の重要性である。新しい研究成果の必要性を非難するわけでは無いが、我々は失敗からだけではなく、成功からも多くの事が学習されることを認識している。そのように容易に入手可能な情報は創造的な方法で活用されるべきであると考える。効果的な保健政策は必ずしも多くの、または良い資源を必要とはせず、既知の情報を駆使する事でより効果的に実施が可能となる。例えば、Mattke（第３章）では、感染症からNCDへの変化の第一段階は、臨床のレベルでのHIV/AIDsの治療でなければならったと記している。この様な知識はNCDキャンペーンにとって非常に貴重なものである。Mattkeの研究は、臨床や機関内の決定的な変化には、必ずしも新しい研究技術は必要では無く、むしろより良い、聡明な既存の情報の統合、セクター間の協力と管理が重要であることを示している。

管理の改善

管理の問題は明らかにNCDに取り組む保健システム再配向において、とても重要である。長期的には、特定の改善が国と地球規模の両方のレベルにおいての管理体制の改善が不可欠である。 保健セクター内の全ての代表者が責任を持ち、敏感になることで、より良い制度ができることが確実である。新興国が安全で手頃な価格の医療を提供するためには管理制度を向上する努力が必要である。現在、医薬品規制と流通が その何よりもの証拠である。本書の各章（第１章及び第２章）では、医薬品規制と流通システムにおける革新的な技術が、既存し理解されている保健システム全体や医薬品流通システム制度においても利益があることを説明している。多くの社会では、健康の主要利益は、医薬品流通システムにおける制度改革と協調制御対策に直結していると考えられるからである。

管理プログラムの中心となるのは改良された監視プログラムである。繰り返すが、この取り組みは既存の技術やグローバルヘルスで既に理解されている政策に構築することが可能である。SmithとYadav（第２章）、White-Guay (第１章)は注意してパフォーマンスの

監視することが あらゆるレベルのNCDに対する対応を向上させると説明している。健全な情報は改善された管理制度と説明責任の為の基盤を提供する。それは、管理制度と最新の政策展開を早期に展開する為に不可欠な技術となる。NCDに対する パフォーマンスの監視を するには幅広いツールが必要であり、それは地域から地球規模の全ての管理レベルで実施されることが重要である。 GBDプロジェクトは、地球規模において、グローバルヘルス政策が新しい責任を持てるよう、国レベルの研究で優先順位の設定をし、より多くのサポートを提供すると約束した。これは、 鍵となる重大な疾患負担の動向を全国区で監視する能力に大きな向上をもたらし、ミレニアム開発目標の終了後に実施される新しい目標の重要な内容となると考えられる。国家、及び地方レベルにおいては、医薬規制当局、民間団体の機関の監視をすることが大切である、地方の保健当局がコストを削減し、効率を向上させることで、より健康に良い影響を与えることができるよう約束するからである。

パフォーマンスの監視については、多くの実用的、理論的な問題は残る。しかし、最近の健康データを管理する為の技術の向上は、これらの問題解決に希望を与えている。デジタル医療記録システムの発展と数多くの医療情報を様々な情報源や保健ネットワークから合併できる能力、改善された情報管理と検索システムに加え、データを革新的な形で利用できるよう、機械学習とデータ採掘の向上、そして、コンピューター上の保健ネットワークや各個人の為の健康に関するメッセージを携帯電話やソーシャルネットワークに送れるようなソーシャルマーケティングや個人化された技術の進歩は、全て既存している保健制度を用いて 健康の質に対する個々や機関の応答の理解の障壁の理解を向上できる方法である。世界規模、地域規模、そして国家規模において、効果的、低コスト、そして公平なUHCシステムの構築には、パフォーマンスの監視は不可欠なツールである。これは、 NCDの管理において、特に必要である。

領域協力と提携

複雑化する生活習慣病の健康課題から前進する為には、領域を越えた協力や提携が必要である。国家規模から診療所規模まで、全ての保健事業や制度の再配向はHIV/AIDSとの闘いにおける成功への鍵であった。これまでの臨床的に焦点を当てた比較的狭い範囲でのヘルスケアモデルの提供から、学際的なチームを用いる事により、最新の根拠に基づいたHIV予防と治療の実施への転換が可能となった。HIV/AIDSと異なり、生活習慣病には多面的な要因や高度な医療課題がある。そのため、公衆衛生と治療目標の調和や、根拠が敏速に変様する環境に適用した最適な介入による、診療の進歩と新たな水準での実行が必要である。

これらの課題に取り組む医療政策の形成には、市民社会から広範な範囲の所望を集める必要がある。実施には、HIV/AIDSの所望を特徴付けた社会における、横断的な制約と調和が必要である。Kruk et al. (第4章) は生活習慣病の管理のためには、より敏感で、学際的なプライマリーヘルスシステムの必要性を述べている。

つまり生活習慣病の脅威は、新興国の医療制度を革命的に変える機会を与えている。現在の感染症に特化したものから、より幅広い範囲において、効率的かつ効果的な保健サービスの介入し提供することが可能になる。保健制度の改正するにあたって、関連した失敗への危険性は避けられない。この時点での失敗とは、新興国における過大なコストや不満を持った多くの患者の発生により、保健システムの破滅に繋がることを意味している。新興国においては"Leap-frog"イノベーションのような 進行中の保健制度改正にも利益に繋がるような介入が必要なことは明確である。AlleyneとNishtarが第5章で述べていた通り、従来の多部門（政府機関間の）連携などの狭い概念から離れ、より広く大きなセクターにおける市民社会、つまりは政府、民間部門、社会行為者を含めた、多部門連携によるモデルが真に効果を発揮する協力的な枠組みである。

プライマリケアの強化

この本で触れた内容において、プライマリケアよりも重要なものは存在しない。もちろん、全ての改正は究極的には生活習慣病へのプライマリケア施設の改善へと繋がるのは言うまでもない。よって、Krug、Nigenda、とKnaulが再配向の提示によるプライマリヘルスケア制度への機会に焦点を当てているのは適正である。第四章で彼らが述べた通り、プライマリケア制度は課題解決のための理想的な設定を提供することができる。これには、生活習慣病の早期診断と予防、定期的な疾患管理、保健教育、統合的な疾患管理などが挙げられる。このようなサービスは、保険制度の慢性疾患におけるコストの削減に希望を与えることができる。早期診断とプライマリケア管理の向上は、コストの削減とともに、患者の健康状態向上にも貢献すると考えられる。しかし、国民皆保険と感染症対策の再配向無しには、どのような保険制度の再配向も効果的では無い。保健経営と初期予防に着眼し、平等性と全ての人々への近接性が重要になる。先進国での研究によると、正しい監督と約束無しには、プライマリケアは必ずしも公衆衛生の向上をもたらすことは無く、不平等性の拡大に繋がる可能性さえある。プライマリケアにおける保険制度の再配向をするにあたっては制限と利益への細心の注意をはらう必要がある。それはプライマリケアが強い政府、協調、良いシステム管理を無くして万能薬に成り得ないということだ。

新たな利害関係者の視点

持続可能性と長期的な実行可能性の分野において、生活習慣病はもっとも高度な挑戦となっている（第５章参照）。改革者は、国連目標の達成への努力のために、生活習慣病における医療財政の長期的な持続可能性に常に注意しておかなければならない。Savedoff et al.は国民皆保険の達成に向かっている国々の特徴をまとめた。それは、経済成長、人口統計、最新技術、ヘルスケアにおける政治、保

