the global food economy, it will be important for Indian veterinary schools to adopt these guidelines. In addition to the core domains of epidemiology and disease control, these include, communication skills to respond to complex public health issues arising at the human–animal interface. Advanced skills include leadership, management and application of risk analysis, which assume greater importance in low- and middle-income countries, owing to limited capacity of their disease-surveillance systems.[13]

In addition to diversifying content, a reformed VPH curriculum should also incorporate new didactic teaching methods and novel experiential learning exercises that sensitize students in application of VPH. This can include the interface with animal and human health-surveillance systems, participatory surveillance methods, and exposure to established field epidemiology training programmes.[16] Mentorship programmes with faculty and industry collaboration can provide valuable experience to students, while exposing future VPH practitioners to need-based and field-centric approaches. A shift to epidemiological and health-systems and policy research will, further, ensure greater programmatic and policy relevance of research.

Improving intersectoral communication and understanding of the interdisciplinary nature of zoonotic disease diagnosis, prevention and control require education models to be collaborative in nature.[17] The "One Health" movement, which gained momentum in the last decade, has highlighted the importance of transdisciplinary education in addressing EIDs.[18] "One Health" principles and frameworks, as yet formally unrecognized by the Indian VPH and public health policy community must thus be enshrined in Indian VPH human resource development policy.

The recent introduction of the National Animal Disease Referral Expert System is a welcome policy shift towards

setting up a comprehensive epidemiological surveillance system for animal diseases. Similarly, the National Standing Committee on Zoonoses has proposed recruitment of VPH professionals in state surveillance units of the Integrated Disease Surveillance Programme, as well as earmarking of dedicated funds for intersectoral coordination. These are recent attempts made by the Ministry of Health of the Government of India, aiming to institutionalize intersectoral coordination with the VPH community,[19] and provide excellent opportunities for VPH students to train in programme settings in an intersectoral environment. Furthermore, research collaborations between the Indian Council of Medical Research and ICAR, and collaborative platforms such as the Roadmap to Combat Zoonosis Initiative in India, are avenues of transdisciplinary and multisectoral approaches to research on EIDs[20] that could benefit VPH capacity-building.

The time to act is Now

VPH capacity-building in India has long suffered from neglect of technical and political leadership, reflected in the policy gaps in building veterinary institutional capacity, thus posing serious threats to global health security. Policy initiatives with strategic focus, and backed by strong and sustained political commitment, as well as advocacy by technical and professional leadership, are necessary in India and rest of the developing world, for the elevation of the profile of VPH and its mainstreaming in public health preparedness and response. Recent EID events, which have galvanized renewed interest in the discipline and its role in responding to these threats, should be seized as an opportunity.

A strategic approach as part of a comprehensive and well-thought-out policy for human-resoruce development for VPH capacity-building in India, is a pressing need that requires to be pursued by veterinary education advocates and policy-makers. Reviews of curriculum and teaching methodologies at undergraduate and postgraduate levels can be led by veterinary schools in India, which could help prepare India's VPH capacity to meet the challenges of existing and emerging zoonotic risks.

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Knowledge brokering for evidence-based urban health policy: a proposed framework

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ABSTRACT

This paper presents a multidimensional approach to examining the urban evidence–policy interface in low- and middle-income countries (LMICs), and applies this approach to a case study from Pakistan. Key features of urban health policy and the significance of the evidence–policy interface in rapidly changing LMICs are articulated; characteristics of evidence that has been successfully incorporated into health policy are also defined. An urban health evidence-to-policy exploratory framework for LMICs based on innovative multidisciplinary thinking and pivotal knowledge brokering is presented. Application of the framework to a case study on road transport and health in urban Pakistan underscores the opportunities and utility of knowledge brokering. Public health practitioners can become knowledge brokers at the evidence–policy interface to develop a concerted, coordinated and informed response to urban health challenges in LMICs.

Key words: urban health, health policy and practice, low- and middle-income countries, urban planning, knowledge broker

INTRODUCTION

In 2007, the world population constituted a majority of urban dwellers for the first time in human history.[1] Growth in urban populations will take place primarily in the developing world and will add considerably to the already large numbers of slum dwellers in these settings, resulting in numerous health and social challenges.[2] Estimates predict that by 2030, two thirds of the world's population will reside in urban settings.[3]

The diverse and evolving definitions of the term "urban" complicate intercountry and temporal comparisons in the developing world.[1] This paper uses the existing definition of "a concentration of people, buildings, or economic activities which a government *chooses* to call an urban centre".[4]

Inherent to urban settings is a unique set of health effects and concerns. Three overarching and interconnected categories of proximal linkages between urban settings and health have been outlined: the physical environment, the social environment, and considerations related to health and social services.[5] These three dimensions emphasize the complexity of urban settings–health linkages and highlight the multiple disciplines required for their analysis. Potential health impacts in each of the categories cover a wide range of conditions including infectious diseases, noncommunicable diseases, and injuries.[6]

Considering these varied challenges, this paper introduces an innovative and multidimensional approach to examining the urban health evidence–policy interface in low- and middle-income countries (LMICs). A successful interface is one that transforms health research findings into effective public policy and practice. The specific objectives are to articulate the significance of the evidence–policy interface in rapidly changing LMICs; propose an urban health evidence–policy framework for potential use in LMICs; and illustrate the framework using a case study on health and road transport in Pakistan.

