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地球規模保健課題推進研究事業

途上国における健康教育教材としての
小学校教科書の役割強化に関する研究

平成23年度 総括研究年度終了報告書

平成24 (2012) 年 5 月 26 日

研究代表者 野中 大輔

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厚生労働科学研究費補助金(地球規模保健課題推進研究事業)

平成 23 年度 総括研究報告書

途上国における健康教育教材としての小学校教科書の役割強化に関する研究

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研究要旨

途上国における小・中学生用の学習教科書は、最も身近にあり、かつ信頼できる情報を提供し得る健康教育教材として重要な役割を担うことが期待されている。本研究の目的は、教科書に記載されている保健情報が疾病の予防のために重要な知識や基本的衛生技術に触れているかどうか、さらに国内外のヘルス・ポリシーや戦略に相反していないかどうかを調べ、健康教育教材としての教科書の役割強化に寄与する知見を導くことである。

本年度は、全対象国(アジア・アフリカの途上国 9 カ国)の小・中学生用の学習教科書(474 冊)について、マラリア、基本的衛生(特に土壌伝播寄生虫)、薬物乱用(特に喫煙対策)に関する解析を実施した。マラリアについては、いずれの対象国でも教科書に記載はあったが、対象国の保健戦略と教科書の記載情報との乖離・相反やマラリアに適切に対処するために必要な知識や技術がしばしば欠けていることが確認された。土壌伝播寄生虫については、3 カ国の対象国の教科書には、全く記載がなかった。記載がある国においても、土壌伝播寄生虫対策として世界保健機関が推奨する教育項目の多くが寄生虫対策と関連付けされずに記載されていた。喫煙については、世界保健機関が推奨する教育項目の多くが教科書中には欠落していることを確認した。

以上の結果から、対象国の教科書は、マラリア、土壌伝播寄生虫、および喫煙対策について、健康教育教材として十分な役割を果たしていないと考えられる。健康教育教材として教科書を強化するためには、世界保健機関や UNICEF 等の推奨する教育項目(科学的エビデンスに基づく、疾患や危険行動に対処するための知識や技術)を教科書の中に取り込む必要がある。さらに、対象国の保健戦略が保健セクターと教育セクターの間で共有され、対象国の保健戦略を反映した教科書に改訂していく努力が求められる。

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A. 研究目的

途上国においては一般に、健康に関する情報ソースの不足、全人口に占める子供の高い割合、保健人材の不足などが共通して見られる。従って、特に途上国における小・中学生用の学習教科書は、最も身近にあり、かつ信頼できる情報を提供し得る健康教育教材としても重要な役割を担うことが期待されている。しかしながら、教科書が疾病予防・健康増進に最低限必要な情報を含んでいるかどうかは、これまで調べられてこなかった。その上、先進国における教科書でさえもその記載に科学的な誤りが時に見られることが報告されているが、途上国における教科書が発信している保健情報の質は、これまで注目されてこなかった。

教科書は、途上国の学童のみならず学童の親も最もアクセスしやすい健康教育教材である。教科書における保健衛生に関する内容の質の向上は、保健指標の改善のための効率的かつ効果的な方法の一つであると考えられる。さらに、学童に対する健康教育の効果は、学童だけに留まらず学童の親や地域の人々に対しても効果が波及することが報告されている。

そこで、本研究の目的は、教科書に記載されている保健情報が疾病対策や健康増進のために必要な知識や技術に触れているかどうか、さらに国内外のヘルス・ポリシーや戦略に相反していないかどうかを調べ、健康教育教材としての教科書の役割強化に寄与する知見を導くことである。

今年度(三年目)は、マラリア、・基本的衛生(特に土壌伝播寄生虫対策)・薬物乱用(特に喫煙予防)について、抽出した教科書記述データを解析した。

B. 研究方法

対象国は、アフリカ4カ国(ベニン、ニジェール、ガーナ、ザンビア)とアジア5カ国(バングラデシュ、ネパール、スリランカ、カンボジア、ラオス)である。研究者と各国の研究協力者が、対象国の教育・保健医療行政機関の支援のもと、教科書やナショナル・ポリシー文書(マラリアと HIV/AIDS 対策)の収集を行った。

教科書選択の基準は、次の通りである。1. 小学校1年生から中学校3年生相当の学習用教科書を収集した。2. 全教科の教科書を収集した。3. 複数の種類の教科書が存在する場合は、公立学校で最も広く使われている教科書を収集した。

教科書に記載されている保健衛生に関する記述の抽出・翻訳は、各国毎に二名の研究者が担当した。抽出・翻訳作業で発生するバイアスをできるだけ排除するために、二名の研究者によるダブルチェックを行った。ガーナとザンビアの教科書を除き、教科書は現地語または仏語で記述されているので、翻訳結果は英語でまとめた。

保健衛生に関する記述は、次の6分野に焦点を置いて抽出した。1. 基本的衛生(Basic hygiene)、2. 母子保健(Maternal and child health)、3. 性感染症 (Sexually transmitted diseases and HIV/AIDS)、4. マラリア(Malaria)、5. 薬物乱用 (Substance abuse)、6. 事故予防 (Injury prevention)。分野の定義は、UNICEF を中心に国連機関によって作成されたハンドブック(Facts for Life 4th edition, available from <http://www.factsforlifeglobal.org/>)に基づいた。

本年度は、マラリア、・基本的衛生(特に土壌伝播寄生虫対策)・薬物乱用(特に喫煙予防)について、抽出した教科書記述データを解析した。

マラリアに関する解析は、第一に、教科書記述データを6種類のカテゴリー(伝達様式/ベクター、

原因／病原体、症状、治療、予防、疫学情報)に分類した。次に、Facts for Life に記載されている、一般住民が知っておくべき知識や技術の7項目について、集めた教科書が触れているかどうかを調べた。その7項目は、1) マラリアはある種の蚊による刺咬によって媒介、2) 殺虫剤処理蚊帳による蚊の刺咬予防、3) ハイリスクグループ(子供と妊婦)、4) 早期に医療施設を受診すること、5) 第一選択薬、6) 妊婦の間欠的予防の必要性、7) マラリア回復期患者の脱水・栄養失調の予防、などである。