健における消費パターンなどに注目している。これらの要素は、国際保健分野での指導力の困難さや、多岐にわたる優先事項、さらには、世界的な経済不安などにより複雑化している。当然、これまでの寄贈者による保健に関連した国連開発目標達成は生活習慣病への取り組みにおいて理想的ではないと思われるため、新たな国際的保健協定、ビジネスモデルが、系統的な問題や、医療の質、医療財政に関する課題を解決するために必要かもしれない。その為には利害関係者が、政府間、二国間機関、多国間機関に留まらず、民間部門や市民社会や基金なども含むべきである。これにより、国際保健コミュニティーにおける役割は、単純な、金融資源の提供や事業の実施から、戦略の相談や助言や革新的アプローチの展開、そして、糾合する力の演習へと転換する。

伝染病から生活習慣病への病気の世界的な負担の変化は、保健制度の働きや、新たな課題の提示において、非常に象徴的な転換である。これらの課題は保険制度の働きや、幅広い部門の共同体と協力、または従事する能力を革命的に変える機会への挑戦である。本書は、保険制度の再配向における今後の問題や機会を突き止め、伝染病は減少していることから、新たな健康への脅威に集中するべきだと述べている。我々は再配向は長期的に見れば、徐々に不均等ながら決定的に発達することを確信している。

本書では、先進国と新興国の生活習慣病流行に対する新たな共通の取り組み探求に対する具体的な前進方法を提供している。国際保健コミュニティーがWHOの国民皆保険の新たなアジェンダの実施へと前進し、生活習慣病の流行により持続可能性の脅威の増大に答えようとする今こそ、具体的な政策目標と実施が新たな保険制度の骨組みの明確化のために不可欠である。私たちは、それらの進歩の為に以下の４つの政策が関与すると信じている：

1. *多部門にまたがるコミットメント：*
   社会が異なれば、非感染性疾患に対して効果的に対応するという目的のもと、ステークホルダーの関わり方は、異なるパター

ンを持っていて；変化に対する抵抗には、様々なパターンが存在し；政策立案者は、複数の部門にまたがって、改革するために最強のコミットメントとして、それらのステークホルダーと関わることを必要とする。進歩の異なる段階を持つ様々な社会のために、二大政党主義と草の根支援を確実にするために、バランスの取れた漸進的な目標を設定する必要がある。先進国と途上国において、効果的な多部門間の協力は、非感染性疾患の流行に対処するための新たな制度や政策のベース作りの達成に不可欠となる。

2. *実績のモニタリングにおける改善:*
業績のモニタリングは、何が上手くいき何が上手くいかないかを理解することだけでなく、将来、保健システムが直面するとされる病気の負担を理解すること、医療財政計画に対して非感染性疾患がもたらす価格と資源の問題を管理することが、必要不可欠である。[i] 非感染性疾患にとって、業績のモニタリングとは単に疾患の終末期の状態と関連する保健サービスの負担を測るのではなく、特にプライマリヘルスケアサービスなどの中級の保健機関における非感染性疾患の定期的な管理、患者の生活の質の維持、コスト制約などにおいて成功を示すことを意味する。（私的または公的を含む）医療財政機関は、一次および二次医療施設と薬局より得られるデータを合併させる必要性を促し、処方実践と定期的な疾病管理の両方が長期的医療費と病院の利用率にいかに影響するかを理解しなければならない。業績のモニタリングは、疾患の終末期の状態の観察にとどまらず、疾患管理プロセスの効率性とコストモニタリングをすることに軸足を変えていく必要がある。データが入手可能な場所では、大規模なデータセットやデータマイニングするための最新の手法を用い、入院患者を減らすための高度なアルゴリズムを用いること、そして薬をパーソナライズするための高性能の予測モデルが打ち出されるべきである。データ分析とその結果報告はそれ自体では十分ではなく、業績のモニタリングの成功には改

善されたフィードバックの過程が必要であり、それは継続的な品質改善の過程における医学界の参画と革新的な遠隔医療とソーシャルマーケティングプロセスがあることの両方によって、個人やステークホルダーに対して、予防医学に関する調査結果を保健システムの外に報告を押し出される。このような変化は、未だデータ収集が発展途上にあり報告システムが脆弱あるいは断片的である発展途上国の保健システムにとって、とりわけ困難となる。

3. *非伝統的なセクターの医療との関わり:*
セクター間協調は、伝統的に保健セクターの境界外とされる機関や組織の関与を要求する： 企業、地域団体、宗教団体、そして労働組合は、セクター間協調において役割を果たすことができ、保健機関との独自のパートナーシップを構築することができる。 これらのパートナーシップは、ドナーとしての伝統的な役割を持ってきた保健分野でないセクターのアクターをより深いレベルで従事させる必要がある：彼らは保健に関するアジェンダの設定と実施を行い、積極的な役割を担うことができるようにしなければならない。グローバルヘルスコミュニティーは、これらの非伝統的なアクターを関与させるために、伝統的な保健セクターの外にあるイニシアチブを招集し調整すること、非感染性疾患と国民皆保険制度における議題に関する目標を統一させること、においてより強力な役割を担っていかなければならない。非感染性疾患の危険因子に対して手がけるグローバルヘルスのプログラムは、労働慣習、消費生活、交通、レジャー活動をターゲットとして、狭い保健の枠組みの外で運用される必要がある；これらの領域のすべてにおける革新的なプログラムは、これらのおかれる分野での主要なステークホルダーの積極的な協力が必要になります。それらステークホルダーの関与は、新しくコミュニティを越えた、そして徐々に国家を越えたパートナーシップを不可欠とする。

4. *プライマリーヘルスケアにおける近代化*:
これらの改革のすべてにとっても最も重要な機関は、プライマリーヘルスケアに関わる機関である。プライマリーヘルスケアは、非感染性疾患の予防と管理に最適な保健セクターの層となっており、また、患者の幸福度を上げ、コストの削減が可能となる、革新的かつ学際的なシステムのための最適なセッティングなのである（第4章を参照）。しかし、一部の国では、まだプライマリーヘルスケアの枠組みの開発の発展途上である、あるいは感染症にのみ焦点を当てたプライマリーヘルスケアのシステムを保持している状況である。プライマリーヘルスケアシステムは、患者のニーズに応えていることを確実にし、公衆衛生プログラムにおいて強力な役割を果たし、NCDの適切な管理のための資源を有し、かつ非感染性疾患の危険因子を対象とすることを可能にするために、近代化されなければならない。保健システムレベルにおける意味としては、家庭医と看護師が予防医療サービスや公衆衛生上の介入を提供するための時間と機会を確保できるように、疾病の早期診断のためのサポートを強化し、決済システムの構造化をはかることを指す；これによって、単に治療の時点での病気の症状に焦点を当てるのではなく、調整された治療プランを開発することを可能にする。前章で示したように、NCDにおけるプライマリーヘルスケアの管理に成功したモデルが幅広く存在し、最も効果的かつ適切なプライマリーヘルスケアのシステムが整っていることを保証するために、それらは国や地方の保健機関によってそのモデルを活用していくことができる。