Urban health in low- and middle-income countries

Sound urban health policy is critical in LMIC settings,, especially with regard to the existing and increasing number of urban dwellers. The linkage of health policy with social policy, which focuses on equity considerations, should be a priority in these settings.[7] Equity-focused urban health and social policy-making is essential in LMICs given the context of widespread poverty. However, this renders policy-making complicated due to the need to incorporate multiple sectors within the policy-making process.[8] Further, the evidence base relevant to urban health policy is produced by a variety of disciplines such as sociology, urban planning and epidemiology, which results in differing perspectives on policy and planning priorities.[9]

Health can serve as a useful common denominator for an effective partnership between disparate players.[8] Such an approach to policy-making is useful, particularly if the definition of health includes physical, mental and social well-being as espoused by the World Health Organization (WHO).[10] Health may also provide an opportunity to extend this policy-making partnership to communities – potential links between health systems and urban communities have been clearly articulated with examples of success in LMICs.[11]

In addition to the type of policy needed, it is important to consider the wide range of possible stakeholders in the policy process. For the purpose of this discussion, we will use material from the WHO-supported Healthy Cities projects, which focus on improving health outcomes in urban centres.[12] The stakeholders considered in Health City programmes include government authorities, local and national politicians; international agencies; public and private service providers; nongovernmental organizations; community-based organizations; and policy networks. Service provision influenced by such urban-health oriented policies covers multiple areas such as health; transport; water and sanitation; education; housing; energy; environmental health; and community services.

The evidence–policy interface in low- and middle-income countries

Disciplines outside the health sector, such as policy and communication sciences, have taken the lead in exploring the linkages between evidence and decision-making.[13] However, the nature of what constitutes evidence in LMICs needs first to be questioned and then defined. The limitations of a narrow science-focused approach to public health have recently been articulated, and it is increasingly recognized that there are different types of useful evidence.[14,15]

For example, evidence is often used to refer to research, while research is only one type of evidence.[16] Evidence can be defined as "information that affects the existing beliefs of important people about significant features of the problem you are studying and how it might be solved or mitigated".[16] Such a definition assumes particular significance in LMIC settings where substantial decision-making power may reside in key networks of important people. Following this line of thought, five types of evidence that inform the policy process are proposed:[16]

(i) research evidence, including experimental trials;

(ii) knowledge and information evidence, such as findings from group consultations, documents and report analyses;

(iii) evidence on ideas and interests, which includes the opinions of individuals, groups and networks;

(iv) evidence relating to politics, e.g. on government agendas and political risk assessments; and

(v) economic evidence.

All of these can potentially influence policy; key pro-policy characteristics using this broader definition of evidence require thinking outside the confines of traditional research.

Beyond evidence, fundamental differences between professional cultures of scientists and policy-makers also exist in LMICs. These include differences in work goals; breadth of focus; consideration of facts and compromises; use of language; funding sources; and time frames for action.[17] At the same time, there is growing recognition in both camps that strengthening evidence throughout the policy-making process is of importance in improving population health.[18-20] Of equal importance is communication for effective public health practice at the evidence–policy interface.[21]

Characteristics of evidence

Empirical studies on the key characteristics of evidence that facilitate incorporation into policy are limited in LMICs. However, five characteristics that fulfil this need are: evidence generated by researchers with whom policy-makers have personal contact; evidence that is considered a priority locally, nationally, or internationally; evidence generated in a timely manner, the findings of which are considered relevant; evidence presented in a comprehensible manner with clear findings; and evidence focused on reality (effectiveness, costs, and sustainability).[23,26] Recognizing the importance of these elements is crucial for an effective evidence–policy interface in any setting.

Proposed urban health evidence–policy framework

The multiple facets of the urban health evidence–policy interface in LMICs are complex. A number of useful frameworks already exist and can be used to explore the evidence–policy interface in general. However, these are often grounded in a high-income country context and fail to account for the unique situation of urban LMIC settings.[22,23] A more detailed and appropriate framework is therefore needed. The evidence–policy framework for urban health in LMICs we propose brings together all the considerations described above – types and characteristics of evidence; stakeholder engagement; and the dimensions of health and urban environment –into an interactive and systematic network of stakeholder influences that determine evidence-informed urban health policy.

