From: **Malaria Journal Editorial Office** <em@editorialmanager.com>
Date: Wed, 16 Jan 2019 at 22:35
Subject: Confirmation of revised submission to Malaria Journal - MALJ-D-18-00607R1
To: Hamzah Hasyim <hamzah.hasyim@gmail.com>

MALJ-D-18-00607R1
Social Determinants of Malaria in an Endemic Area of Indonesia
Hamzah Hasyim, PhD candidate; Pat Dale, Professor, PhD; David A. Groneberg, Professor. Dr. Dr.; Ulrich Kuch, Dr; Ruth Müller, Professor Dr. rer. nat.
Malaria Journal

Dear Mr. Hasyim,

Thank you for the revised version of your manuscript 'Social Determinants of Malaria in an Endemic Area of Indonesia' submitted to Malaria Journal.

You may check the status of your manuscript at any time by accessing the journal's website.

Your username is: Hamzah

If you forgot your password, you can click the 'Send Login Details' link on the EM Login page at https://www.editorialmanager.com/malj/.

We will inform you of the Editor's decision as soon as possible.

Best wishes,

Editorial Office
Malaria Journal
https://malariajournal.biomedcentral.com/

MALJ-D-18-00607_R1.pdf
3395K

Gmail Hamzah Hasyim <hamzah.hasyim@gmail.com>

Your PDF for your Malaria Journal submission has been created

6 messages

Malaria Journal Editorial Office <em@editorialmanager.com> 16 January 2019 at 19:23
Reply-To: Malaria Journal Editorial Office <magesh.murugappan@springer.com>
To: Hamzah Hasyim <hamzah.hasyim@gmail.com>

Social Determinants of Malaria in an Endemic Area of Indonesia
Hamzah Hasyim, PhD candidate; Pat Dale, Professor; David A. Groneberg, Professor. Dr. Dr.; Ulrich Kuch, Dr; Ruth Müller, Professor Dr. rer. nat.
Malaria Journal

Dear Mr. Hasyim,

The PDF for your submission is ready for viewing.

Please return to the main menu to approve and complete your submission. This can be accessed by log onto the journal's website.

Your username is: Hamzah

If you forgot your password, you can click the 'Send Login Details' link on the EM Login page at https://www.editorialmanager.com/malj/.

Best wishes,

Editorial Office
Malaria Journal
https://malariajournal.biomedcentral.com/

Malaria Journal Editorial Office <em@editorialmanager.com> 16 January 2019 at 19:23
Reply-To: Malaria Journal Editorial Office <magesh.murugappan@springer.com>
To: Hamzah Hasyim <hamzah.hasyim@stud.uni-frankfurt.de>

[Quoted text hidden]

Hamzah Hasyim <hamzah.hasyim@gmail.com> 16 January 2019 at 19:32
To: Ruth Müller <Ruth.Mueller@med.uni-frankfurt.de>

Dear Dr Ruth,

Kindly see final revision of our manuscript before I approved it. I look forward to hearing back from you about the next stage of the process.

Gmail Hamzah Hasyim <hamzah.hasyim@gmail.com>

Reminder: your revision for Malaria Journal is due soon - MALJ-D-18-00607R1

8 messages

Malaria Journal Editorial Office <em@editorialmanager.com> 10 March 2019 at 16:38
Reply-To: Malaria Journal Editorial Office <parthiban.gurusamy@springernature.com>
To: Hamzah Hasyim <hamzah.hasyim@gmail.com>

MALJ-D-18-00607R1
Social Determinants of Malaria in an Endemic Area of Indonesia
Hamzah Hasyim, PhD candidate; Pat Dale, Professor, PhD; David A. Groneberg, Professor. Dr. Dr.; Ulrich Kuch, Dr; Ruth Müller, Professor Dr. rer. nat.
Malaria Journal

Dear Mr. Hasyim,

When checking our records, we noticed that the revised version of your manuscript MALJ-D-18-00607R1 is due soon on 13 Mar 2019.

If you are ready to submit, please access the manuscript by log onto the journal's website.

Your username is: Hamzah

If you forgot your password, you can click the 'Send Login Details' link on the EM Login page at https://www.editorialmanager.com/MALJ/.

We are looking forward to receiving your revision.

Best wishes,

Editorial Office
Malaria Journal
https://malariajournal.biomedcentral.com/

Recipients of this email are registered users within the Editorial Manager database for this journal. We will keep your information on file to use in the process of submitting, evaluating and publishing a manuscript. For more information on how we use your personal details please see our privacy policy at https://www.springernature.com/production-privacy-policy. If you no longer wish to receive messages from this journal or you have questions regarding database management, please contact the Publication Office at the link below.

_____
In compliance with data protection regulations, you may request that we remove your personal registration details at any time. (Use the following URL: https://www.editorialmanager.com/MALJ/login.asp?a=r) Please contact the publication office if you have any questions.