ここで紹介するNCDの危機に関する分析は、多部門やセクター間の協力、良い統治、既存の知識の応用におけるイノベーション、そしてNCDへの挑戦を成功の鍵となる、改革されたプライマリーヘルスケアの重要性に、公正に焦点を当てている。我々は、HIV/エイズなど、既存の健康問題に対する過去の成功例から多くの教訓を得てきた。今となってグローバルヘルスコミュニティは、発展途上国

で直面した新たな問題に対し、これらの教訓を活かしていく必要がある。先に待ち受けている改革は、政策と実践において大きな変化を要するものとなる。より広いコミュニティーからの新しいステークホルダーたちは、注目を受け、関わりを持っていかなければならなく、それにはパートナーシップを構築し、維持するための新たな方法を必要とする。医療政策立案者は、これらの新たなパートナーシップ、イノベーション、およびコミュニティーへの関わりに適応することができた場合には、NCD の挑戦を、社会のすべて人へ病気の軽減を提供するための公平性、効率性、保健システムの応答性を改善する機会に変換していくことも可能にする。

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Cash-transfer programmes in developing countries

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In *The Lancet*, Laura Robertson and colleagues present research that adds to the impressive record of cash-transfer programmes.[1] In a cluster-randomised trial undertaken in difficult circumstances in Zimbabwe, Robertson and colleagues[1] show that a conditional cash transfer (CCT) programme improved the proportion of children aged 6–12 years who attend school regularly by 7·6% (95% CI 1·2–14·1) and that of children aged 0–4 years with birth certificates by 16·4% (7·8–25·0) compared with a control group. An unconditional cash transfer (UCT) programme also increased the proportion of children aged 6–12 years who attend school regularly by 7·2% (0·8–13·7), but it did not have a significant effect on birth registration (increase of 1·5%, 95% CI −7·1 to 10·1). Neither programme had a significant effect on the proportion of children aged 0–4 years with up-to-date vaccinations: 1·8% (−5·0 to 8·7) more children in the CCT group and 3·1% (−3·8 to 9·9) more in the UCT group than in the control group had complete records.[1]

Robertson and colleagues[1] have also provided a rare head-to-head comparison of UCT and CCT programmes, enabling comparison of their health and welfare effects. As with previous programmes,[2] households in the CCT group in areas where the intervention was most effective received substantial community support. The results confirm the strong role that cash-transfer programmes—both UCT and CCT—can have in poverty alleviation, but questions remain as to their effectiveness in improvement of health outcomes.[2,3] How then should such programmes be implemented, and what more needs to be known to realise their potential health benefits?

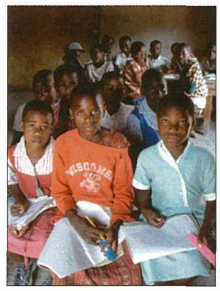
These programmes induce behavioural change in the target population through two main pathways: lowering of financial barriers to health services and raising awareness of beneficial behaviour. UCT programmes work best when supported by supply-side investment and health-system expansion. CCT programmes work best when their conditions are aligned with broad health development goals;[4,5] they might have little effect where health services have poor coverage, are high cost without risk-pooling mechanisms, or raise non-financial barriers to access.[6] CCTs also have many information-system and administrative requirements,[7] and can necessitate governance reforms and improvements in information infrastructure simultaneous with their implementation. Therefore, many low-income countries could prefer to use UCT programmes for social welfare despite the weaker evidence for their health benefits.[8] If so, other forms of

health investment might be necessary at the same time as the UCT programme to produce real health gains.

Timeframe and scope are additional considerations in design of cash-transfer programmes. With a robust level of service provision, evidence indicates that economic incentives are more effective at ensuring one-off, short-term behaviour change or processes—as with birth registration in Robertson and colleagues' study—than distal, long-term outcomes, such as mortality or morbidity reduction. The scope of cash-transfer programmes can also be highly variable in terms of the nature of supplementary interventions, level of remuneration, and strictness of conditions. Further research assessing the relation between timeframe, conditionality, and scope is necessary to maximise their effects.[9]

Additionally, cash-transfer programmes can be expensive, and, so far, none have been subject to cost-effectiveness analysis.[10] Whether they are the best use of money in resource-constrained settings is unknown, especially where they are being implemented on top of broad supply-side investments. In view of the potentially high additional cost of administrative requirements for CCT programmes compared with UCT or broad-based health-system strengthening, cost-effectiveness and ethical factors need to be taken into account.

The policy framework for these programmes is clear: their implementation should coincide with strengthening of health infrastructure, information systems, and governance to ensure effective means testing and programme delivery. The research agenda is also clear: programme assessment should include detailed cost-effectiveness studies and research that gives a deep, qualitative understanding of how and why cash transfers affect health-seeking behaviour. Understanding of how households actually expend the received cash or respond to disbursement conditions is important for design of cash-transfer programmes to better affect health outcomes. Such research could further shed light on claims that CCT programmes are a so-called magic bullet.[11] The challenge for the global health community is to support countries to ensure that these programmes are used in the right settings and to address the right problems, and are subject to the same measured and evidence-based judgments as every other intervention.



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*Stuart Gilmour, Tomohiro Hamakawa, *Kenji Shibuya*
Department of Global Health Policy (SG, KS) and Global Health Leadership Program (TH), University of Tokyo, Bunkyo-ku, Tokyo 113-0003, Japan
shibuyak@m.u-tokyo.ac.jp

We declare that we have no conflicts of interest.

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Polygenic familial hypercholesterolaemia: does it matter?

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Familial hypercholesterolaemia affects at least one in 500 people, or more than 12 million people worldwide.[1] Raised low-density lipoprotein cholesterol (LDL-C) from birth is caused by mutations in the LDL receptor gene (*LDLR*), of which over 1200 mutations have been described,[2] and less frequently by mutations in $APOB_{100}$ or *PCSK9*. If raised LDL-C is untreated, or inadequately treated, familial hypercholesterolaemia results in early and recurrent cardiovascular disease.[3]

Since the first description nearly 75 years ago,[4] diagnosis and treatment have advanced, now based on a combination of LDL-C concentrations, clinical findings, and personal and family history.[5] Drug therapy for LDL-C, often pioneered in familial hypercholesterolaemia

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COMMENTARY **Open Access**

Simple steps to equity in child survival

Stuart Gilmour and Kenji Shibuya*

Abstract

Although the number of child deaths has declined globally over the past 20 years, many countries still lag behind their millennium development goal targets, and inequity in child health remains a pernicious problem both between and within countries. Breastfeeding is a key intervention to reduce child mortality, and in an article published in *BMC Medicine,* Roberts and colleagues have shown that breastfeeding interventions can have a significant role in reducing inequity in child health. With the proper attention paid to overcoming the barriers to scaling up breastfeeding interventions, deployment of effective interventions in health facilities and the community, and improvements in support for breastfeeding interventions across society, many countries that are struggling to meet their millennium development goals could make significant gains in child survival and inequity.

Please see related research: http://www.biomedcentral.com/1741-7015/11/254/abstract.