The knowledge broker function

In order to implement this framework, we introduce the concept of knowledge brokers to act as translational scientists or intermediaries, effectively linking policy-makers with researchers.[17,24] Knowledge brokering has been defined as "all the activity that links decision makers with researchers, facilitating their interaction so that they are able to better understand each other's goals and professional cultures, influence each other's work, forge new partnerships, and promote the use of research-based evidence in decision-making".[24]

Professional knowledge brokers that can navigate the evidence–policy interface and connect scientists and policy-makers are a potential solution to the complexity of policy-making in urban LMIC settings. Such professionals would be better equipped than either policy-makers or scientists to facilitate bi-directional exchange between two apparently disparate groups. This approach has already been explored in Kenya, Uganda and the United Republic of Tanzania as a way to provide a more streamlined conduit of evidence than the fragmentary approach that characterizes many LMIC settings.[26] It is therefore recommended that more research is needed in this area.[25]

A key question immediately arises: who should be these knowledge brokers? One approach would be to adapt the role of a few public health practitioners, whose broad training and exposure to various fields make them well-situated to take on the role of knowledge brokering.[27,28] Another potential option would be to train social scientists with backgrounds in sociology, anthropology, research and development with, ideally, some exposure to epidemiology, urban health, health promotion and economics. A cadre of such professionals with a sound grounding in evidence-based decision-making, information management and policy science, could be instrumental in assuring an effective interface between evidence and policy-making in various urban settings in LMICs.[29] (Figure 1). These knowledge brokers would potentially function within current institutional mechanisms; they could also become an integral part of a new strategy in settings where institutional mechanisms are either absent or weak.

Case study from urban Pakistan

Linkages between transport and health, especially in urban areas, are well known.[30] They include the effects of noise pollution, excess particulate matter, climate change and injuries. A published case study on health and road transport in Pakistan focused on policy considerations and research gaps between health and transit. The systematic review found that the ill-health effects of transport were closely tied to a rapidly urbanizing society.[31] For example, road traffic injuries became a leading cause of death among young men, lead toxicity was among the highest in Asia, and particulate matter from vehicle exhaust far exceeded international standards. Despite political awareness of these health issues, no formal road transportation policy or interventions were in place to combat them.

This study highlights the existing evidence–policy gap in Pakistan and provides an opportunity to apply the proposed urban evidence–policy framework. However, it is important to note that Pakistan is only one of many LMICs with a growing urban setting: Table 1 illustrates Pakistan's similarities with Egypt, Gambia, Indonesia and Paraguay on fatality rates in urban areas.

Figure 2 highlights the proposed framework's application to Pakistan. The three-dimensional approach to linkages between the urban environment and health allows structured thinking of these linkages in urban Pakistan. The first dimension – the physical environment – highlights the impact of transport such as road traffic injuries, air pollution, and noise pollution; less intuitive linkages such as the effect of road transport on