Malaria Journal Editorial Office <em@editorialmanager.com> 10 March 2019 at 16:38
Reply-To: Malaria Journal Editorial Office <parthiban.gurusamy@springernature.com>
To: Hamzah Hasyim <hamzah.hasyim@stud.uni-frankfurt.de>

[Quoted text hidden]

Hamzah Hasyim <hamzah.hasyim@gmail.com> 10 March 2019 at 20:45
To: Malaria Journal Editorial Office <parthiban.gurusamy@springernature.com>

Dear Journal Editorial Office,

Gmail Hamzah Hasyim <hamzah.hasyim@gmail.com>

Confirmation of revised submission to Malaria Journal - MALJ-D-18-00607R2

3 messages

Malaria Journal Editorial Office <em@editorialmanager.com> 13 March 2019 at 23:22
Reply-To: Malaria Journal Editorial Office <parthiban.gurusamy@springernature.com>
To: Hamzah Hasyim <hamzah.hasyim@gmail.com>

MALJ-D-18-00607R2
Social Determinants of Malaria in an Endemic Area of Indonesia
Hamzah Hasyim, PhD candidate; Pat Dale, Professor, PhD; David A. Groneberg, Professor. Dr. Dr.; Ulrich Kuch, Dr; Ruth Müller, Professor Dr. rer. nat.
Malaria Journal

Dear Mr. Hasyim,

Thank you for the revised version of your manuscript 'Social Determinants of Malaria in an Endemic Area of Indonesia' submitted to Malaria Journal.

You may check the status of your manuscript at any time by accessing the journal's website.

Your username is: Hamzah

If you forgot your password, you can click the 'Send Login Details' link on the EM Login page at https://www.editorialmanager.com/malj/.

We will inform you of the Editor's decision as soon as possible.

Best wishes,

Editorial Office
Malaria Journal
https://malariajournal.biomedcentral.com/

Recipients of this email are registered users within the Editorial Manager database for this journal. We will keep your information on file to use in the process of submitting, evaluating and publishing a manuscript. For more information on how we use your personal details please see our privacy policy at https://www.springernature.com/production-privacy-policy. If you no longer wish to receive messages from this journal or you have questions regarding database management, please contact the Publication Office at the link below.

_____
In compliance with data protection regulations, you may request that we remove your personal registration details at any time. (Use the following URL: https://www.editorialmanager.com/malj/login.asp?a=r) Please contact the publication office if you have any questions.

Malaria Journal Editorial Office <em@editorialmanager.com> 13 March 2019 at 23:22
Reply-To: Malaria Journal Editorial Office <parthiban.gurusamy@springernature.com>
To: Hamzah Hasyim <hamzah.hasyim@stud.uni-frankfurt.de>

[Quoted text hidden]

Hamzah Hasyim <hamzah.hasyim@gmail.com> 13 March 2019 at 23:48
To: Parthiban Gurusamy <parthiban.gurusamy@springer.com>
Cc: Hamzah Hasyim <hamzah.hasyim@stud.uni-frankfurt.de>

Gmail Hamzah Hasyim <hamzah.hasyim@gmail.com>

Proofs for your article in MALARIA JOURNAL (2760) [First Reminder]

2 messages

Hamzah Hasyim <hamzah.hasyim@gmail.com> 8 April 2019 at 09:41
To: Professor Pat Dale <p.dale@griffith.edu.au>

Dear Prof Pat,

Thank you for your feedback. Fyi, we have obtained another message from Springer Correction Team. Would you please look "the Author Query Form" that consists of query AQ1 to AQ4. Please feel free to access the details required of the form as an attached.

In AQ2, may we change of the symbol “**” reflected inside table 1 to the symbol “a” and the symbol “b” respectively? Some of the articles use of the symbol “*”, and “**” to describe significance level p-value < 0.05 and 0.01 respectively, isn't it?

We ensure that we have filled out our response to the queries raised in the form, and return this form along with our corrections. If you agreed with the "author query form" that I have made previously, we would submit our corrections online, via e-mail that also insert our corrections in the proof PDF and email the annotated PDF.

Please find attached the file that we discussed and please feel free to review the document.

I am grateful for the positive learning environment you provided me and I appreciate your help.

Have a safe flight

Sincerely

Hamzah

---------- Forwarded message ---------
From: <bmc_corrections@springer.com>
Date: Fri, 5 Apr 2019 at 08:43
Subject: Proofs for your article in MALARIA JOURNAL (2760) [First Reminder]
To: <hamzah.hasyim@stud.uni-frankfurt.de>

Dear Author,

The message below was sent to you more than 48 hours ago but we have not yet received your corrections.
Please return your proof as soon as possible so as not to delay the publication of your article.

Yours sincerely,
Springer Corrections Team

PS: This is an auto reminder generated 48 hours after you have received proofs for corrections. Keeping in mind the global time difference, you may receive reminders even after you have sent in your corrections. If you already have sent us the necessary corrections, kindly ignore this email.

SOCIAL DETERMINANTS OF MALARIA IN AN ENDEMIC AREA OF INDONESIA
Article DOI: 10.1186/s12936-019-2760-8

Dear Author,

We are pleased to inform you that your paper is nearing publication. Your article proofs are available at:

https://eproofing.springer.com/journals_v2/index.php?token=S9OxcJJvSLRpXmMx6-a1HIV3M_k3GWEHFX52TW66BkWp6EWtxJGfxZ_CP_0lpUMe

The URL is valid only until your paper is published online. It is for proof purposes only and may not be used by third parties.

We hope you are pleased with the publication. You can help us facilitate quick and accurate publication by using our e.Proofing system. The system will show you an HTML version of the article that you can correct online. In addition, you can view/download a PDF version for your reference.

Please submit your corrections within 2 working days and make sure you fill out your response to any AUTHOR QUERIES raised during typesetting. Without your response to these queries, we may not be able to continue with the processing of your article for Online Publication.

Should you encounter difficulties with the proofs, please contact me.

Thank you very much.

Sincerely yours,

Springer Correction Team

No. 6&7, 5th Street, Radhakrishnan Salai,
Mylapore, Chennai, Tamilnadu
India, Pincode 600 004
e-mail: bmc_corrections@springer.com
Fax: +917305880700 (INDIA)

---------- Forwarded message ---------
From: **Patricia Dale** <p.dale@griffith.edu.au>
Date: Mon, 8 Apr 2019 at 08:48
Subject: Re: Proofs for your article in Malaria Journal (2760).
To: Hamzah Hasyim <hamzah.hasyim@gmail.com>

HI Hamzah
Still at airport but have read the pdf proofing file. I have not changed anything.