土壌伝播寄生虫に関する解析は、第一に、教科書記述データを6種類のカテゴリー(生物学的特性、原因／感染様式、症状、治療、疫学情報)に分類した。次に、世界保健機関出版のWHO Information Series on School Health: Strengthening Interventions to Reduce Helminth Infections に掲載されている、学童が知っておくべき知識や技術の10項目が教科書に含まれているかどうかを調べた。その10項目は、1) 食事前の手洗い、2) 用便後の手洗い、3) 外遊び後の手洗い、4) 爪を清潔に保つこと、5) 指しゃぶり、6) 靴またはサンダルを履くこと、7) 農作業中の手袋着用、8) 野菜・果物の洗浄、9) トイレの使用、10) 糞便を肥料として使用しない、である。

喫煙対策に関する解析は、WHO Information Series on School Health: Tobacco use prevention に掲載されている喫煙予防教育に重要なコンポーネント(項目)が存在するかどうかを調べた。なお、世界保健機関は6項目を挙げているが、その中の1項目(ライフスキル)は特に喫煙に特化したものではないので、解析から除外した。5項目は以下の通りである。1) 喫煙の害、2) 喫煙に関する社会規範、3) 喫煙の理由、4) 喫煙の社会的影響、5) 喫煙を進められても断る技術。

(倫理面での配慮)

この研究方法は既に出版された教科書の解析であり、倫理面での問題はない。

C. 研究結果

1. マラリア

解析対象の474冊の教科書のうち、35冊(7.4%)にマラリアに関する記述が確認された。いずれの対象国においても、少なくとも1冊以上の教科書は、マラリアに触れていた。アジアの対象国では1冊または2冊の教科書しか触れていないのに対し、アフリカの各対象国では少なくとも4冊以上の教科書に記述が確認された。マラリアの教科書の記述があった教科書のほとんどは、理科または理科・生活関連の教科であったが、中には、国語や社会科などの教科書にも、マラリアに関する記述が見られた。

記述の内容では、伝達様式／ベクターに関して記述していた教科書が最も多く(n=22, 77%)、次に、予防方法(60%)、疫学情報(57%)であった(表1)。症状(37%)や治療(23%)に関する内容を提供していた教科書は少なかった。

表1. マラリアに関する教科書記載内容

記載内容	n (n=35)	%
伝達様式(ベクター)	27	77.1
予防方法	21	60.0
疫学情報	20	57.1
原因(寄生虫)	19	54.3
症状	13	37.1
治療	8	22.9
その他	8	22.9

いずれの対象国においても、教科書は伝達様式(ベクター)、原因(寄生虫)、症状、予防方法に関する内容を含んでいた。しかし、バングラデシュ、スリランカ、ザンビア、ベニンの教科書には、治療に関する記述は認められなかった。治療に関する記述があった国の教科書(n=8)においても、対象国のポリシー(Artemisinin-based combination therapy)とは異なるクロロキン等の治療薬を紹介していたり(n=4)、自己治療・受療の遅延の危険性を記述した教科書は少なかった(n=4)。

マラリアがある種の蚊の刺咬によって感染することは、全ての対象国において教科書中に触れられていた(表 2)。殺虫剤処理蚊帳の使用は、全対象国のマラリア対策ポリシーとして掲げられているものの、4 か国のみでしか教科書の中で紹介されていなかった。カンボジアの教科書のみ、Facts for Life で重視している項目のほとんどを包含していた。

表 2. 教科書中の Facts for Life7 項目の有無

	国*								
	1	2	3	4	5	6	7	8	9
伝達様式	✓	✓	✓	✓	✓	✓	✓	✓	✓
殺虫剤処理蚊帳での予防	✓	✓				✓			✓
リスクグループ			✓						
早期診断治療の必要性		✓							
推奨治療薬									✓
妊婦の間欠的予防治療		✓							
患者の脱水・栄養失調		✓							

*: 1: ラオス, 2: カンボジア, 3: バングラデシュ, 4: ネパール, 5: スリランカ, 6: ザンビア 7: ニジェール, 8: ベニン, 9: ガーナ

2. 土壌伝播寄生虫対策(基本的衛生)

解析対象の 474 冊の教科書のうち、14 冊(3.0%)

の教科書に土壌伝播寄生虫に関する記述が確認された。スリランカ、ザンビアおよびガーナの教科書には、土壌伝播寄生虫に関する記述は認められなかった。ネパールの教科書は、土壌伝播寄生虫に触れているものの、中学生用教科書ではじめて土壌伝播寄生虫に触れていた。

原因/感染様式や予防方法を記述した教科書が多く見られたが(n=10, 71.4%)、症状(42.9%)や治療(28.6%)について記述した教科書は半数以下であった(表 3)。

表 3. 土壌伝播寄生虫に関する教科書記載内容

記載内容	n (n=14)	%
生物学的特性	3	21.4
原因/感染様式	10	71.4
症状	6	42.9
治療	4	28.6
予防方法	10	71.4
疫学情報	6	42.9

次に、世界保健機関が土壌伝播寄生虫対策として学校で教育すべき内容として挙げている 10 項目が教科書に記載されているかどうかについて調べた結果を述べる(表 4)。全ての対象国において、食事前や用便後の手洗い、清潔な爪を保つこと、野菜・果物の洗浄、トイレの使用などは、教科書の中で触れられているものの、かならずしも土壌伝播寄生虫対策と関連付けて触れられていなかった。指しゃぶりと農作業中の手袋着用について触れている教科書は確認できなかった。靴・サンダルの着用は、鉤虫対策として重要であるが、4 カ国の教科書は、この点について触れていなかった。