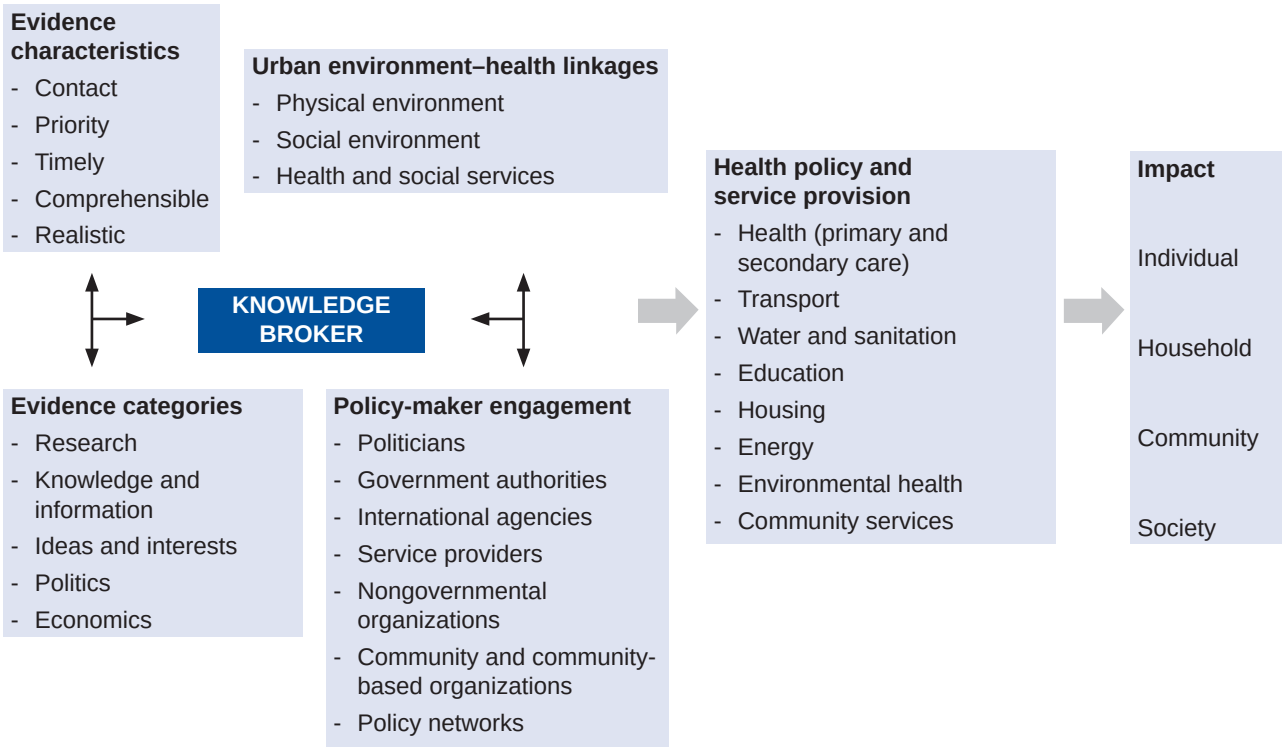

Figure 1: An evidence–policy framework for urban health in low- and middle-income countries

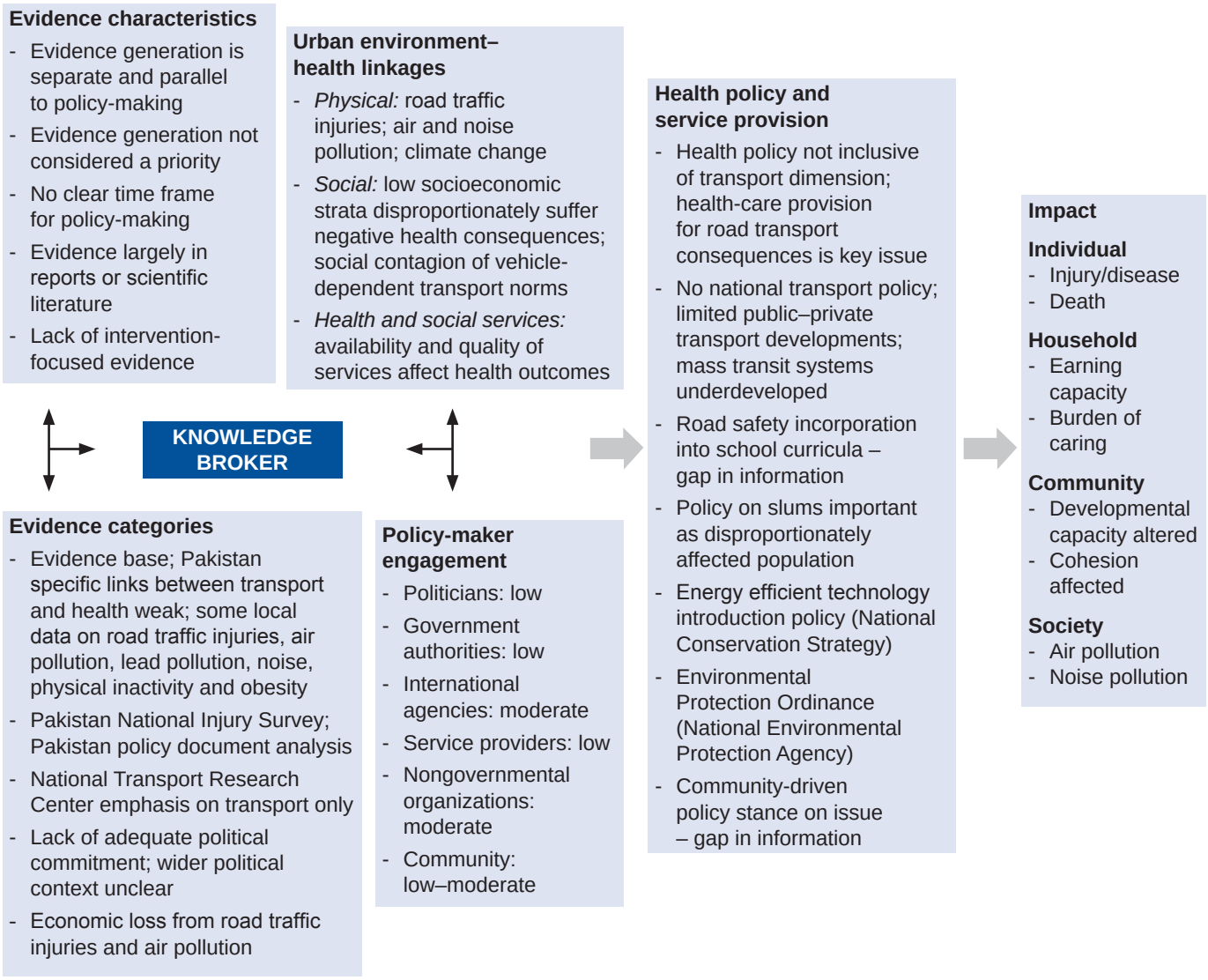

Figure 2: Application of urban evidence-policy framework for low- and middle-income countries to Pakistan