I have NOT compared it to the original but have read it to see if it reads well. When in doubt I have gone to the original to check.
2 minor things, although the text change would be good if allowed

!. “Riskedas’ is in italics at the start but not later...do you want it to be changed? It was not in italics in the paper submitted

2. Lines 259-261 do not read well but are the same as submitted, so the journal may not want to change. It would be better as shown below: (that would not cause much change in line layout etc so the journal might allow it)

ORIGINAL:

"...Sarawak, Malaysia, malaria infection was associated in male than a female with seven-fold risk to be malaria-infected [21]. "

SUGGESTED CHANGE:

'...Sarawak, Malaysia, malaria infection was greater in males than females, with seven-fold risk of malaria-infection [21]'

Hope that helps

Pat

Emeritus Professor Pat Dale
School of Environment and Science,
Environmental Futures Research Institute,
Griffith University,
Nathan,
Queensland, Australia 4111
Email: p.dale@griffith.edu.au

From: Hamzah Hasyim <hamzah.hasyim@gmail.com>
Sent: Friday, 5 April 2019 12:08:22 PM
To: Patricia Dale
Subject: Fwd: Proofs for your article in Malaria Journal (2760).

Dear Prof Pat,

I am pleased to inform you that we have received a message from Springer Nature Corrections Team, please see below.

Would you please look the link for our article proofs and rectify my feedback as author's response. I have filled the form in offline and created some revision documents to fix it. Please kindly find the attached file.

Thanks for taking the time to proofs our script.

With gratitude,

Hamzah.

.
---------- Forwarded message ---------
From: <bmc_corrections@springer.com>
Date: Wed, 3 Apr 2019 at 18:46
Subject: Proofs for your article in Malaria Journal (2760)
To: <hamzah.hasyim@stud.uni-frankfurt.de>

SPRINGER NATURE

Article Title : Social determinants of malaria in an endemic area of Indonesia
DOI : 10.1186/s12936-019-2760-8
MALJ-D-18-00607.2

Dear Author,

We are pleased to inform you that your paper is nearing publication. Your article proofs are available at:

https://eproofing.springer.com/journals_v2/index.php?token=S9OxcJJvSLRpXmMx6-a1HIV3M_k3GWEHFX52TW66BkWp6EWtxJGfxZ_CP_0lpUMe

The URL is valid only until your paper is published online. It is for proof purposes only and may not be used by third parties. You may share the link with co-authors, but please ensure only one person edits at a time to avoid changes being lost

You can help us facilitate quick and accurate publication by using our e.Proofing system. The system will show you an HTML version of the article that you can correct online. In addition, you can view/download a PDF version for your reference.

As you are reviewing the proofs, please keep in mind the following:

- This is the only set of proofs you will see prior to publication.
- Only errors introduced during production process or that directly compromise the scientific integrity of the paper may be corrected.
- Any changes that contradict journal style will not be made.
- Any changes to scientific content (including figures) will require editorial review and approval.

Please check the author/editor names very carefully to ensure correct spelling, correct sequence of given and family names and that the given and family names have been correctly designated (NB the family name is highlighted in blue).

Please submit your corrections within 2 working days and make sure you fill out your response to any AUTHOR QUERIES raised during typesetting. Without your response to these queries, we will not be able to continue with the processing of your article for Online Publication.

Should you encounter difficulties with the proofs, please contact me.

Thank you very much.

Sincerely yours,

Springer Nature Corrections Team

No. 6&7, 5th Street, Radhakrishnan Salai,
Mylapore, Chennai, Tamilnadu
India, Pincode 600 004
e-mail: bmc_corrections@springer.com
Fax: +91 73 0588 0700 (or) +91 44 4219 7763

6 attachments

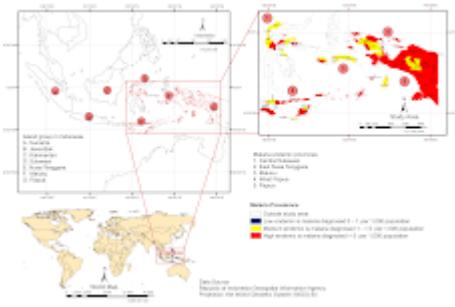


Fig 1..png
1213K

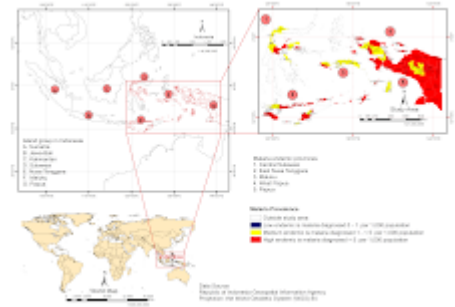


Fig - Revision.png
1236K

Author Query Form.docx

19K

table 1 - Rev.docx
31K

12936_2019_2760_MOESM1_ESM - Rev.docx
28K

12936_2019_2760_Author.pdf
1524K

Patricia Dale <p.dale@griffith.edu.au> 8 April 2019 at 09:56
To: Hamzah Hasyim <hamzah.hasyim@gmail.com>

HI Hamzah
I did see your response to AQ 1-4 in your first message. They looked OK.
If that has not changed then I do not need to look at again
All best
Pat