Keywords: Breastfeeding, Child mortality, Health inequity, Interventions, Millennium development goals

Background

Significant progress has been made towards achieving Millennium Development Goal 4 (MDG 4), which pertains to reducing child mortality, but much more is still to be done [1]. Since the turn of the millennium the number of child deaths has declined significantly, from an estimated 11.6 million in 2000 to 7.2 million in 2010 [2]. However, greater efforts are required if the world is to meet the millennium development goals [2], and despite recognition of the problem, inequity in child health remains a persistent and galling issue holding back progress [3]. Although the importance of within-country inequalities has been recognized, they are difficult to eliminate. Interventions to improve accessibility and coverage of health services are often taken advantage of first and most successfully by the wealthiest segments of society [4]. Further, interventions such as cash transfers that target welfare and poverty directly may not have observable health benefits [5].

It is in this context that Roberts *et al.* show the potential for breastfeeding interventions to reduce inequity in child mortality [6]. Roberts and colleagues use available data to estimate the changes in prevalence of exclusive and partial breastfeeding in 137 developing countries, separately by wealth quintile, and show that gains in breastfeeding coverage are equal across wealth quintiles. Breastfeeding does not rely on health infrastructure, is not taken up preferentially by the wealthy, and helps to prevent diseases such as pneumonia that have higher prevalence in poorer communities [7]. Therefore, breastfeeding interventions have greater potential than others to reverse major inequalities in child mortality [8]. Breastfeeding also plays an important role in addressing both the short-term and long-term effects of malnutrition, and can have greater benefits in the poorest communities [9].

For the benefits of breastfeeding to be realized, however, rates of breastfeeding need to be high in all countries, and Roberts *et al.* present a mixed picture of success in this regard. Some countries have made remarkable progress in scaling up breastfeeding as a child health intervention since 1990: in Malawi, for example, rates of exclusive breastfeeding in the first 5 months of life have increased from 5.0% in 1990 to 49.7% in 2010, and over this time period the rates of predominant breastfeeding in some countries have doubled from a low base. However, many countries, often those with the highest rates of child mortality, have regressed during this time. In some countries, concerns about mother-to-child transmission of HIV are likely to contribute to low rates of breastfeeding [10], despite strong World Health Organization (WHO) guidelines on HIV and infant feeding practices [11]. In these countries, better understanding of the competing risks of suboptimal breastfeeding and HIV/AIDS, better adherence to WHO guidelines, and education of mothers and health

* Correspondence: shibuyak@m.u-tokyo.ac.jp
Department of Global Health Policy, Graduate School of Medicine, University of Tokyo, Hongo 7-3-1, Bunkyo-ku, Tokyo 113-0033, Japan

providers, are essential to improve breastfeeding rates in future. However, some countries with low HIV prevalence such as Afghanistan, Guyana and Indonesia have shown a reduction in exclusive breastfeeding rates over the duration of the study [6]. Understanding the barriers to breastfeeding in these countries, and identifying interventions that will work, is crucial to reducing child mortality and health inequity.

What is to be done to encourage breastfeeding in these countries? What interventions are complementary to and support breastfeeding, and what intersectoral gains need to be made to support breastfeeding interventions in those countries that are furthest from achieving MDG 4?

Interventions to support breastfeeding

The efficacy of basic interventions to promote breastfeeding is well established [12], and the benefits of an ambitious scale up of breastfeeding in developing nations potentially substantial [13]. Breastfeeding interventions can also be implemented without substantial investment in facilities and medical technology or other medical infrastructure, and offer the potential for a cheap, high coverage mechanism to elevate the health of all children, without leaving the poorest behind. However, effective interventions often involve peer education, individual counseling and prenatal and postnatal support. These are interventions that depend on the availability of a workforce that is often lacking in countries most in need of interventions to scale up breastfeeding. Furthermore, these interventions can lose their efficacy as they are scaled up and incorporated into standard health system structures [14]. As is the case with most effective community health interventions, counseling interventions administered by community health workers require sufficient remuneration, training and workplace support [15]. Such conditions do not necessarily exist in low-income countries where prenatal counseling and support is most needed, and will need to be established early in the process of expanding both breastfeeding-specific and broader maternal and child health (MCH) interventions. Without careful attention to the levels of payment, training and professional support that community health workers receive, it will be difficult to build a sustainable intervention capable of making the large-scale, prolonged and broad-based changes to breastfeeding practice necessary to achieve MDG 4.

Beyond the health sector

Breastfeeding is also a nutrition intervention with significant developmental and welfare benefits. The success of breastfeeding programs is also tied to the quality of maternal nutrition, and to the level of social support for breastfeeding. Roberts *et al.* rightly indicate the role of legislative changes and the media in encouraging and supporting breastfeeding, and this shows the important role of intersectoral collaboration in building an environment supportive of the full benefits of breastfeeding. Legislative support for public breastfeeding, family friendly workplace policies, strict standards on the content and advertising of baby foods for complementary feeding should become commonplace and acceptable community-level interventions in low-income nations.

Because breastfeeding does not rely on technology investment or extensive health infrastructure, it is also amenable to community based and grassroots initiatives to improve uptake [16], and these initiatives should be implemented and supported wherever possible. These complementary efforts have been shown to be effective at improving breastfeeding adherence in low-income nations [17], and are particularly important in settings where facility-based births are the minority [18]: typically, settings where exclusive breastfeeding is likely to have the largest effect on child mortality and inequality in infant health and development outcomes. In communities where most births occur in the home, it is not enough to have child friendly hospitals; instead, we need intersectoral development programs to build child friendly communities.

Conclusions

Roberts *et al.* have identified the powerful equity benefits of scaling up breastfeeding, and quantified its significant contribution to preventing illness and mortality in low-income and middle-income countries. With this knowledge, we can better prioritize funding and system organization both for improving child health and for reducing inequity in illness and mortality in some of the poorest countries in the world. Nonetheless, challenges to scaling up breastfeeding remain. Only through careful attention to what is known to be effective and cost-effective, coupled with strategic use of multisectoral agents and cooperation across society, can we realize the large benefits of breastfeeding's unique contribution to reducing the burden of disease and inequity in disease distribution in low-income and middle-income countries. With the deadline for the MDGs approaching and many countries still lagging on the key indicators of child health, now is the time to redouble efforts to scale up this cheap, reliable and equitable intervention, and to achieve the promise of better and more equitable health made in 2000.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

Both authors contributed to conception of the article. SG drafted the article. Both authors were involved in editing and revision of the manuscript and both agreed to its publication.

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confidence, hope, and determination. Whereas simultaneously confronting the multiple and sometimes overwhelming challenges of a comprehensive programme can lead to low coverage, low morale, and a pervasive sense of failure.

The substantial achievements of Bangladesh, against great odds, are based on a willingness to take problems one at a time and a commitment to reach everyone with the solution. If this is "vertical programming" then so be it. Examples of planned development efforts that have succeeded on this scale are not so many that we can ignore an approach that has manifestly worked.

I declare that I have no competing interests.

Jon E Rohde
jrohde@msh.org

James P Grant School of Public Health, BRAC University, Dhaka, Bangladesh

1 Chowdhury AMR, Bhuiya A, Chowhury ME, Rasheed S, Hussain Z, Chen LC. The Bangladesh paradox: exceptional health achievement despite extreme poverty. *Lancet* 2013; **382:** 1734–45.
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Health achievement in Bangladesh as described by Chowdhury and colleagues[1] has indeed been exceptional. But it is ironic that universal health coverage is portrayed as the eventual desired culmination of that progress. Whereas universal health coverage is something of a diffuse concept,[2] in practice it typically appears predominantly to mean access (coverage) to the full range of clinical, largely curative medical care. In contrast, as Chowdhury and colleagues[1] describe, Bangladesh has successfully taken a rather different course: one that emphasises prevention and non-clinical outreach, community, and social marketing approaches, prioritising such interventions as oral hydration, family planning, vitamin A supplementation, and immunisation.