climate and, subsequently, on health also surface. The second dimension – the social environment – illustrates how the disease burden associated with road transport disproportionately affects people in low socioeconomic strata; further, the application of the social contagion theory shows the effects of vehicle-dependent transport norms in urban settings on health. The third dimension – health and social services – identifies how the availability and quality of health services, especially emergency medical services, affects the health outcomes of road transport in urban Pakistan.

Within the categories of evidence listed, we know that a body of both global and Pakistan-specific research exists on transport–health linkages.[31,32] Knowledge and information are also available from national injury surveys and policy analyses.[32] The Pakistan National Transport Research Center's emphasis on transport alone, rather than a broader remit that includes health, mirrors the ideas and interests of many local experts. Finally, there is no evidence of political commitment to transport and health issues at the national level, although some economic evidence exists on financial losses associated with road traffic injuries.[33]

Applying the characteristics of evidence described above to health and road transport in Pakistan, it is apparent that linkages between evidence-generation and policy-making are weak. There appears to be limited contact between evidence-generators and policy-makers, who do not appear to consider evidence generation on road transport and health to be a priority. This may be due to inappropriate timing or practical focus of the evidence, or poor attention to effective interventions. Finally, the evidence that is available is largely in the form of reports and scientific literature, and no clear focus on communicating these findings in a comprehensible manner exists.

Analyses of existing policies and service provision in relation to road transport and health point to areas for consideration from a variety of perspectives. For example, an educational

Table 1: Selected indicators for urban areas in Pakistan and similar LMICs

	Population living in urban centres (%) (2004)	Slum population in urban areas (%) (2005)	Annual mean concentration of urban particulate matter (μg/m³) (2004)	Road traffic fatality rate per 100 000 (2010)
Egypt	32	17.1	136	13.2
Gambia	19	45.4	138	18.8
Indonesia	22	26.3	114	17.7
Pakistan	28	47.5	165	17.4
Paraguay	25	17.6	103	21.4

dimension will highlight whether or not road safety is incorporated into school curricula in Pakistan, while a civic dimension may indicate whether community mobilization has occurred.

In the context of road transport and health in urban Pakistan, the absence of a knowledge broker function is apparent. Whatever information and knowledge exists on the subject – and there appears to be a moderate amount – does not seem to flow to and from the individuals, networks, and institutions that need it to establish an effective evidence-to-policy system.

CONCLUSION

The purpose of our proposed framework is to enable a systematic analysis of the complex multidimensional context within which the evidence–policy interface exists in urban settings in LMICs. Furthermore, the framework postulates the centrality of the knowledge broker function in the translation of evidence to policy. The possible utility of such an approach is demonstrated when considering the transport–health challenges in urban Pakistan, which are similar to those seen in many LMICs.[2,31,34-38] Advocating the use of such brokers to national governments is therefore considered worthwhile; international donors that are committed to evidence-based practice may also consider facilitating this form of capacity-building in low- and middle-income countries.

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Fiscal competition in health spending among local governments in the Philippines

Uma Kelekar

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ABSTRACT

The Philippines is one of several Asian countries that has decentralized the provision of health care to its local governments in recent decades. In the context of decentralization, a few studies have previously examined the issue of fiscal competition among local governments in the developing world. This report presents a summary of a published study that examined the existence of inter-jurisdictional competition in health-care spending in the Philippines. The results indicate the presence of positive fiscal "spillovers" in health spending, consistent with municipalities/cities competing to outspend their neighbours. Several potential explanations for this finding are discussed.

** This article is based on the article "Do Local Government Units (LGUS) Interact Fiscally While Providing Public Health Services In The Philippines?" published in the World Medical & Health Policy: Vol. 4: Issue. 2.*

Key words: decentralization, fiscal competition, health spending, the Philippines

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INTRODUCTION

The "one-size fits-all" principle traditionally used by developing countries to provide public services has been challenged in recent decades.[1] The focus of managing and financing social services such as education, health, water and sanitation is shifting from the central government to local governments in many developing countries in Asia, including China, India, Indonesia, Pakistan, the Philippines and Thailand. While supporters of decentralization believe that this has been an effective reform in terms of allowing the local community to participate in public decision-making,[2] critics point to several flaws of decentralized systems.[3] This report presents a summary of the empirical findings of a published study that assessed fiscal competition among local government units within the decentralized health-care system of the Philippines.[4] It explores the issue of whether local governments compete, either positively or negatively, with their neighbours in determining their health spending.