Emeritus Professor Pat Dale
School of Environment and Science,
Environmental Futures Research Institute,
Griffith University,
Nathan,
Queensland, Australia 4111
Email: p.dale@griffith.edu.au

From: Hamzah Hasyim <hamzah.hasyim@gmail.com>
Sent: Monday, 8 April 2019 12:41:40 PM
To: Patricia Dale
[Quoted text hidden]

[Quoted text hidden]

Gmail Hamzah Hasyim <hamzah.hasyim@gmail.com>

Yet to receive your corrections for the article 10.1186/s12936-019-2760-8

9 messages

Shine David Santhamma Albert <ShineDavidSA@springer.com> 8 April 2019 at 17:33
To: "hamzah.hasyim@stud.uni-frankfurt.de" <hamzah.hasyim@stud.uni-frankfurt.de>
Cc: Joseph Harrison <Joseph.Harrison@springernature.com>, "hamzah@fkm.unsri.ac.id" <hamzah@fkm.unsri.ac.id>

Dear Author,

We are the typesetters of your above-mentioned article. Currently we are waiting for your corrections or approval for the proofs sent to you. We are in doubt if the e-mail concerning the proof has reached your mailbox; maybe a spam filter has blocked it. Hence, we have attached the uncorrected PDF for your reference. Please go through the proof and send us your approval or corrections by email (ShineDavid.SanthammaAlbert@springernature.com).

Please treat this email as high-priority and send us your response today.

It would be very kind if you could in advance confirm the receipt of this message.

Many thanks for your help and support.

Kind regards

Dr. S. A. Shine David

Springer Correction Team

No. 6&7, 5th Street, Radhakrishnan Salai,

Mylapore, Chennai, Tamilnadu

India, Pincode 600 004

e-mail: ShineDavid.SanthammaAlbert@springernature.com

Fax: +91-7305880700 (India)

3 attachments

12936_2019_2760_Author.pdf
1524K

12936_2019_2760_MOESM1_ESM.docx
29K

12936_2019_2760_MOESM2_ESM.docx
22K

Hamzah Hasyim <hamzah.hasyim@gmail.com> 8 April 2019 at 17:58
To: "Prof. Dr. Prof. Dr. rer. nat. Ruth Müller" <Ruth.Mueller@med.uni-frankfurt.de>, "Dr. Ulrich Kuch" <kuch@med.uni-frankfurt.de>
Cc: "Prof. Dr. Prof. Dr. rer. nat. Ruth Müller" <rmuller@itg.be>, "Dr. Ulrich Kuch" <thananomics@t-online.de>

Dear Dr Ruth and Dr Ulrich,

Please allow me to submit the revision of our paper due to we have obtained the email again from Springer Correction Team.

Please find attached the file that we discussed in a pdf file and an image file. I am grateful for the positive learning environment you provided me and I appreciate your help.

Sincerely yours,

Hamzah
[Quoted text hidden]

8 attachments

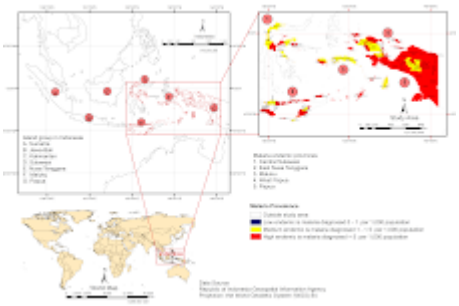


Fig 1..png
1213K

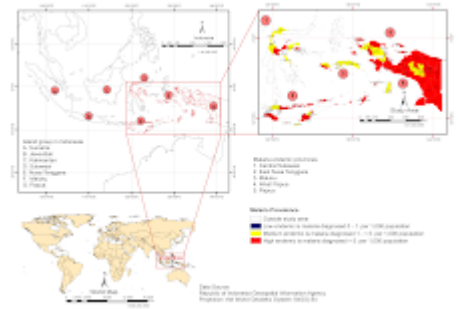


Fig - Revision.png
1236K

12936_2019_2760_Author.pdf
1524K

12936_2019_2760_MOESM1_ESM.docx
29K

12936_2019_2760_MOESM2_ESM.docx
22K

Author Query Form.pdf
100K

table 1 - Rev.pdf
160K

12936_2019_2760_MOESM1_ESM - Rev.pdf
101K

Ruth Müller <rmuller@itg.be> 8 April 2019 at 18:37
To: Hamzah Hasyim <hamzah.hasyim@gmail.com>, "Prof. Dr. Prof. Dr. rer. nat. Ruth Müller" <Ruth.Mueller@med.uni-frankfurt.de>, "Dr. Ulrich Kuch" <kuch@med.uni-frankfurt.de>
Cc: "Dr. Ulrich Kuch" <thananomics@t-online.de>

I will work on this in the next hours.

[Quoted text hidden]

Hamzah Hasyim <hamzah.hasyim@gmail.com> 8 April 2019 at 19:13
To: Shine David Santhamma Albert <ShineDavidSA@springer.com>
Cc: "hamzah.hasyim@stud.uni-frankfurt.de" <hamzah.hasyim@stud.uni-frankfurt.de>, Joseph Harrison <Joseph.Harrison@springernature.com>, "hamzah@fkm.unsri.ac.id" <hamzah@fkm.unsri.ac.id>

Dear Dr S. A. Shine David,
Springer Correction Team

I am sorry for my delay in responding. Thanks for reminding me. I have made a revision of the paper (MALJ-D-18-00607R2) and sent to others who act as equivalent co-senior authors a few days ago. However, I am still waiting for their final revision right now. I will bring you up to date as soon as I finish my task.

Please find attached the draft file that you're requested in a pdf file and an image file. However, another coauthor still improves it. Kindly advise me about your view for the draft that I made in my side currently.