Whereas medical care is important, clearly problems largely outside the medical realm but amenable to further public health approaches must remain the priority. These problems include still-rampant malnutrition, poor water and sanitation, and eventually lifestyle behaviours underlying non-communicable disease and injury. Unfortunately most people conceive of universal health coverage as universal clinical care access. Hopefully, Bangladesh will conceive of universal health coverage in a larger sense that continues to put health itself, rather than medical care, at the forefront.

I declare that I have no competing interests. The views expressed do not necessarily reflect those of USAID.

James D Shelton
jshelton@usaid.gov

USAID, Washington, DC 20523, USA

1 Chowdhury AMR, Bhuiya A, Chowhury ME, Rasheed S, Hussain Z, Chen LC. The Bangladesh paradox: exceptional health achievement despite extreme poverty. *Lancet* 2013; **382:** 1734–45.
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Chowdhury and colleagues[1] provided a remarkably positive review of Bangladesh's health systems performance and health outcomes, in which maternal and child health status improved throughout the country. The authors noted that disease burden shifted rapidly from communicable to non-communicable disease (NCD); however, they overlooked the economic burden of these illnesses and health financing performance.

Although some developments have been observed in health-care service delivery in Bangladesh, to date, the health financing system remains very poorly designed. More than two-thirds of total expenditure is privately financed through out-of-pocket payments. Households in Bangladesh are facing the highest incidence of financial catastrophe (18%) among the Asia-Pacific region and more than 12% of households are forced to adopt distress financing to pay for health care related to major communicable diseases and chronic NCDs.[2,3]

Despite these enormous challenges, the Government of Bangladesh has neither taken comprehensive action nor made any concrete future plans to adopt health insurance schemes in their health financing system.

Although Bangladesh has a similar sociodemographic profile to countries such as Vietnam and Sri Lanka, these countries' social insurance systems are now being extended and the burden of out-of-pocket payment has declined significantly since the introduction of these insurance systems,[4] whereas in Bangladesh there is no national health insurance nor is the private insurance market well developed. Only small NGO-based insurance schemes exist, and they have not reduced the burden of out-of-pocket payments.[5] Therefore, the government should give more attention to NCD management programmes and incorporate health insurance in health financing systems.

I declare that I have no competing interests.

Md Mizanur Rahman
mizanur_rub@yahoo.com

Population Science and Human Resource Development, University of Rajshahi, Rajshahi 6205, Bangladesh; and Department of Global Health Policy, University of Tokyo, Tokyo, Japan

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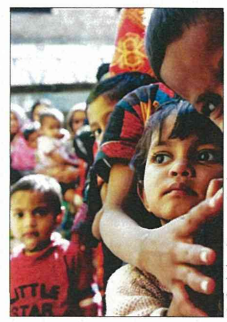
Shafiqul Alam/Demotix/Corbis

Should we use oral polio vaccine in Europe?

The eradication of polio, the ultimate goal set by WHO in 1988, has not been achieved despite massive use of oral polio vaccine (OPV). Polio is still endemic in Afghanistan, Nigeria, and Pakistan, and circulation of wild

Prevalence of diabetes and prediabetes and their risk factors among Bangladeshi adults: a nationwide survey

Shamima Akter,[a] M Mizanur Rahman,[b] Sarah Krull Abe[b] & Papia Sultana[c]

Objective To estimate the prevalence of diabetes and prediabetes in Bangladesh using national survey data and to identify risk factors.
Methods Sociodemographic and anthropometric data and data on blood pressure and blood glucose levels were obtained for 7541 adults aged 35 years or more from the biomarker sample of the 2011 Bangladesh Demographic and Health Survey (DHS), which was a nationally representative survey with a stratified, multistage, cluster sampling design. Risk factors for diabetes and prediabetes were identified using multilevel logistic regression models, with adjustment for clustering within households and communities.
Findings The overall age-adjusted prevalence of diabetes and prediabetes was 9.7% and 22.4%, respectively. Among urban residents, the age-adjusted prevalence of diabetes was 15.2% compared with 8.3% among rural residents. In total, 56.0% of diabetics were not aware they had the condition and only 39.5% were receiving treatment regularly. The likelihood of diabetes in individuals aged 55 to 59 years was almost double that in those aged 35 to 39 years. Study participants from the richest households were more likely to have diabetes than those from the poorest. In addition, the likelihood of diabetes was also significantly associated with educational level, body weight and the presence of hypertension. The prevalence of diabetes varied significantly with region of residence.
Conclusion Almost one in ten adults in Bangladesh was found to have diabetes, which has recently become a major public health issue. Urgent action is needed to counter the rise in diabetes through better detection, awareness, prevention and treatment.

Abstracts in عربي, 中文, Français, Русский and Español at the end of each article.

Introduction

Diabetes mellitus is a leading cause of death and disability worldwide.[1,2] Its global prevalence was about 8% in 2011 and is predicted to rise to 10% by 2030.[3] Nearly 80% of people with diabetes live in low- and middle-income countries.[3] Asia and the eastern Pacific region are particularly affected:[3–8] in 2011, China was home to the largest number of adults with diabetes (i.e. 90.0 million, or 9% of the population), followed by India (61.3 million, or 8% of the population) and Bangladesh (8.4 million, or 10% of the population).[3] However, many governments and public health planners remain largely unaware of the current prevalence of diabetes and prediabetes, the potential for a future rise in prevalence and the serious complications associated with the disease. Consequently, knowledge of the prevalence of diabetes and prediabetes and of related risk factors could raise awareness of the disease and lead to new policies and strategies for prevention and management.

In Bangladesh, which had a population of 149.8 million in 2011,[9] a recent meta-analysis showed that the prevalence of diabetes among adults had increased substantially, from 4% in 1995 to 2000 and 5% in 2001 to 2005 to 9% in 2006 to 2010.[5] According to the International Diabetes Federation, the prevalence will be 13% by 2030.[3] However, no nationally representative, epidemiological study of the prevalence of diabetes mellitus and its risk factors has been carried out in the country. Previous studies have been limited to specific urban or rural regions or to a single sex or had a small sample.[4,10–13] Moreover, no previous study has fully assessed the effect of individual, household and community factors on diabetes and prediabetes. The aims of this study, therefore, were to obtain a nationally representative estimate of the age-adjusted prevalence of diabetes and prediabetes in Bangladesh and to identify individual, household and community factors associated with the conditions.

Methods

The study used data from the most recent Bangladesh Demographic and Health Survey (DHS), which was carried out between July and December 2011 in collaboration with the Bangladesh National Institute of Population Research and Training. Nationally representative, probability samples of men and women were selected for interview using a two-stage, stratified cluster sample of households that included strata for rural and urban areas and for the seven administrative divisions of Bangladesh.[14] The primary sampling units, each of which contained 120 households on average, were taken from the most recent census enumeration areas. In the first stage of sampling, 600 sampling units were selected, with the probability of selection proportional to the unit size. In the second stage, 30 households were selected within each primary sampling unit by systematic random sampling. Of the 17 964 households selected using this procedure, 17 511 were eligible for inclusion in the survey. Interviews were completed successfully in 17 141 households containing a total of 83 731 household members. The overall response rate for eligible households was 97.9%.