Passage of the local government code in the Philippines

In 1991, the *Local Government Code* of the Philippines transferred several responsibilities of providing health care from the central government to subnational governments. Provinces were given the responsibility of managing provincial-level hospitals and municipalities and cities were tasked with managing district hospitals and rural or city health offices. As a result, local governments are now in charge of health programmes, including medical and dental services, nutrition, control of infectious and non-infectious diseases, and family planning programmes.[5] While local governments continue to rely on funds received from the central government, they exercise a considerable degree of autonomy. In addition, local health offices report directly to their locally elected bodies instead of the central government.[5]

As envisioned by its proponents, decentralization has led to some innovative initiatives by local governments, in health-service delivery in the Philippines. Following the stipulation of the *Local Government Code*, local communities have increasingly been involved in the process of local governance in various ways – co-financing insurance programmes, managing awareness campaigns and monitoring health programmes. Indeed, some studies have shown the connection between the involvement of the community and excellence in service delivery in some local governments.[6]

However, decentralization in the Philippines may also have significant drawbacks. There is evidence that locally run programmes not only benefit the residents of the province but also have "spillover" effects on neighbouring provinces.[6] These "spillover" effects raise some important concerns; if residents of a region travel to the neighbouring regions

to use health services, would the neighbouring government discourage this behaviour by not providing similar services to its own residents?[7] For example, in one study, a decline in the vaccination coverage during the post-decentralization period in the Philippines, was attributed to negative inter-jurisdictional spillovers.[8]

On the other hand, researchers have examined whether some local governments would have incentives to out-perform their neighbouring local governments and invest in similar local programmes in a decentralized system. While this kind of competition, also called "yardstick competition", has been observed in high-income countries, it is debatable whether it would occur in a developing country like the Philippines. A study in Benin found that local governments strategically competed with each other prior to elections, in order to be re-elected.[9] Political competition of this nature may be undesirable if the money is being spent on unnecessary health projects that do not translate into better health outcomes.

Competition among local governments in the Philippines

Research was conducted to test whether municipalities of the Philippines reacted positively or negatively in response to their neighbours' decisions in the year 2007. Per capita health expenditures of local governments were examined and a complex spatial model was developed to compare the response of a local government to their neighbours' spending. The impacts of other socioeconomic, fiscal, demographic and political factors on per capita health spending were also assessed.[4] Not surprisingly, the influence of per capita provincial income, per capita revenue and the percent share of internal revenue allotment on per capita health spending was clearly positive. In other words, local governments with greater income and those with grants comprising a significant share of the total revenue are able to spend more per person on health. The political variable measuring the pork barrel effect is positive and significant. The research revealed that with respect to competition, local governments were indeed found to compete positively with their neighbours. Specifically, an increase in bordering municipalities' spending is associated with an increase in the municipalities' spending.[4]

What explains competition among local governments in the Philippines? One explanation is that a local scarcity of doctors is resulting in local governments bidding salaries and benefits upward, in order to attract physicians. Doctors are indeed compensated based on the income levels of different municipalities. Therefore, higher-income municipalities can afford to pay their doctors higher salaries and benefits as compared to lower-income municipalities. Furthermore, anecdotal evidence suggests that not all local government units are capable of providing the allowances under the Magna Carta for Public Health Workers, a system under which health workers are granted allowances in addition to their salary.[10]

Further, some scholars point out "yardstick competition" among local governments, a basis for efficiency in a decentralized system. However, this seems to be less of a possibility in young democracies like the Philippines and Benin. Additionally, anecdotal evidence suggests that better health performance is not consistently observed at the regional level.[6] Health disparities continue to persist across local governments. If some local governments indeed try to outperform their neighbours by spending more, it is not apparent that spending is translating into commensurate health outcomes. Hence, this may be plausibly explained as strategic competition among political actors prior to the election period; 2007 was an election year.[9]

Policy implications and recommendations

It is quite clear that some local governments have an advantage over others in their access to resources, and, as a result, disadvantaged governments may not be able to compete for specialized personnel such as doctors. While higher-income municipalities can afford to provide their personnel with more benefits, this might also induce the doctors from neighbouring lower-income municipalities to seek positions with better benefits, or to demand better benefits from the local municipalities. In turn, this movement of personnel or increase in the health-care personnel costs may eventually contribute to disparities in the levels of health services provided, as well as health outcomes.