Please let me know if you have any questions or need additional information.

Sincerely yours,

Hamzah

[Quoted text hidden]

---

5 attachments

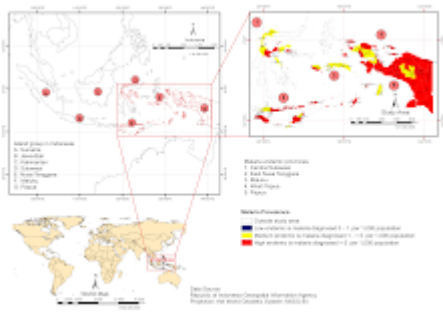
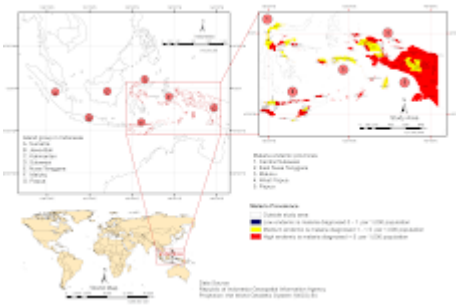


Fig - Revision.png
1236K

Fig 1..png
1213K



Author Query Form.pdf
100K

table 1 - Rev.pdf
160K

12936_2019_2760_MOESM1_ESM - Rev.pdf
101K

Hamzah Hasyim <hamzah.hasyim@gmail.com> 8 April 2019 at 19:19
To: Ruth Müller <rmuller@itg.be>
Cc: "Prof. Dr. Prof. Dr. rer. nat. Ruth Müller" <Ruth.Mueller@med.uni-frankfurt.de>, "Dr. Ulrich Kuch" <kuch@med.uni-frankfurt.de>, "Dr. Ulrich Kuch" <thananomics@t-online.de>

Dear Dr Ruth,

Thank you for your kind feedback about the revision of our paper. I'm waiting for the next step.

Sincerely,

Hamzah
[Quoted text hidden]

Ruth Müller <ruth.mueller@med.uni-frankfurt.de> 8 April 2019 at 22:31
Reply-To: ruth.mueller@med.uni-frankfurt.de
To: Hamzah Hasyim <hamzah.hasyim@gmail.com>, "Dr. Ulrich Kuch" <kuch@med.uni-frankfurt.de>

Dear Hamzah,

please find attached my corrections in the manuscript and proof letter.

Please submit.

Great work!

Best,

Ruth

Am 08.04.2019 um 12:58 schrieb Hamzah Hasyim:
[Quoted text hidden]

---

2 attachments

12936_2019_2760_Author-RM.pdf
1533K

Author Query Form-RM.pdf
98K

Hamzah Hasyim <hamzah.hasyim@gmail.com> 8 April 2019 at 22:49
To: "Prof. Dr. Prof. Dr. rer. nat. Ruth Müller" <ruth.mueller@med.uni-frankfurt.de>
Cc: "Dr. Ulrich Kuch" <kuch@med.uni-frankfurt.de>

Sehr geehrte Frau Dr Müller,

Danke für ihre Hilfe und Unterstützung

Mit freundlichen Grüßen,

Hamzah
bit.ly/weM38G
Bitte denken Sie an die Umwelt, bevor Sie diese e-Mail ausdrucken

[Quoted text hidden]

Hamzah Hasyim <hamzah.hasyim@gmail.com> 8 April 2019 at 23:17
To: Shine David Santhamma Albert <ShineDavidSA@springer.com>
Cc: "hamzah.hasyim@stud.uni-frankfurt.de" <hamzah.hasyim@stud.uni-frankfurt.de>, Joseph Harrison <Joseph.Harrison@springernature.com>, bmc_corrections@springer.com, Hamzah Hasyim <hamzah@fkm.unsri.ac.id>

Dear
Dr S. A. Shine David
Springer Correction Team,

Kindly see an attached a final revision of our paper both in clean and track changes in pdf file version. Would you please help me rectify it in the last article?

Besides, I have been sent some of the related attachment files, previously.

Thank you for having taken your time to provide us with your valuable feedback

Hopefully, our current paper will be published soon.

Sincerely yours,

Hamzah

On Mon, 8 Apr 2019 at 19:13, Hamzah Hasyim <hamzah.hasyim@gmail.com> wrote:

> Dear Dr S. A. Shine David,
> Springer Correction Team
>
> I am sorry for my delay in responding. Thanks for reminding me. I have made a revision of the paper (MALJ-D-18-00607R2) and sent to others who act as equivalent co-senior authors a few days ago. However, I am still waiting for their final revision right now. I will bring you up to date as soon as I finish my task.
>
> Please find attached the draft file that you're requested in a pdf file and an image file. However, another co-author still improves it. Kindly advise me about your view for the draft that I made in my side currently.
>
> Please let me know if you have any questions or need additional information.
>
> Sincerely yours,
>
> Hamzah

[Quoted text hidden]

3 attachments

Final Author Query Form.docx
19K

Track changes_12936_2019_2760_Author-RM.pdf
1533K

Track changes_Author Query Form-RM.pdf
98K

Ruth Müller <ruth.mueller@med.uni-frankfurt.de> 10 April 2019 at 01:35
Reply-To: ruth.mueller@med.uni-frankfurt.de
To: Hamzah Hasyim <hamzah.hasyim@gmail.com>
Cc: "Dr. Ulrich Kuch" <kuch@med.uni-frankfurt.de>

Lieber Hamzah,

ein Sprichwort heißt bei uns: Was lange währt, wird gut.