The 2011 DHS was the first national survey in Bangladesh to incorporate the measurement of biomarkers, including blood pressure and blood glucose levels. One in three of the 17 511 eligible households was selected for biomarker

[a] Department of Epidemiology and Prevention, Clinical Research Center, National Center for Global Health and Medicine, Toyama 1-21-1, Shinjuku-ku, Tokyo 162-8655, Japan.
[b] Department of Global Health Policy, University of Tokyo, Tokyo, Japan.
[c] Department of Statistics, University of Rajshahi, Rajshahi, Bangladesh.
Correspondence to Shamima Akter (e-mail: samimarub@yahoo.com).
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measurement. This subsample included 8835 household members aged 35 years or older: 4524 men and 4311 women. After exclusion of nonresponders and individuals with missing data, the final working sample included 7541 respondents (participation rate: 89.17%). The survey received ethical approval from the Institutional Review Board of Macro International in Calverton, United States of America, and from the National Ethical Review Committees in Bangladesh. Informed consent was obtained from all subjects.

Detailed information on the sociodemographic characteristics of all participants was collected by trained staff using a standard questionnaire, which contained questions on the diagnosis and treatment of diabetes and hypertension. Each data collection team included a health technician who was trained to measure blood pressure and collect blood samples. Blood pressure, blood glucose concentration, body weight and height were assessed using standard methods, as previously described.[15] Blood pressure was measured using a LifeSource UA-767 Plus blood pressure monitor (A&D Medical, San Jose, USA), as recommended by the World Health Organization (WHO). Three measurements were taken at approximately 10-minute intervals and the respondent's blood pressure was obtained by averaging the second and third measurements. Blood glucose was measured using the HemoCue Glucose 201 Analyzer (Teleflex Medical L.P., Markham, Canada) in whole blood obtained by finger prick from capillaries in the middle or ring finger after an overnight fast – an approach that is widely used in resource-limited countries.[10,15,16] Blood glucose measurements were adjusted to obtain equivalent plasma glucose levels.[17]

Prediabetes and diabetes were defined according to WHO and American Diabetes Association criteria.[16,18] Prediabetes was defined as a fasting blood glucose level of 6.1 mmol/L to 6.9 mmol/L, without medication. Diabetes was defined as a level greater than or equal to 7.0 mmol/L or self-reported diabetes medication use. These levels have been used in previous studies in Bangladesh[15] and in other Asian countries.[19–21]

We investigated whether the following characteristics of individuals, their communities and their households were associated with the risk of diabetes or prediabetes: the respondent's age, sex, marital status, educational level, working status and body mass index; the presence of hypertension, which was defined as a systolic blood pressure ≥ 140 mmHg or a diastolic blood pressure ≥ 90 mmHg or current treatment with antihypertensive medication; rural or urban residence; region of residence; and household socioeconomic status. Household socioeconomic status was derived from the household wealth index reported in the Bangladesh DHS, which was based on the household's amenities, assets and living conditions.[22] Households were classified as belonging to a socioeconomic status quintile according to the household wealth index quintile to which they belonged.

Statistical analysis

The study was designed and reported in accordance with Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.[23] Differences in variables between individuals with diabetes and those without were assessed using a t test or χ^2 test for continuous and categorical variables, respectively. The prevalence of diabetes and prediabetes was estimated for the whole study population and for population subgroups. The age-adjusted prevalence of diabetes and prediabetes was derived using logistic regression models. Prevalence estimates took into account the complex survey design and sampling weights.

In the Bangladesh DHS data, individuals were mainly nested in households, which were nested in communities. Thus, individuals in the same household and households in the same community were strongly clustered. Multilevel models were used to compensate for the effect of clustering at individual and household levels.[24] Consequently, we assessed associations between individual, household and community characteristics and the presence or absence of diabetes and the presence or absence of prediabetes using three separate multilevel logistic regression models. The first model included only individual and household characteristics and the random intercept at the household and community level. The second model included only community characteristics and had no random intercept. The third (i.e. full) model included individual, household and community characteristics to account for clustering of individuals within households and households within communities. Imputation, based on a regression model, was used to estimate missing values from known values to account for missing data, most frequently for the body mass index (i.e. in 30.6% of respondents).[25] Age, sex and place of residence were included as covariates in the imputation. All statistical analyses were performed using Stata version 12.1 (StataCorp. LP, College Station, USA).

Results

The sociodemographic and health characteristics of individuals in the study population and details of their households and communities are presented in Table 1 (available at: http://www.who.int/bulletin/volumes/92/3/13-128371), according to whether or not they had diabetes. Individuals with diabetes were significantly older than those without, they were significantly less likely to have no formal education or to be hypertensive and they were significantly more likely to be currently working or to be overweight or obese. In addition, diabetics were more likely to come from a household with a high socio-economic status: 40.7% came from the richest quintile, whereas 12.7% came from the poorest quintile.

The unadjusted and age-adjusted prevalence of diabetes and prediabetes are presented in Table 2, according to the characteristics of individuals in the study population and their households and communities. Overall, the age-adjusted prevalence of diabetes and prediabetes was 9.7% and 22.4%, respectively, and there was no significant difference between the sexes. However, the age-adjusted prevalence of diabetes among urban residents was almost double that in rural residents: 15.2% versus 8.3%, respectively. In contrast, the age-adjusted prevalence of prediabetes was slightly lower among urban than rural residents: 19.0% versus 23.5%, respectively. Among diabetics, 56.0% were unaware they had the condition and only 39.5% were receiving treatment regularly (Fig. 1).

Table 3 shows the risk factors associated with prediabetes identified using the three multilevel logistic regression models. The fully adjusted model indicated that older age, high educational level and high body weight were significantly and positively associated with

Table 2. **Prevalence of diabetes and prediabetes in individuals aged 35 years or more, by characteristic, Bangladesh, 2011**