表 4. 教科書中の土壌伝播寄生虫対策として学校で教育すべき項目の有無

	国*								
	1	2	3	4	5	6	7	8	9
食事前の手洗い	○	○	○	△	△	△	△	○	△
用便後の手洗い	○	△	○	○	△	△	△	○	△
外遊び後の手洗い	×	×	×	△	△	×	×	×	×
爪を清潔に保つ	△	×	○	△	△	△	△	△	△
指しゃぶりしない	×	×	×	×	×	×	×	×	×
靴・サンダルを履く	○	×	○	×	×	△	○	○	×
農作業中の手袋着用	×	×	×	×	×	×	×	×	×
野菜・果物の洗浄	○	△	○	△	△	△	△	○	△
トイレの使用	○	△	○	○	△	△	○	○	△
糞便を肥料としない	○	×	×	×	×	×	○	○	×

*: 1: ラオス, 2: カンボジア, 3: バングラデシュ, 4: ネパール, 5: スリランカ, 6: ザンビア 7: ニジェール, 8: ベニン, 9: ガーナ

○: 土壌伝播寄生虫対策と関連して記載

△: 寄生虫対策と関連付けないが、基本的衛生技術として記載

×: 記載なし

3. 喫煙予防対策(薬物乱用)

解析対象の 474 冊の教科書のうち、41 冊 (8.6%) の教科書に喫煙に関する記述が確認された。いずれの対象国においても、教科書は喫煙対策教育に関する内容を包含していた。

世界保健機関が学童の喫煙対策教育として学校で教育すべき内容として挙げている 5 項目が教科書に記載されているかどうかについて報告する。いずれの国においても、喫煙による健康被害は、教科書の中で強調されていた(表 5)。しかし、他の項目(喫煙の理由、喫煙による社会的影響、喫煙の誘いを断る技術)については、教科書の中で触れていない対象国が目立った。

表 5. 教科書中の喫煙予防対策として学校で教育すべき項目の有無

	国*								
	1	2	3	4	5	6	7	8	9
喫煙による健康被害	✓	✓	✓	✓	✓	✓	✓	✓	✓
喫煙に対する社会規範	✓	✓	✓	✓		✓			✓
喫煙の理由	✓						✓	✓	✓
喫煙による社会的影響	✓			✓			✓	✓	✓
喫煙の誘いを断る技術	✓			✓					

*: 1: ラオス, 2: カンボジア, 3: バングラデシュ, 4: ネパール, 5: スリランカ, 6: ザンビア 7: ニジェール, 8: ベニン, 9: ガーナ

D. 考察

1. マラリア

マラリアが流行している多くの国々では、マラリアに対処するための知識や技術を知らない人が多くいることが報告されている。また、そのような人ほど、蚊帳を使用しない・マラリアに感染しやすいことが報告されている。さらに、マラリアの症状を知らない・自己治療の危険性を知らない・早期診断治療の重要性を認識していない人ほど、医療施設への受療行動が遅れ、マラリアが重症化しやすいとも考えられている。

本研究では、いずれの対象国においてもマラリアは教科書中で触れられているものの、マラリアに対処するための知識や技術の多くは、カンボジアを除いて、対象国の教科書には記載されていないことを示した。

本研究では、マラリアに触れている教科書の半数以上に何らかのマラリア予防方法に関する記述が存在することが分かった。しかし、最も重要な予防方法であり、いずれの対象国においても国家のマラリア対策戦略として重視されている殺虫剤処理蚊帳については、半数以上の対象国において

教科書の中で触れられていなかった。

マラリア流行国の政府や援助機関が殺虫剤処理蚊帳をマラリア流行国の住民に配布しても、蚊帳が活用されないということがしばしば報告されている。住民が殺虫剤処理蚊帳を使用することの意味・利益を分かっていないことが、蚊帳が活用されない原因の一つであることがわかっている。従って、殺虫剤処理蚊帳に関する情報をカリキュラムの中に統合する(具体的には教科書に記載する)ことによって、住民による殺虫剤処理蚊帳の利用率が向上する可能性がある。我が国からもグローバルファンドや国際協力事業を通して、マラリア流行国に対して殺虫剤処理蚊帳の援助を行っている。学校教育カリキュラムの中で殺虫剤処理蚊帳の教育が追加されれば、我が国の国際援助の効果も増幅される可能性がある。

本研究では、教科書がマラリアに触れていても、治療に関する記述は最も少なく、4か国の対象国では治療に関する記述は認められなかった。ケニアやウガンダなどのマラリア流行国では、学童による危険な自己治療(不適切な薬の服用や誤った用量、重症化するまで受診しないなど)が報告されており、世界保健機関や研究者らは、マラリアに対処するための知識や技術を学校教育で教える必要性を指摘している。

治療に関する記述がある教科書でも、対象国のマラリア対策ポリシーが推奨している治療薬(artemisinin-based combination therapy)以外の治療薬(クロロキン等)や民間伝統療法を教科書が推奨しているなど、対象国のポリシー・世界保健機関の推奨治療薬と教科書内容とのギャップが認められた。artemisinin-based combination therapyが登場するまでは、一般的な熱帯熱マラリアの治療薬としてクロロキンが広く使用されていたが、現在

では多くの地域においてマラリア原虫がクロロキンに対して抵抗性を獲得していることが報告されている。クロロキンは現在でも、多くの途上国において処方箋なしに薬店などで安価な値段で購入が可能であるため、マラリア対策ポリシーが推奨していないクロロキンは教科書に記載されていることは好ましくないと考えられる。

対象国のマラリア対策ポリシーが規定する治療薬と教科書が推奨する治療薬が異なるなどのギャップが生じた理由としては、教科書の改訂があまり行われていないことや教科書を作成する教育省とマラリア対策ポリシーを策定する保健省との間の連携不足などが考えられる。

2. 土壌伝播寄生虫

全世界人口のおおよそ半分は、土壌伝播寄生虫の感染の危険性に曝されており、途上国に住む子供のおおよそ半分は、少なくとも一種類以上の土壌伝播寄生虫または住血吸虫に感染していると推定されている。回虫や鞭虫の感染は、学童期の子供に特に集中して見られるため、世界保健機関をはじめ、学童に対する土壌伝播寄生虫対策の重要性が認識されている。

しかしながら本研究では、土壌伝播寄生虫が蔓延しているガーナやザンビア、そして一部の地域でエンデミックであるスリランカにおいて、調べた教科書の中には土壌伝播寄生虫に関する記述が無いことを確認した。従って、これらの国々では、土壌伝播寄生虫について学童は教育を受けていない可能性が考えられる。