Das ist zwar nicht immer der Fall, aber bei dir schon.

Mit besten Grüßen,

Ruth

[Quoted text hidden]

Journal:	**12936**
Article:	**2760**

Author Query Form

Please ensure you fill out your response to the queries raised below and return this form along with your corrections

Dear Author

During the process of typesetting your article, the following queries have arisen. Please check your typeset proof carefully against the queries listed below and mark the necessary changes either directly on the proof/online grid or in the 'Author's response' area provided below

Query	Details Required	Author's Response
AQ1	Author details: Kindly check and confirm the processed corresponding affiliation for author "Hamzah Hasyim" was appropriate.	Yes, corresponding affiliation for author "Hamzah Hasyim" is appropriate right now.
AQ2	Figure: The image of Figure 1 seems to be truncated in the manuscript and author submitted package. Please provide the missing part of the figure.	We have changed label orientation left and right of the data frame properties. So, it shows the whole part of the figure. Kindly see the revision of Fig 1.
AQ3	Table: Please specify the significance of the symbol "**" reflected inside Table 1 by providing a description in the form of a table footnote. Otherwise, kindly amend if deemed necessary.	the symbol [a] 95% CI of percentage in univariate analysis [b] 95% CI of percentage in bivariate analysis. Kindly see the revision of table 1.
AQ4	Additional file: Additional files 1 and 2 was received; however, no citation was provided in the manuscript. Please check and confirm the inserted citation. Otherwise, kindly advise us on how to proceed. Please note that additional files should be cited in ascending numerical order in the main body of the text.	Referencing and citation styles have been created as "APA 6th" that additional files have been cited in ascending numerical order in the main body of the text. Kindly see the revision of Appendix S1.

Date:	01 Apr 2019
To:	"Hamzah Hasyim" hamzah@fkm.unsri.ac.id;hamzah.hasyim@stud.uni-frankfurt.de;hamzah.hasyim@gmail.com;hamzah_hasyim@fkm.unsri.id
From:	"Malaria Journal Editorial Office" parthiban.gurusamy@springernature.com
Subject:	Decision has been reached on your submission to Malaria Journal - MALJ-D-18-00607R2

MALJ-D-18-00607R2
Social determinants of malaria in an endemic area of Indonesia
Hamzah Hasyim, PhD candidate; Pat Dale, Professor, PhD; David A. Groneberg, Professor. Dr. Dr.; Ulrich Kuch, Dr; Ruth Müller, Professor Dr. rer. nat.
Malaria Journal

Dear Mr. Hasyim,

I am pleased to inform you that your manuscript "Social determinants of malaria in an endemic area of Indonesia" (MALJ-D-18-00607R2) has been accepted for publication in
Malaria Journal.

Before publication, our production team will check the format of your manuscript to ensure that it conforms to the standards of the journal. They will be in touch shortly to request any necessary changes, or to confirm that none are needed.

Any final comments from our reviewers or editors can be found, below. Please quote your manuscript number, MALJ-D-18-00607R2, when inquiring about this submission.

We look forward to publishing your manuscript and I do hope you will consider Malaria Journal again in the future.

Best wishes,

Marcel Hommel, MD, PhD
Malaria Journal
https://malariajournal.biomedcentral.com/

****

** Visit the Springer Nature Editorial and Publishing website at www.springernature.com/editorial-and-publishing-jobs for more information about our career opportunities. If you have any questions please email editorial.publishing.jobs@springernature.com. **

Appendix S1: Detailed explanation of the scope of variables and analytical method.

Scope of variables

Data handling. Data were processed with Stata software as follows: For the dependent variable (malaria), healthy participants (no malaria) were coded 0 and participants who had malaria were coded 1. Likewise, for the independent variables, a “small” code was given to describe a variable as “good condition” or a “group that is not at risk”. Reference was coded as 0. Stata automatically treated the lowest code in the comparison group as a reference category. These data were collected from questionnaire *RKD 2013.*

Malaria prevalence. In this view, "having malaria" was defined as participants who had ever been recognised as having malaria by health workers. Malaria was characterised as "malaria" or "no malaria" as a binary variable. Health surveyors using a standardised questionnaire collected the data by retrospective assessment. Healthcare professionals asked the participants whether they had ever had a diagnosis of a particular disease (D: Diagnosis). The participants who said that they never had any disease diagnosed were further investigated as to whether they used to/presently experienced certain clinical symptoms of such disease (G: Symptoms). The disease of interest was malaria. Prevalence was measured for one year or less. In the present study, the sample size was 130,585 participants who lived in five out of Indonesia's 33 provinces in 2013. Malaria prevalence in 2013 was 6.0 %. The five provinces with the highest malaria prevalence are: Central Sulawesi, East Nusa Tenggara, Maluku, Papua, and West Papua Provinces (Figure 1).

The characteristics of participants

Gender distinctions were divided into male and female and were taken from questionnaire *b4k4*. The age of the participants was recorded in years; if the age was <1 year "00" was filled in and if the age was ≥97 years "97" was recorded. Age categories were set up and coded as follows: (0) "0 – 4 years"; (1) "5 – 14 years"; (2) "15 – 24 years"; (3) "25 – 34 years"; (4) "35 – 44 years; (5) "45 – 54 years"; (6) "55 – 64 years"; (7) "65 – 74 years"; (8) "more than 75 years ". These data were taken from questionnaire *b4k7*. Education in this paper was defined as the highest level of education attained by participants. Upon completion of high school education, participants were considered as higher educated and coded = 0. Participants who had not completed high school education were seen as low educated and given a code = 1, and, if the respondent was <10 years, the code = 2. These data were collected from questionnaire *b4k8*. For further analysis, the variable 'age of participants' was coded as binary dummy variables with a code = 0 for participants more than five years of age as referent category, and code 1 for less than five years of age. Similarly, for education a code = 0 was given for participants who were considered as higher educated as a referent and a code = 1 was given for others. The primary occupation of participants was taken from questionnaire *b4k9*, and the researcher divided this variable into two groups. If the respondents were not working they were given a code = 0 and if the respondents were working the code = 1.