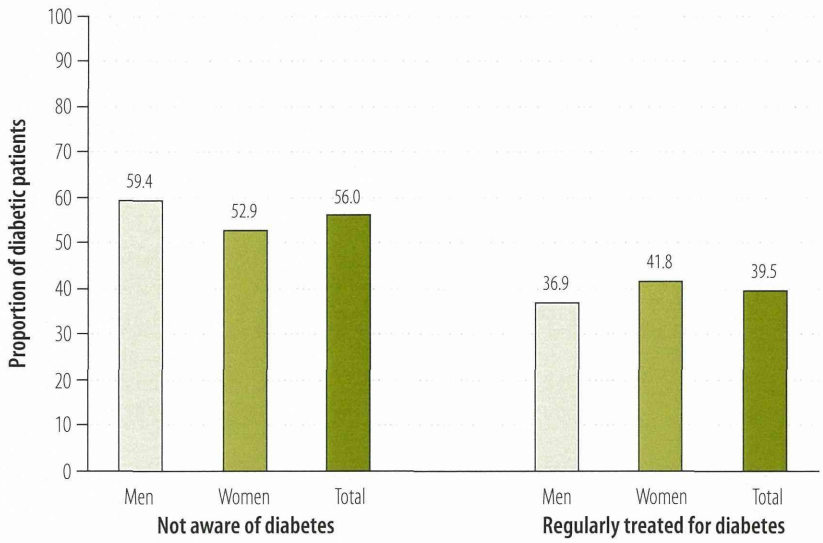
Characteristic	Diabetes prevalence, % (95% CI)		Prediabetes prevalence, % (95% CI)	
	Unadjusted	Age-adjusted	Unadjusted	Age-adjusted
Individual				
Sex				
Male	9.4 (8.3–10.5)	9.3 (8.2–10.4)	22.6 (20.6–24.6)	22.4 (20.4–24.4)
Female	10.3 (9.2–11.4)	10.4 (9.3–11.5)	22.4 (20.5–24.4)	22.5 (20.6–24.5)
Educational level				
No education	7.4 (6.3–8.4)	7.0 (6.1–8.0)	22.6 (20.6–24.9)	22.3 (20.2–24.5)
Primary education	9.9 (8.4–11.3)	10.1 (8.6–11.6)	23.2 (20.7–25.8)	23.3 (20.7–25.8)
Secondary education	12.1 (10.1–14.1)	12.8 (10.7–15.0)	21.9 (19.1–24.9)	22.2 (19.3–25.2)
Higher education	20.6 (17.3–23.9)	21.9 (18.4–25.5)	20.5 (16.6–25.0)	21.2 (16.9–25.4)
Currently working				
Yes	11.1 (9.9–12.3)	10.9 (9.8–12.1)	22.2 (20.3–24.4)	22.5 (20.4–24.5)
No	8.5 (7.5–9.6)	8.7 (7.6–9.7)	22.7 (20.7–24.8)	22.5 (20.4–24.5)
Marital status				
Currently married	9.6 (8.7–10.5)	9.7 (8.8–10.6)	22.3 (20.6–24.1)	22.5 (20.7–24.3)
Divorced, widowed or other	11.4 (9.2–13.5)	10.7 (8.6–12.7)	23.4 (20.6–26.6)	22.3 (19.2–25.3)
Hypertension				
Yes	8.0 (7.1–8.8)	8.0 (7.2–8.9)	24.0 (22.1–25.9)	17.6 (15.4–19.8)
No	15.4 (13.4–17.5)	15.1 (13.1–17.0)	18.2 (16.0–20.5)	24.2 (22.3–26.1)
Body weight				
Normal	8.8 (8.0–9.6)	8.8 (8.0–9.7)	22.3 (20.6–24.1)	22.3 (20.5–24.0)
Overweight or obese	23.5 (19.1–27.8)	22.8 (18.7–27.0)	25.2 (21.5–29.4)	25.2 (21.2–29.1)
Household				
Socioeconomic status				
Poorest	6.4 (4.8–8.0)	6.4 (4.8–8.0)	23.6 (20.2–27.3)	23.5 (20.0–27.1)
Poorer	6.3 (4.7–7.9)	6.3 (4.7–7.8)	23.8 (20.7–27.3)	23.8 (20.5–27.2)
Middle	6.3 (5.0–7.6)	6.3 (5.0–7.6)	24.5 (21.5–27.7)	24.4 (21.2–27.5)
Richer	10.4 (8.5–12.2)	10.4 (8.6–12.2)	21.2 (18.6–24.1)	21.2 (18.4–23.9)
Richest	19.2 (16.9–21.5)	19.3 (17.0–21.6)	19.6 (17.0–22.4)	19.7 (17.0–22.5)
Community				
Place of residence				
Urban	15.0 (13.0–16.9)	15.2 (13.2–17.2)	18.8 (16.4–21.5)	19.0 (16.4–21.6)
Rural	8.3 (7.4–9.2)	8.3 (7.4–9.2)	23.6 (21.6–25.7)	23.5 (21.5–25.6)
Region of residence				
Khulna division	6.4 (5.2–7.6)	6.4 (5.2–7.6)	17.0 (14.1–20.4)	17.0 (13.9–20.1)
Barisal division	11.7 (9.4–14.0)	11.6 (9.3–13.8)	29.1 (24.9–33.7)	28.9 (24.5–33.3)
Chittagong division	12.7 (10.4–14.9)	12.4 (10.3–14.7)	29.3 (25.0–34.1)	29.2 (24.7–33.8)
Dhaka division	10.1 (8.2–12.0)	10.2 (8.2–12.1)	19.5 (16.4–23.1)	19.5 (16.1–22.9)
Rajshahi division	9.9 (8.0–11.9)	10.2 (8.2–12.2)	23.7 (19.2–28.8)	23.8 (19.0–28.6)
Rangpur division	8.1 (6.0–10.2)	8.0 (6.0–10.1)	19.9 (15.7–24.9)	20.0 (15.4–24.5)
Sylhet division	10.2 (8.1–12.0)	10.0 (8.1–12.0)	27.8 (22.7–33.5)	27.8 (22.4–33.1)
Overall prevalence	9.9 (9.0–10.7)	9.7 (4.2–10.5)	22.5 (20.8–24.2)	22.4 (20.7–24.1)

CI, confidence interval.

prediabetes. The risk of prediabetes in individuals aged 60 to 69 years was 1.64 times that in younger individuals aged 35 to 39 years; in those aged 70 years or more, the risk was 1.81 times that in the younger age group. The risk in overweight or obese individuals was more than double that in normal-weight individuals. Risk also varied with region of residence: residents in the Barisal division had more than double the risk of prediabetes than those in the Khulna division.

Table 4 shows the risk factors associated with diabetes. The risk factors identified using the logistic regression model based on sociodemographic and health characteristics only were similar to those identified using the fully adjusted model. There was a positive association between older age and the risk of diabetes. The risk was significantly higher in individuals aged 45 to 49 years and in those aged 55 years or older than in younger individuals aged 35 to 39 years; for example, in those aged 55 to 59 years, the risk was about twice that in those aged 35 to 39 years. In addition, the risk of diabetes was significantly associated with a high educational level, hypertension, being overweight or obese and belonging to one of the richest households. The fully

Fig. 1. **Diabetics aged 35 years or older who are not aware of their condition and receiving regular treatment, Bangladesh, 2011**



adjusted model showed that the risk in individuals currently working was 0.72 more than in those who were not. There was a striking variation in risk among the seven administrative divisions of Bangladesh: the risk in individuals living in Barisal and Chittagong divisions was around double that of those living in the Khulna division. Moreover, the risk of diabetes was also significantly higher in individuals from the Dhaka, Rajshahi and Sylhet divisions than in those from the Khulna division.

Discussion

In this, the first, nationally representative study in Bangladesh, we estimated the prevalence of prediabetes and diabetes and quantified the effect of risk factors for these conditions associated with the characteristics of individuals and their households and communities. The findings suggest that diabetes has become epidemic among the adult population of Bangladesh: around 10% of study participants had diabetes and around 23% had prediabetes. We also found that the prevalence of prediabetes and diabetes varied substantially with the individual's age, educational level and body weight, the presence of hypertension, household socioeconomic status and region of residence.