土壌伝播寄生虫に関して記載がある国においても、土壌伝播寄生虫対策として世界保健機関が学校で教えるべき項目として挙げている知識や技術の中で、指しゃぶりをしないことや外遊び後の手

洗い、農作業中の手袋の着用などは、ほとんどの対象国の教科書は触れていなかった。

土壌伝播寄生虫対策として世界保健機関が学校で教えるべき項目として挙げている知識や技術の半分以上は、教科書に記載されていた。しかしながら、しばしば土壌伝播寄生虫とは関連付けはされていなかった。このため、土壌伝播寄生虫に対処する方法を知らずに、学童は大人(親)になってしまう可能性がある。

我が国は、橋本イニシアティブのもと、国際寄生虫対策センターを設立し、東南アジア・西アフリカ・東アフリカにおける土壌伝播寄生虫対策を推進し、集団駆虫システムなどを構築した。集団駆虫の効果を上げる・維持するためには、土壌伝播寄生虫に(再)感染しないための基本的衛生技術の教育が不可欠である。今後我が国の寄生虫対策に関する貢献を維持・拡大するためにも、土壌伝播寄生虫に関する教育を学校教育カリキュラムの中に統合していく必要がある。

3. 喫煙対策

多くの開発途上国においては、喫煙開始年齢の低下や喫煙する青少年数の増加、喫煙を原因とした生活習慣病の増加が問題になっている。大人に対する禁煙指導は容易ではないので、学童をターゲットとした喫煙対策が重視されている。

本研究では、世界保健機関が喫煙対策として学校で教えるべき 5 項目のうち、全ての対象国の教科書に共通して含まれているのは、1 項目(喫煙による健康被害)しかないことを明らかにした。この項目(喫煙による健康被害)のみを強調する喫煙予防教育は古典的な方法であり、効果が低いことが分かっている。

喫煙の誘いを断る技術を紹介している対象国は、

2 か国しかなかった。一般的に、青少年が喫煙を開始する最も大きな理由は、peer pressure であることが知られている。同僚からの喫煙の誘いを断る技術は、喫煙を阻止するために最も重要なスキルであるので、教科書に包含されるべきである。

ラオス国の教科書は、世界保健機関が喫煙対策として学校で教えるべき 5 項目が包含されていたが、有機的に 5 項目が紹介されておらず、さらにブースターセッション(学年をまたいだ復習)が設けられていないため、高い教育効果は期待できないと思われる。

以上の点より、ラオス国以外の対象国における喫煙予防教育の内容は不十分であり、教育効果は高くない可能性がある。

4. その他

今後は、未だ解析を行っていない分野(性感染症、母子保健、事故予防)について、解析・論文発表を順次進めていく。

E. 結論

本年度は、マラリア、土壌伝播寄生虫対策(基本的衛生)、喫煙対策(薬物乱用)について、教科書の記載内容を解析した。マラリアについては、対象国の保健戦略と教科書の記載情報との乖離・相反や予防や治療に必要な知識や技術がしばしば欠落していることが分かった。土壌伝播寄生虫については、3 カ国の対象国の教科書には、全く記載がなかった。記載がある国においても、世界保健機関が土壌伝播寄生虫対策教育として重視している知識や技術の多くが寄生虫対策と関連付けられておらず、単なる基本的衛生技術として紹介されているにすぎなかった。喫煙については、世界保健機関が学校で教育するべきと推奨している

項目の多くが教科書中には欠落していることを確認した。

以上の点より、対象国の教科書は、マラリア、土壌伝播寄生虫、および喫煙対策について、健康教育教材として十分な役割を果たしていないと考えられる。健康教育教材として教科書を強化するためには、世界保健機関や UNICEF 等の推奨する健康教育コンポーネント(エビデンスに基づく、健康増進や疾病対処に必要な知識や技術)を教科書の中に取り込む必要がある。さらに、対象国の保健戦略が保健セクターと教育セクターの間で共有され、対象国の保健戦略を反映した教科書に改訂していく努力が求められる。

F. 健康危険情報

特になし。

G. 研究発表

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H. 知的財産権の出願・登録状況

なし

研究成果の刊行に関する一覧表

書籍

著者氏名	論文タイトル名	書籍全体の編集者名	書籍名	出版社名	出版地	出版年	ページ

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Marino Nomoto, Daisuke Nonaka, Tetsuya Mizoue, Jun Kobayashi, Masamine Jimba	Content analysis of school textbooks on health topics: A systematic review	BioScience Trends	5	61-68	2011

Content Analysis of Primary and Secondary School Textbooks Regarding Malaria Control: A Multi-Country Study

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Abstract

Background: In tropical settings, malaria education at school is potentially useful, but textbook content related to malaria education has so far received little attention. This study aimed to examine whether school textbooks contain sufficient knowledge and skills to help children in primary and lower secondary schools and their family members to cope with malaria.

Methodology/Principal Findings: This was a descriptive, cross-country study. We collected textbooks that were used by children in grades one to nine from nine countries endemic for malaria: Laos, Cambodia, Nepal, Bangladesh, Sri Lanka, Zambia, Niger, Benin, and Ghana. Two reviewers per country identified descriptions about malaria by seeking the term "malaria" or a local word that corresponds to malaria in languages other than English. The authors categorized the identified descriptions according to the content of the descriptions. Additionally, the authors examined whether the identified contents addressed life skill messages. Of a total of 474 textbooks collected, 35 contained descriptions about malaria. The most commonly included content was transmission mode/vector (77.1%), followed by preventive measures (60.0%), epidemiology (57.1%), cause/agent (54.3%), signs/symptoms (37.1%) and treatment (22.9%). Treatment-related content was not included in any textbooks from four countries and textbooks failed to recommend the use of insecticide-treated bed nets in five countries. Very few textbooks included content that facilitated prompt treatment, protection of risk groups, and use of recommended therapy.

Conclusion/Significance: Textbooks rarely included knowledge and skills that are crucial to protect schoolchildren and their families from malaria. This study identified the need for improvement to textbook contents regarding malaria.