The behaviour of the participants. From questionnaire *b4k12*, the use of mosquito nets was categorised as follows: If participants slept under mosquito nets at night, these were given a code = 0. If participants did not use mosquito nets, then these were given a code = 1. From questionnaire *b4k13*, the variable of insecticide-treated nets (ITNs) was examined. Those participants sleeping under ITNs to prevent malaria were given a code = 0, while those who did not use ITNs were given a code = 1, and those who did not answer this question were given a code = 2.

Knowledge of health services. Healthcare service access described in the Riskesdas 2013 refers to the knowledge of households about the healthcare facilities nearest to their residence. In this situation, healthcare workers asked the participants about the accessibility and utilisation of healthcare facilities such as a public hospital or government hospitals; private hospitals; primary healthcare centres (puskesmas/pustu); clinics or doctor practices; midwife practices or maternity hospitals; and integrated health posts (posyandu). The participants were also asked regarding village health posts (poskesdes), village maternity clinics (polindes). From the questionnaire, those participants who knew of the availability of the health facilities were given a code = 0, and those who did not know of the availability of the health facilities were given a code = 1. The questionnaire *b5r2k1* shows the availability of government hospitals and *b5r2k1* indicates the availability of private hospitals. Information on primary healthcare centres was obtained from questionnaire *b5r3k1*, information on clinics/practices from *b5r4k1*, and that on midwife practices or maternity hospitals from *b5r5k*. Data about health facilities such as integrated health posts, rural health posts, rural clinics, and traditional health services were obtained from questionnaire *b5r6k1*, *b5r7k1*, *b5r8k1*, and *b6cr1*, respectively. For advanced analysis, participants knowing of the availability of health services were further classified using binary dummy variables with a code = 0 for participants who knew about the availability of certain health facilities and 1 for those who did not know about such health facilities.

The kind of health care facilities and health services in Indonesia such as a public hospital or government hospitals; private hospitals; primary health care centres (puskesmas/pustu); clinics or doctor practices; midwife practices or maternity hospitals or maternity hospitals; and integrated health posts (posyandu), village health posts (poskesdes), village maternity, and village clinics (polindes) in generally. (Heywood & Harahap, 2009; Mahendradhata et al., 2017)

Environmental sanitation. Environmental sanitation included information on the primary source of water, distance to drinking water, and wastewater disposal. According to questionnaire *b8r1a*, participants who had improved drinking water were given the code = 0, and those who did not the code = 1.

The questionnaire variable *b8r1a* consist of the main clean water supply of household. This variable categorised improved when the participants use water taps, buying water from water taps, drilled well pump, well water sheltered, the water spring protected, and rainwater storage. Contrarily, the variable categorised unimproved for who use well water is not protected, the water spring is not protected, and water from the river, lake, and irrigation.

According to questionnaire *b8r3c*, participants who had an improved primary source of water were given a code = 0, and a code = 1 if it was not improved. The questionnaire variable *b8r3c* consist of the drinking water storage. This variable categorised improved when the participants drinking water storage from the dispenser, kettle, thermos, and jerry cans, kind of earthenware jug and bucket, covered pans. In another way; the variable categorised unimproved for who drinking water storage from the bucket, and open pans.

The same categories were coded for participants who responded to drinking water needs in questionnaire *b8r6a*. The questionnaire *b8r6a* is the distance which needed to drinking water needs. This variable categorised improved for participants who get drinking water where the location of the drinking water in the house, the distance to get drinking water needs is less than or equal to 100 meters. Differently, this variable categorised unimproved for participants who get drinking water where the range of drinking water between 101-1,000 meters and more than 1,000 meters. Wastewater disposal was for those participants who managed domestic wastewater disposal from water taps, kitchens, and bathing areas in questionnaire *b8r10*. Further, for bivariate and multivariable analysis, the environmental sanitation variable was composited into binary dummy variables with a code = 0 for participants whose environmental sanitation was improved and a code = 1 for those with unimproved

environmental sanitation. Similar codes were given for the variable of settlement or housing condition of the participants of the study.

Behaviour to prevent mosquito bites. These independent variables were selected from questionnaire *b8r14*. According to questionnaire *b8r14a*, if participants slept using mosquito nets they were coded = 0, and if not, = 1. The same categories were coded for participants who used mosquito coils, and/or electric mosquito repellents in questionnaire *b8r14b*. Similar coding was used for participants who covered ventilation holes with anti-mosquito nets in questionnaire *b8r14c*; participants who used mosquito repellent to avoid mosquito bites in questionnaire *b8r14d*; participants who used spray with mosquito insecticide in questionnaire *b8r14e*; participants seeking anti-malarial drugs for malaria prevention when staying in a malaria endemic area in questionnaire *b8r14f*. Furthermore, behaviours preventing mosquito bites were composited into binary dummy variables with a code = 0 for participants who took prevention measures, and a code = 1 for those who had not.

Housing condition. Questionnaires *b9r4*, *b9r5*, and *b9r6* regarding “the widest type of tile”, “the widest type of wall”, and “the widest type of ceiling”, respectively, describe conditions of houses inhabited by the participants. Participants who had the kind of housing conditions considered "improved”, were given the code = 0 and the others were given the code = 1.