Our study's findings are consistent with the increasing prevalence of diabetes in Bangladesh observed in a previous systematic review.[5] Similar figures have been noted recently in most Asian countries: 10% in China,[7,8] 9% in India,[3] 8% in the Islamic Republic of Iran,[26] 11% in Pakistan[6] and 8% in the Republic of Korea.[20] However, the prevalence was only 4% in Viet Nam, perhaps due to differences in climate or dietary habits.[19] We also found that the prevalence of prediabetes was slightly lower among urban than rural residents (19% versus 24%, respectively), as was observed in a study in China.[7] In contrast, the prevalence of diabetes was significantly higher among urban than rural residents (15% versus 8%, $P < 0.001$). Similar findings have been reported previously in Bangladesh (8% versus 4% in the two groups, respectively),[27] China (11% versus 8%)[7] and the Islamic Republic of Iran (18% versus 15%).[26] Diabetes may be more common among urban residents in these countries because they have a more sedentary lifestyle or different dietary habits or are more likely to be overweight or obese.[28,29]

The associations we found between diabetes and age and body weight are similar to those observed around the world. However, associations with educational level and household socioeconomic status vary internationally. The positive associations we found between these two factors and diabetes have also been observed previously in Bangladesh,[27] China[7,30] and India.[31] In contrast, another study in China found that the prevalence of diabetes was generally unaffected by educational level but was higher in the high-income group.[32] Moreover, studies from both developing and developed countries have found inverse associations between diabetes and educational level and household socioeconomic status, perhaps because the better-educated were more health-conscious.[19,33–35] However, obesity appears to be an independent risk factor for diabetes and a study from Brazil showed that better-educated and wealthier individuals were more likely to be obese.[36] Several other studies in developing countries also showed that the risk of obesity and diabetes increased with socioeconomic status.[11,37,38] In our study, the risk of diabetes was greater in individuals with hypertension than in those without, as has been reported elsewhere.[4,7,11,12] The reason for the regional variation we found in the prevalence of diabetes and prediabetes is unclear and needs further investigation.

In our study, 56% of diabetics were not aware they had the disease and only 40% were receiving treatment regularly. Similarly, the International Diabetes Federation reported recently that over 50% of people with diabetes in south Asia were unaware of their condition.[3] The epidemic of diabetes in developing countries is affecting young people and is causing disability, loss of income and early death.[1–3,39,40] Since the working-age population is especially susceptible, the economic potential of these countries could be reduced. A study in Bangladesh showed that about 12% of households either borrow money or sell household assets to pay for diabetes treatment.[41] Consequently, diabetes is not only causing serious health problems but is also placing a financial burden on households.

Although diabetes and other chronic diseases are serious public health problems in Bangladesh, they are given only a low priority by the health-care system. In particular, achieving good outcomes in individuals with diabetes in Bangladesh is hampered by: (i) the unavailability of health insurance, except in small areas of the country where it is provided by programmes run by non-governmental organizations; (ii) inadequately trained staff and limited health-care facilities in rural areas; (iii) rapid lifestyle changes caused by urbanization; and (iv) the absence of health awareness programmes in the education curriculum. The best way to ensure accessible and affordable care is by introducing universal health coverage.[42,43] Given that an epidemiological transition currently

Table 3. **Risk factors associated with prediabetes in individuals aged 35 years or more, Bangladesh, 2011**

Characteristic	Logistic regression model[a]					
	First[b]		Second[c]		Full[d]	
	OR (95% CI)	*P*	OR (95% CI)	*P*	OR (95% CI)	*P*
Individual						
Age group (years)						
35–39	1.00	NA	NA	NA	1.00	NA
40–44	1.18 (0.94–1.47)	0.16	NA	NA	1.16 (0.92–1.45)	0.21
45–49	1.27 (1.01–1.60)	0.04	NA	NA	1.27 (1.01–1.60)	0.04
50–54	1.43 (1.12–1.82)	< 0.01	NA	NA	1.39 (1.09–1.77)	0.01
55–59	1.40 (1.06–1.86)	0.02	NA	NA	1.36 (1.03–1.81)	0.03
60–69	1.69 (1.31–2.18)	< 0.01	NA	NA	1.64 (1.27–2.12)	< 0.01
≥ 70	1.84 (1.37–2.47)	< 0.01	NA	NA	1.81 (1.35–2.43)	< 0.01
Sex						
Male	1.00	NA	NA	NA	1.00	NA
Female	1.16 (0.92–1.45)	0.21	NA	NA	1.18 (0.94–1.48)	0.16
Educational level						
No education	1.00	NA	NA	NA	1.00	NA
Primary education	1.16 (0.98–1.38)	0.09	NA	NA	1.11 (0.93–1.31)	0.25
Secondary education	1.22 (0.98–1.51)	0.07	NA	NA	1.17 (0.95–1.46)	0.15
Higher education	1.51 (1.1–2.07)	0.01	NA	NA	1.49 (1.09–2.03)	0.01
Currently working						
Yes	0.93 (0.74–1.16)	0.51	NA	NA	0.98 (0.78–1.22)	0.85
No	1.00	NA	NA	NA	1.00	NA
Marital status						
Currently married	1.00	NA	NA	NA	1.00	NA
Divorced, widowed or other	0.96 (0.77–1.19)	0.70	NA	NA	0.92 (0.74–1.15)	0.48
Hypertension						
Yes	0.67 (0.57–0.8)	< 0.01	NA	NA	0.71 (0.60–0.84)	< 0.01
No	1.00	NA	NA	NA	1.00	NA
Body weight						
Normal	1.00	NA	NA	NA	1.00	NA
Overweight or obese	2.04 (1.57–2.65)	< 0.01	NA	NA	2.05 (1.58–2.67)	< 0.01
Household						
Socioeconomic status						
Poorest	1.00	NA	NA	NA	1.00	NA
Poorer	1.04 (0.82–1.32)	0.77	NA	NA	0.99 (0.78–1.25)	0.91
Middle	1.01 (0.79–1.28)	0.96	NA	NA	0.96 (0.76–1.21)	0.72
Richer	0.81 (0.64–1.03)	0.09	NA	NA	0.81 (0.64–1.04)	0.10
Richest	0.85 (0.65–1.11)	0.23	NA	NA	0.88 (0.67–1.17)	0.40
Community						
Place of residence						
Urban	NA	NA	1.00	NA	1.00	NA
Rural	NA	NA	1.20 (0.95–1.51)	0.12	1.10 (0.92–1.31)	0.31
Region of residence						
Khulna division	NA	NA	1.00	NA	1.00	NA
Barisal division	NA	NA	2.20 (1.58–3.06)	< 0.01	2.52 (1.89–3.35)	< 0.01
Chittagong division	NA	NA	2.30 (1.64–3.23)	< 0.01	2.04 (1.56–2.67)	< 0.01
Dhaka division	NA	NA	1.28 (0.93–1.77)	0.13	1.13 (0.86–1.47)	0.38
Rajshahi division	NA	NA	1.60 (1.12–2.29)	0.01	1.50 (1.14–1.97)	< 0.01
Rangpur division	NA	NA	1.23 (0.84–1.81)	0.28	1.12 (0.85–1.48)	0.43
Sylhet division	NA	NA	1.99 (1.39–2.87)	< 0.01	1.98 (1.50–2.63)	< 0.01

CI, confidence interval; NA, not applicable; OR, odds ratio.

[a] The analysis included data from 600 communities, 4162 households and 6746 household members.

[b] The first logistic regression model considered only individual and household characteristics.

[c] The second model considered only community characteristics.

[d] The full model considered individual, household and community characteristics.