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Introduction

In many countries with endemic malaria, the general community does not necessarily know much about the disease. For example, it has been reported that many rural community members in Nigeria, Ethiopia and Bangladesh do not know how malaria is transmitted [1–3]. Such poor knowledge is often associated with inappropriate preventive behavior among members of the local community, and consequently can lead to increased risk of infection; people who understand little about the linkage between malaria and mosquito bites were more likely not to use a bed net in Ghana, Tanzania and India [4–6]. Moreover, people who did not know about the cause of malaria were more

likely to have malaria in Tanzania and Zimbabwe [5,7]. Lack of knowledge about symptoms and treatment of malaria can cause delays in seeking health care from trained health workers who usually diagnose malaria using microscopy to detect malaria parasites or by using a rapid diagnostic test kit [8].

There are few reports that have considered how knowledge about malaria control measures changes over time within a country or how this understanding varies between countries. However, a number of studies have suggested that urban dwellers are more likely to have greater knowledge of malaria than people who reside in rural areas because they have higher levels of literacy and greater exposure to educational media [9,10].

Recently, researchers and international agencies have increasingly recognized the importance of malaria education targeted to schoolchildren [11–13]. Although the burden of malaria among children of school-going age has been largely overshadowed by the huge burden among young children, a recent review has shown that in unstable transmission settings, teenagers (10–19 years) encounter clinical episodes as often as young children, or sometimes more frequently. Globally, malaria is a common cause of death in adolescence, accounting for 7.4% of deaths from all causes [14]. Malaria also widely contributes to school absenteeism and poor academic achievement, accounting for 3–8% of all reasons for absenteeism [11,13]. Thus, schoolchildren should be educated to cope with malaria. Additionally, schoolchildren are not merely recipients of malaria education but also can be health change agents; children can convey the knowledge and skills that they acquire at school to the community, thus increasing general community awareness about malaria [14,15].

Schools have the potential to reach large portions of the population in an effective and efficient manner and play an important role in disseminating information to children and their families in rural communities where access to information via mass media, literature and the Internet is likely limited. For example, a study conducted with schoolchildren in Tanzania reported that the primary source of information about malaria was the school/teachers [16].

A number of studies have analyzed the content of textbooks used in primary and/or secondary schools to assess health education messages delivered at school [17]. However, these studies focused chiefly on sexually transmitted diseases, reproductive health and nutrition issues [17] and, to the best of our knowledge, no published data are available regarding malaria in school textbooks.

This study aimed to examine whether textbooks in malaria-endemic countries contain sufficient knowledge and skills to help schoolchildren and their family members to cope with malaria.

Methods

Textbook collection

This was a descriptive, cross-country study. We collected a total of 474 textbooks that were used for primary and lower secondary school students from nine Asian and African countries where malaria still remains a threat to the population and where the authors have established relationships with local collaborators. These countries (number of collected textbooks) were Laos (63), Cambodia (37), Nepal (69), Bangladesh (70), Sri Lanka (68), Zambia (41), Niger (57), Benin (36) and Ghana (33).

We collected information about textbooks from the education sector such as the Ministry of Education and local education department in each country. Then we obtained textbooks from bookshops, the Ministry of Education, or through organizations that are authorized by the government to distribute textbooks to schools. These textbooks covered all subjects taught in public schools from grades one to nine. As the types of textbooks used in public schools differ according to the school, the textbooks that were most commonly used were collected. Textbook collection took place between January 2009 and March 2010.

Textbook examination

In each country, two public health experts reviewed the contents of the textbooks and identified descriptions about malaria by seeking the term “malaria” or a term that corresponded to malaria in a language other than English. Non-English descriptions were translated into English. The textbooks of Ghana and Zambia, and

some textbooks for foreign language subjects were written in English. The second reviewer checked the results of the first reviewer. When there was a discrepancy between the two reviewers on identification of descriptions or translation results, they re-examined the material for a solution.

Content analysis

The authors categorized the identified descriptions of the textbooks according to the content of the descriptions. The content categories included transmission mode/vector, cause/agent, signs/symptoms, treatment, preventive measures and epidemiology.

Additionally, the authors examined whether the identified descriptions address the key messages presented in Facts for Life, which is a book published by the United Nations and designed to deliver life skills information on how to prevent child and maternal deaths, injuries and violence [18]. This book has been used elsewhere to assess health knowledge among women in rural communities [19,20]. Although there are four key messages pertaining to malaria in this book, three of these key messages were comprised of multiple sentences and were difficult to use for assessment in this study in its original form, so they were further divided into six to make a total of seven key messages.

Results

Characteristics of textbooks

Of a total of 474 textbooks, 35 (7.4%) textbooks contained descriptions about malaria. Most of these textbooks were designed for science-related subjects whereas four textbooks for language subjects also referred to malaria in Zambia and Niger (Table 1).

The number of textbooks that referred to malaria was higher in African countries than in Asian countries: one or two textbooks per country in Asian countries whereas four or more in African countries.

The grade at which malaria education was initiated varied from country to country. The descriptions about malaria first appeared in grade two textbooks in Niger and Zambia, grade four in Bangladesh, Laos, Ghana and Benin, and grade five or higher in Cambodia, Nepal and Sri Lanka.

In every country, textbooks consistently covered content regarding transmission mode/vector, cause/agent, signs/symptoms and preventive measures. However, none of the textbooks used in Bangladesh, Sri Lanka, Zambia and Benin contained treatment-related content.

Most of the textbooks (28, 80.0%) were published in the target countries and all of the textbooks used in Asian target countries (9) were published by a government body. The initial years of publication ranged from 1990 to 2009; nine textbooks have been revised after publication. Niger’s biology textbooks for grade seven and nine were the same as those of Benin (Table S1).

Characteristics of the content

Of the 35 textbooks that referred to malaria, more than half of these contained information regarding transmission mode/vector (27, 77.1%), cause/agent (19, 54.3%), preventive measure (21, 60.0%) and epidemiology (20, 57.1%). Less than half of the textbooks contained content regarding signs/symptoms (13, 37.1%) and treatment (8, 22.9%).