In order to combat competition between local governments, the central government encourages local governments to cooperate with one another through inter-local health zones, wherein local governments are encouraged to share resources. Resources ranging from personnel to equipment could be shared among municipalities by coordinating with one another. Unfortunately, these zones have not been functional thus far in the Philippines.

Finally, if higher spending among municipalities is induced by political competition, it is possible that more resources will be allocated to the health-care sector in comparison to the other sectors. However, the question that arises is whether such politically driven spending is really addressing the health needs of the residents, in either the short or long term, or whether it is merely serving to achieve the strategic political motives of politicians.

Given that several Asian countries have undertaken decentralization as a part of their reforms, the experience of the Philippines should be of interest to policy-makers in the South Asian region. Drawing from the experience of the Philippines, several lessons for policy-makers are apparent.

- ***Conduct audits before elections:*** it may also be useful for the central government to develop an entity to monitor the use of local and national government funds. Independent investigating bodies should hold regular audits prior to local and national elections as an attempt to prevent unnecessary politically motivated spending on health that has little long-term impact on health outcomes.
- ***Encourage coordination among local governments through inter-local health zones:*** the Bureau of Local Health Development, an agency of the Department of Health, provides a platform for local government units to

"collude" into inter-local health zones – by sharing ideas, experiences and resources. While this approach is ideally suited to deal with "spillover" effects, or cross-border use of resources, the central government must take more proactive steps to encourage cooperation among local governments.

- ***Revise the payment structure of doctors:*** the salary and benefits structure of doctors should be revised such that they do not vary significantly across local governments. This might indeed be one of the steps in reducing intergovernmental competition.

CONCLUSIONS

To conclude, every government system has its flaws, and a decentralized system of public-service delivery is no exception. Although decentralization has proved to be effective in certain provinces of the Philippines, research indicates that, on average, local governments compete with their neighbours to spend more on health. Furthermore, this competition may not necessarily translate into better health outcomes. Unfortunately, evidence suggests that the money is spent on paying higher salaries to doctors, or is spent by politicians as a part of their campaigns to get re-elected prior to an election. To improve health outcomes in the Philippines, action must be taken by the central government to encourage local governments to coordinate spending, rather than compete with their neighbours while providing public health services.

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Letter

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Trends in tobacco use in Nepal

Demographic and Health Surveys (DHS) are carried out in many developing countries, approximately once every five years, on nationally representative samples of males and females usually aged 15–49 years. In the countries of the World Health Organization South-East Asia Region (SEAR), DHS are available for India, Indonesia, Maldives, Nepal and Timor-Leste. A recent comparison of tobacco use in the Region indicates that the prevalence of any tobacco use among males in the SEAR are high, ranging from 53.0%(2009 DHS data) in Maldives (2009 DHS data) to 69.5%(2009/10 DHS data) in Timor-Leste (2009/10 DHS data). By contrast, the prevalence of any tobacco use among females ranges from 3.0%(2007 DHS data) in Indonesia (2007 DHS data) to 19.6%(2006 DHS data) in Nepal (2006 DHS data).[1] The high prevalence of tobacco use among women in Nepal prompted us to assess whether there had been any change between the 2006 DHS and the most recent DHS, which was carried out in 2011, for both men and women in Nepal.[2]

Prevalence data, with 95% confidence intervals (CI), for the 2006 survey were taken from the recent comparative study.[1] Prevalence and 95% CI for the 2011 survey were calculated from the 2011 DHS Report.[2] Comparison of data from the two surveys reveals that 53.4% (95% CI 51.2–55.6%) of adult males in Nepal used tobacco in any form in 2006, and 51.9% (95% CI 50.4–53.4%) in 2011. Thus there was no significant change in the number of male any-tobacco users. There was, however, a change in the type of tobacco they used among males. Although the use of manufactured cigarettes did not change during these years (30.2%; 95% CI 27.4–33.0% in 2006; and 29.8%; 95% CI 28.4–31.2% in 2011), the prevalence of the use of other smoked products increased steeply from 1.4% (95% CI 0.85–2.0%) in 2006 to 7.1% (95% CI 6.3–7.9%) in 2011 and the prevalence of smokeless tobacco use decreased from 36.2% (95% CI 34.3–38.2%) in 2006 to 34.8% (95% CI 32.4–37.3%) in 2011 (Table 1).

Among females in Nepal, the overall use of tobacco decreased from 19.6% (95% CI 18.0–21.2%) to 13.3% (95% CI 12.7–13.9%) between 2006 and 2011. This decline is mostly attributable to a decrease in the use of manufactured cigarettes from 15.2% (95% CI 13.9–16.6%) in 2006 to 8.7% (95% CI 8.2–9.2%) in 2011 (Table 1). Use of other smoked tobacco products and of smokeless tobacco in females has remained nearly the same.