Although most of the textbooks that referred to malaria included information about transmission mode/vector, these textbooks did not necessarily specify anopheles mosquitoes as the vector: 14 textbooks (40.0%) mentioned that mosquitoes can transmit malaria, without specifying the anopheles mosquito,



Table 1. Subjects and grades of school textbooks containing content pertaining to malaria.

a	Content						
	Transmission mode/vector	Cause/agent	Signs/symptoms	Treatment	Preventive measures	Epidemiology	Other
1	World around us (4) Science (8)	World around us (4) Science (8)	World around us (4) Science (8)	World around us (4) Science (8)	World around us (4) Science (8)	World around us (4) Science (8)	Science (8)
2	Practical science (5) Sociology (9)	Practical science (5) Sociology (9)	Practical science (5) Sociology (9)	Practical science (5) Sociology (9)	Practical science (5) Sociology (9)	Practical science (5) Sociology (9)	
3	Science (4) Home economics (8)	Science (4)	Science (4)		Science (4) Home economics (8)		
4	Health & physical education (6)	Health & physical education (6)	Health & physical education (6)	Health & physical education (6)	Health & physical education (6)	Health & physical education (6)	
5	Health & physical education (7) Science (8)	Science (8)	Health & physical education (7)		Health & physical education (7) Science (8)	Science (8)	Science (8)
6	Social & development studies (2) Integrated science (3) Environmental science (5) Creative & technology studies (6) English (7, 9)	Integrated science (3) Environmental science (5) Creative & technology studies (6) English (9)	Creative & technology studies (6)		Social & development studies (2, 7) Environmental science (5) Integrated science (7) English (7)	Social & development studies (2, 7) Integrated science (3, 7) English (4,7) Creative & technology studies (6) Environmental science (8)	English (2) Social & development studies (7)
7	Reading & writing (2, 5) Science (5) Biology (7, 9)	Science (5) Biology (7, 9)	Science (5) Biology (9)	Reading & writing (5) Science (5)	Reading & writing (5) Science (5)	Reading & writing (2) Science (5) Biology (9)	Reading & writing (2)
8	Science (4–5) Life & earth science (7) Biology (7, 9)	Life & earth science (7) Biology (7, 9)	Science (4–5) Biology (9)		Science (4–5) Life & earth science (7)	Life & earth science (7) Biology (9)	
9	Social studies (5) Citizenship education (5) Integrated science (9)	Integrated science (8, 9)	Integrated science (9)	Integrated science (9)	Citizenship education (4,5) Integrated science (9)	Integrated science (9)	Citizenship education (4) Social studies (9) Integrated science (9)

^a: Country (1: Laos, 2: Cambodia, 3: Bangladesh, 4: Nepal, 5: Sri Lanka, 6: Zambia, 7: Niger, 8: Benin, 9: Ghana)
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whereas 13 (37.1%) mentioned the transmission mode, specifying anopheles (Table 2). Similarly, 11 textbooks (31.4%) mentioned that a parasite or germ is the cause/agent, whereas 8 (22.9%) named the cause/agent, specifying plasmodium. Whenever textbooks referred to signs/symptoms, fever was presented together with one or more other symptoms. Only 4 textbooks (11.4%) presented information about danger signs such as convulsions and unconsciousness. When textbooks referred to treatment, they often introduced therapies other than artemisinin-based combination therapy: 4 textbooks (11.4%) presented information about treatments such as quinine, chloroquine or herbal medicines, whereas only one textbook introduced artemisinin-based combination therapy. Textbooks rarely included information about the danger of inappropriate treatment (11.4%), the need to seek care from a health worker (8.6%) and need for prompt treatment (8.6%).

The most commonly included preventive measure was the use of bed nets (40.0%) and source control by environmental modification (40.0%), followed by cleaning/weeding grass in and around the house compound (34.3%) and use of mosquito coils/sprays (22.9%). Some textbooks also included epidemiological information such as morbidity and mortality due to malaria (48.6%) and the consequences/adverse effects of malaria (45.7%). Few textbooks (5.7%) presented information about risk groups such as children and pregnant women.

Assessment with Facts for Life

In every country, at least one textbook had content that corresponded to the key message that “Malaria is transmitted through the bites of some mosquitoes” (Table 3). In the four countries of Laos, Cambodia, Zambia and Ghana, textbooks contained information that indicated the meaning of the key message that “Sleeping under an insecticide-treated bed net is a way to prevent mosquito bites.” Cambodia’s textbooks addressed four other key messages of Facts for Life relating to children and pregnant women as the risk group, including the need for prompt treatment from a health worker, the need for preventive treatment during pregnancy and the need for plenty of liquid and food for children suffering or recovering from malaria. In addition, one textbook from Ghana introduced artemisinin-based combination therapy as one of the treatment choices. However, the textbook did not mention whether the treatment is recommended.

Discussion

This study showed that textbooks provided information about transmission mode/vector, cause/agent and preventive measures of malaria in every country, whereas in four countries no information was provided about treatment. Textbooks often lacked life skills information including the use of an insecticide-treated bed net (ITN), the need for prompt treatment from a health worker, the protection of children and pregnant women from malaria, the recommended therapy, and the prevention of dehydration and malnutrition due to malaria.

The findings suggest a need for improvement of school textbook content pertaining to malaria. In Kenya and Uganda, for example, children often practiced self-treatment of their malaria-like illnesses or provided their younger siblings with treatment in an inappropriate manner [21,22]. Due to such risky child behavior, researchers and international agencies have emphasized the importance of educating schoolchildren about life skills to cope with malaria, within the framework of the existing curricula [11–14,23,24].

Table 2. Details of content pertaining to malaria in textbooks.