While a reduction in overall tobacco use among females (about 31%) and a small decrease in smokeless tobacco use among men (about 11%) are encouraging findings, a 500% increase in smoking of non-cigarette tobacco products among males is extremely worrisome. Also, cigarette smoking among men has not decreased, in absolute terms,; the prevalence remains substantial and therefore a major cause of public health concern.

Table 1. Tobacco use prevalence among women and men aged 15–49 years in Nepal

Year of survey	Percentage using any tobacco (95% CI)	Percentage using manufactured cigarettes (95% CI)	Percentage using other smoked tobacco (95% CI)	Percentage using smokeless tobacco (95% CI)
Women				
2006	19.6 (18.0–21.2)	15.2 (13.9–16.6)	2.0 (0.9–3.1)	5.0 (4.1–5.8)
2011	13.3 (12.7–13.9)[a]	8.7 (8.2–9.2)[a]	1.7 (1.5–1.9)	4.6 (4.2–5.0)
Men				
2006	53.4 (51.2–55.6)	30.2 (27.4–33.0)	1.4 (0.8–2.0)	36.2 (34.3–38.2)
2011	51.9 (50.4–53.4)	29.8 (28.4–31.2)	7.1 (6.3–7.9)[b]	34.8 (32.4–37.3)

[a] CI shows statistically significant decline ($P < 0.05$).

[b] CI shows statistically significant rise ($P < 0.05$).

The results of our analysis underscore the need for intensive tobacco-control efforts in Nepal, embracing with an equal emphasis on control of all tobacco products. Furthermore, there is a clear need to increase efforts that target male tobacco users in Nepal.

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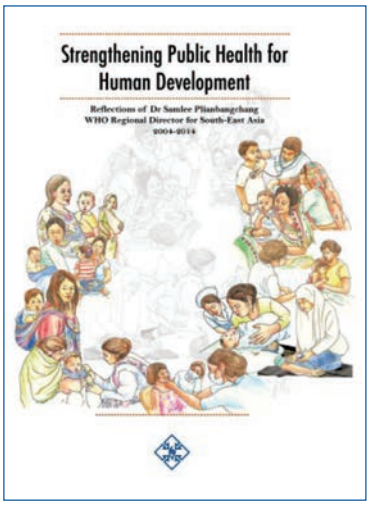

Strengthening public health for human development: reflections of Dr Samlee Plianbangchang WHO Regional Director for South-East 2004–2014

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This publication is a collaborative effort of the WHO Regional Office for South-East Asia and the Voluntary Health Association of India (VHAI). It is a contemplation of Dr Samlee Plianbangchang's work as a recognized public health professional – an outstanding health expert and an administrator. It is an endeavour to highlight his leadership and contribution in furthering the health of the people of the Region. Since 2004, Dr Samlee has campaigned for an increased collaboration among Member States through horizontal collaborations. He believes it imperative for each country to take into account the prevailing demographic, social and economic situation that looks at issues of availability and accessibility. He is a firm believer of the need to close the gaps and inequities in health by promoting conditions that promote health and self-reliance among all groups especially women and other vulnerable groups. He also believes in promoting health systems based on primary health care and a thorough understanding of social determinants of health. The WHO Regional Office for South-East Asia under the leadership of Dr Samlee has played a pro-active role as a coordinating international authority, striving to establish and maintain effective collaboration with the United Nations and other agencies.

This collection of his reflections provides his perspectives drawn from select speeches on various health concerns and is an invaluable resource to understand the principles and policies of WHO's work in the Region. It attempts to chart a roadmap for the future, placing emphasis on a comprehensive and holistic strategy towards health, through vigorous human resource development and trained public health personnel who are socially responsible for taking aggressive steps to ensure health for all.

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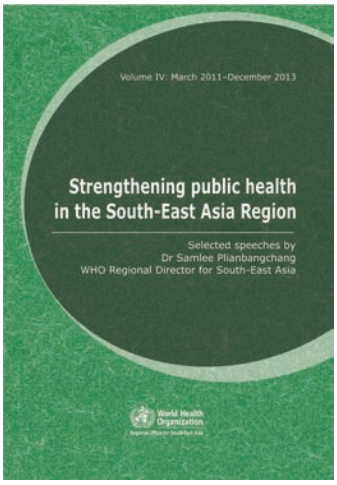

Strengthening public health in the South-East Asia Region: selected speeches by Dr Samlee Plianbangchang WHO Regional Director for South-East Asia: Volume IV: March 2011–December 2013

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This fourth volume of selected speeches by Dr Samlee Plianbangchang, WHO Regional Director for South-East Asia, covers the period from March 2011 to December 2013. The first three volumes, A vision for health development in South-

East Asia, Working towards better health in South-East Asia and Improving health in the South-East Asia Region covered the period from March 2004 to February 2011.

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