Content	n (n = 35)	%
Transmission mode/vector		
Mosquito	14	40.0
Anopheles mosquito	13	37.1
Breeding site	9	25.7
Other	9	25.7
Cause/agent		
Plasmodium	11	31.4
Parasite/germ/poison	8	22.9
Incubation period	4	11.4
Other	2	5.7
Signs/symptoms		
Fever and other symptoms	13	37.1
Recurrent fever involving coldness and sweating	8	22.9
Danger signs	4	11.4
Treatment		
Therapy other than artemisinin-based combination therapy	4	11.4
Danger of inappropriate treatment and/or treatment delay	4	11.4
Need to seek care from health worker	3	8.6
Need for prompt treatment	3	8.6
Artemisinin-based combination therapy	1	2.9
Need to follow-up patients	1	2.9
Need for adhering to prescriptions	1	2.9
Prevention of dehydration and malnutrition	1	2.9
Preventive treatment during pregnancy	1	2.9
Other	2	5.7
Prevention		
Bed nets	14	40.0
Source control by environmental modification	14	40.0
Cleaning/weeding grass in and around house compounds	12	34.3
Mosquito coils and/or sprays	8	22.9
Source control by the use of chemicals	6	17.1
Chemo-prophylaxis	5	14.3
Source control by larvivorous fish	4	11.4
Repellents	3	8.6
Mosquito screen on windows	2	5.7
Other	5	14.3
Epidemiology		
Morbidity, mortality and characteristics of endemic regions	17	48.6
Consequence/adverse effect	16	45.7
Risk group (children and/or pregnant women)	5	14.3
Risk factor	2	5.7
Other		
Non-specific information, awareness creating message etc.	8	22.9

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Table 3. Presence of textbook content that corresponds to key messages of Facts for Life.

Key messages of Facts for Life	Country ^a								
	1	2	3	4	5	6	7	8	9
Malaria is transmitted through the bites of some mosquitoes.	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sleeping under an insecticide-treated bed net is a way to prevent mosquito bites.	✓	✓				✓			✓
Malaria is very dangerous for children and pregnant women.		✓							
Where malaria is present, a child with a fever should be examined immediately by a trained health worker.		✓							
Artemisinin-based combination therapies are recommended for treatment of <i>Plasmodium falciparum</i> malaria.									✓ ^b
Wherever malaria is common, pregnant women should prevent malaria by taking antimalarial tablets recommended by a trained health worker.		✓							
A child suffering or recovering from malaria needs plenty of liquids and food.		✓							

^a: 1: Laos, 2: Cambodia, 3: Bangladesh, 4: Nepal, 5: Sri Lanka, 6: Zambia, 7: Niger, 8: Benin, 9: Ghana.

^b: Insufficient description.

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In response to a remarkable increase in the school enrolment rate and the availability of textbooks at schools in tropical and sub-tropical countries [25], the importance of textbooks has been increasing. For example, in the nine target countries there are 35 million children that make up the primary school-age population, and potentially most of them use the textbooks that were examined in this study. Therefore, improvement to the content of school textbook could have a large impact on community knowledge and skills to fight against malaria.

Although ITNs have been adopted as a national malaria control strategy in all the target countries [26], the results here have shown that ITNs were not discussed in any textbooks in five countries. Use of an ITN is the best way to prevent mosquito bites in terms of cost-effectiveness and effectiveness in reducing morbidity and mortality [27,28]. However, a number of studies have reported that many people do not use an ITN because their benefits are poorly understood [6,29–31]. Incorporation of information regarding ITNs into textbooks has the potential to help promote their proper use in communities.

Our results showed that only one textbook in Cambodia presented information about the need for taking recommended antimalarial tablets by pregnant women; i.e., preventive treatment during pregnancy. Inclusion of information regarding preventive treatment may not be relevant in textbooks used in the Asian target countries, as preventive treatment is not recommended in such a low endemic setting [26]. Except for this point, however, all of the key messages of Facts for Life must be commonly relevant to the target countries and should be discussed in textbooks.

Our results also showed that content addressing treatment and symptoms was least likely to be included in the textbooks. Additionally, textbooks in four countries lacked treatment-related content. Generally, health education in school curricula tends to focus on biomedical knowledge and prevention, but not on actively coping with illness, as treatment practices are considered the role of medical experts [21]. However, as treatment for malaria should start within 24 hours of the onset of symptoms [32], children should be equipped with knowledge and skills to recognize symptoms of malaria and to make an appropriate treatment choice [23].

Even when textbooks contained treatment-related content, textbooks often introduced therapies other than artemisinin-based combination therapy, which has been adopted as the first line treatment for uncomplicated falciparum malaria in the target countries. This indicates the gap between therapies introduced in textbooks and national malaria control strategies. This gap might be due partly to infrequent updating of textbook information, as chloroquine which was previously the first line treatment in many countries was most commonly discussed in textbooks.

As Table S1 shows, the textbooks examined were published or revised between 1990 and 2010 (median year: 2006). In the target countries, ITNs and artemisinin-based combination therapy have been adopted as a national malaria control strategy, between 1992 and 2000 and between 2000 and 2008, respectively. Especially in the African target countries, preventive treatment during pregnancy was also adopted between 2001 and 2005 [26,33,34]. Hence, textbooks that were published or revised before these periods are likely to lack content related to these strategies. In contrast, general scientific knowledge about malaria (e.g., risk group, the need for prompt treatment and the prevention of dehydration and malnutrition as shown in Table 3) have not changed over time, and thus the absence of such information from textbooks may not be due to infrequent updating of textbooks, but possibly due to insufficient collaboration between the education and health sectors during textbook development.

As also shown in Table S1, many textbooks had not been revised frequently; 15 out of 35 textbooks had not been revised for more than five years since their publication or previous revision. Resource-rich countries can overcome infrequent updating by adopting information communication technologies. Electronic textbooks enable publishers to easily update content when content becomes out-of-date [35]. For example, more than 600 school districts in the United States have adopted an iPad program without paper textbooks [36]. Although, due to infrastructure constraints, replacing paper textbooks with electronic ones is currently unlikely to be realistic in many resource-limited countries, including those in our study, electronic textbooks or other electronic media may play an important role in the future in providing schoolchildren with up-to-date information.

In contrast to the wide gap between textbook content and most of the key messages of Facts for Life, the results showed that in every country the key message that “malaria is transmitted through the bites of some mosquitoes” was introduced in the textbooks. One concern is whether the textbook content actually translates into knowledge among children. A study conducted with primary school children in Ghana, where the present study found that textbooks included information regarding transmission mode and ITNs, reported that the participating children had a good level of knowledge; 76.2% (95% confidence interval: 67.9–84.5) of grade three to five primary school children knew how malaria is transmitted and 80.4% (72.2–87.8) knew about ITNs [15]. In contrast, 64.0% (56.7–71.2) of grade three primary school children did not know how malaria is transmitted in Zimbabwe where malaria information is taught at grade four or higher [7].

As Table 3 shows, Cambodia’s textbooks had the most complete presentation of life skills information among the defined Facts for Life, whereas textbooks in other countries failed to present most of this information. In Cambodia the School Health Policy advocates integration of life skills education on nutrition, hygiene, and disease prevention into the school curriculum [37], and the Ministry of Health is involved in curriculum development [38]. These school health efforts might be attributable to the comprehensiveness of life skills information in Cambodia’s textbooks. In Cambodia, the number of malaria cases has decreased slightly at the national level and in some parts of the country decreased remarkably, by more than 50%, between 2000 and 2010. Although the roles of village malaria workers seem to be critical [39], improved textbooks might be one of the factors associated with the decreasing malaria trends in this country.

Another clear difference between countries is that textbooks of the African target countries were more likely to refer to malaria than those of Asian target countries. This difference might reflect the higher burden of malaria in African children.

According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), primary school children are expected to learn about mosquito breeding places in lower grades, transmission, cause and prevention in middle grades and means to care for people who are sick with malaria in higher grades [24]. The results of this study indicated that in most of the studied countries malaria health education started with grade four or higher, suggesting a possible need for earlier initiation of malaria health education in the target countries.

This study focused on textbooks alone. However, textbooks are not the sole learning materials in classrooms; electronic learning media are increasingly used, particularly in resource-rich countries [36] and even in some of the resource-limited countries included in our target area, paper-based learning materials other than textbooks can sometimes be available. For example, in Laos, “Blue Box”, which is a package of health education materials including a storybook for malaria, has been developed with support from international agencies and has been made available at many primary schools. Compared to textbooks, however, the supply of such extra learning materials is more likely to be susceptible to reduced external funding in resource limited settings. Additionally, extra materials are unlikely to be sustainable if they are not integrated into the curricula [40].

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Limitations

This study has four major limitations. First, the sampling was confined to textbooks used for children up to grade nine. As there may be malaria-related content in textbooks for children in higher grades and in learning materials other than textbooks for all grades, the results of this study do not entirely reflect the malaria education programs in the target countries. Second, although two reviewers were involved in the identification of descriptions of malaria in each target country, the review was not done independently. Thus, the results of this study might be biased compared to those produced by independent reviews. Third, this study only adopted descriptions that were obviously linked with malaria. For example, general descriptions about nuisance control, maintenance of a clean environment or first-aid were not included. Therefore, the results of the present study could underestimate descriptions that are indirectly connected with malaria control. Finally, the accuracy of the information provided in textbooks was not taken into account. For example, de Irala *et al.* reported that the content of Spanish science textbook regarding sexually transmitted diseases and reproductive health sometimes provided inaccurate information [41]. Further study is necessary to assess the accuracy of content pertaining to malaria in school textbooks.

Conclusion

The textbooks examined in this study rarely addressed life skills information such as the use of ITNs, the need for prompt treatment from a health worker, protection of children and pregnant women, recommended therapy, or the prevention of dehydration and malnutrition due to malaria. This suggests that the current generation of textbooks plays a very limited role in conveying knowledge and skills that help schoolchildren and their family members cope with malaria in the countries in this study. Improving school textbook content in accordance with a national malaria control strategy could be the key challenge in malaria endemic countries to increase children’s access to life skills information.

Supporting Information

Table S1 Textbook publishers, authors, and years of publication/revision.
(DOC)

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Author Contributions

Conceived and designed the experiments: DN MJ TM JK. Performed the experiments: DN IA ACJ SS KK SEH SY. Analyzed the data: DN SY. Contributed reagents/materials/analysis tools: TM IA ACJ SS KK SEH SY. Wrote the paper: DN MJ JY.

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Table S1. Textbook publishers, authors and years of publication/revision.

Country	Textbook (Grade)	Publisher	Publisher location	Authors	Published year	Revised year
Laos	Science (8)	Ministry of Education, Laos	Vientiane, Laos	Khambounphan P, Sibounhueang P, Nanthavoung B, Khounphilaphan B, Keosada H, Silalak B, Philavong V	1997	-
	World around us (4)	Ministry of Education, Laos	Vientiane, Laos	Xaynyavong B, Wainyakoun S	2009	-
Cambodia	Practical science (5)	Ministry of Education, Youth and Sport	Phnom Penh, Cambodia	Kimsan I, Thysaron T, Sary K, Prasoeu T, Hak S, Hak K, Srong T, An SP	2000	2005
	Sociology (9)	Ministry of Education, Youth and Sport	Phnom Penh, Cambodia	Yahon C, Pao P, Kimsen B, Bunheng N, Yar K, Chutema M, Nim P, Somaly N, Neang B, Vanthany M, Sokhema T, My L	1999	-
Bangladesh	Science (4)	National Education and Textbook Board	Dhaka, Bangladesh	Ministry of Primary and Mass Education	2004	-
	Home economics (8)	National Education and Textbook Board	Dhaka, Bangladesh	Ministry of Education	1996	-
Nepal	Health and physical education (6)	Ministry of Education, Curriculum Development Center	Bhaktapur, Nepal	Maharjan RK, Shrestha HP, Serchan L, Maharjan SK, Rokaya RB	1994	2001
Sri Lanka	Health and physical education (7)	Educational Publications Department	Colombo, Sri Lanka	Pushpakumara WMNJ, Nalika WDP, Piyaseeli WAN, Abeywickram A, Senanayak S, Piyas WAN, Sugathadas S	2007	-
	Science (8)	Educational Publications	Colombo, Sri Lanka	Pushpakumara WMNJ, Nanayankara EFD, Nalika	2008	-