In this study, the settlement or housing condition is a composite of variables: floors, walls, and ceiling which categorised improved and unimproved. Improved flooring is categorised who those use the kind of the widest floor of housekeeping with ceramics, tiles, marble, and cement floor. Contrarily, unimproved flooring who use the widest floor with cement plastering cracked, boards, bamboo, wicker bamboo, and rattan, and soil. Further, improved wall who those use the kind of the wall of housekeeping with stonewall panels and wood, board, and or plywood. On the contrary, unimproved wall who use the widest wall with

bamboo, zinc wall. Also, the variable improved ceiling categorised who use the kind of the widest ceiling of housekeeping with concrete and gypsum. Conversely, an unimproved wall categorised for participants who use the kind of the widest ceiling of housekeeping: asbestos and GRC board wood and or plywood, woven bamboo or nothing. The criteria environmental health of material houses are based on joint monitoring programme WHO-UNICEF in Riskesdas 2013.

Details of data analysis

Data were analysed using the statistical data processing applications by Stata taking into account the complex sampling design (David W. Hosmer, 2013). Data included the proportion of participants with malaria, the characteristics of participants, the behaviour of participants, the accessibility and utilisation of health services, environmental sanitation, mosquito bite prevention measures, and housing conditions. These data were analysed using Stata 14. In univariate analysis we used the command "svy: tabulate" for one-way tabulations for complex survey data. The primary characteristic is that “svy: tabulate” computes a standard of independence that is useful for complex survey data. Parameter confidence intervals and standard errors can optionally be displayed for weighted counts or row, cell, or column proportions. Furthermore, the 95% CI for proportions are set up using a logit transform so that their endpoints always lie between 0 and 1.

Social data analysis commonly uses multivariable regression. In multivariable regression, explanatory variables do not come into the regression simultaneously but step by step according to p-value. The variable which has the largest *p-value* is the first to be removed from the model. The model was retested again to evaluate the effect of the deletion of one variable which had a p-value > 0.05, and it was found to have no confounding effect. As a rule of thumb, if the regression coefficient from the simple regression model changes by more

than 10%, then an independent (predictor or explanatory) variable is said to be a confounder. Simple logistic regression analysis refers to the regression application with one dichotomous outcome that is malaria prevalence and one independent variable. At this stage, we show crude odds ratios (OR) with 95% CI. In bivariate analysis, some of the variables with a p-value > 0.05 were still inserted into the multivariable model but only when these variables were considered substantially necessary. Multiple logistic regression analysis applies when there is a single dichotomous outcome and more than one independent variable. It will be referred to as "multivariable analysis". At this stage the adjusted odds ratio (AOR) in 95% CI is shown. In the multivariable analysis, we selected only variables with a p-value < 0.05 as presented in table 2.

In multiple regression situations, scientists are affected by working out the "strongest" predictors in the analysis. Logistic regression requires a categorical dependent variable. By-passing bivariate logistic regressions, independent variables that may have predictive value for the dependent variable were selected for the multiple regression models (Wald test, $\boldsymbol{P} < 0.25$) (Bursac, Gauss, Williams, & Hosmer, 2008).

References

Bursac, Z., Gauss, C. H., Williams, D. K., & Hosmer, D. W. (2008). Purposeful selection of variables in logistic regression. *Source Code for Biology and Medicine*, *3*(1), 17. doi:10.1186/1751-0473-3-17

David W. Hosmer, J. S. L., Rodney X. Sturdivant. (2013). *Applied Logistic Regression, Third Edition*: Wiley Series in Probability and Statistics.

Heywood, P., & Harahap, N. P. (2009). Health facilities at the district level in Indonesia. *Australia and New Zealand Health Policy*, *6*(1), 13.

Mahendradhata, Y., Trisnantoro, L., Listyadewi, S., Soewondo, P., Marthias, T., Harimurti, P., & Prawira, J. (2017). The Republic of Indonesia health system review.

Springer

Dear Author,

Here are the proofs of your article.

- You can submit your corrections **online**, via **e-mail** or by **fax**.
- For **online** submission please insert your corrections in the online correction form. Always indicate the line number to which the correction refers.
- You can also insert your corrections in the proof PDF and **email** the annotated PDF.
- For fax submission, please ensure that your corrections are clearly legible. Use a fine black pen and write the correction in the margin, not too close to the edge of the page.
- Remember to note the **journal title**, **article number**, and **your name** when sending your response via e-mail or fax.
- **Check** the metadata sheet to make sure that the header information, especially author names and the corresponding affiliations are correctly shown.
- **Check** the questions that may have arisen during copy editing and insert your answers/ corrections.
- **Check** that the text is complete and that all figures, tables and their legends are included. Also check the accuracy of special characters, equations, and electronic supplementary material if applicable. If necessary refer to the *Edited manuscript*.
- The publication of inaccurate data such as dosages and units can have serious consequences. Please take particular care that all such details are correct.
- Please **do not** make changes that involve only matters of style. We have generally introduced forms that follow the journal's style.
  Substantial changes in content, e.g., new results, corrected values, title and authorship are not allowed without the approval of the responsible editor. In such a case, please contact the Editorial Office and return his/her consent together with the proof.
- If we do not receive your corrections **within 48 hours**, we will send you a reminder.
- Your article will be published **Online First** approximately one week after receipt of your corrected proofs. This is the **official first publication** citable with the DOI. **Further changes are, therefore, not possible.**

Metadata of the article that will be visualized in OnlineFirst

ArticleTitle	Social determinants of malaria in an endemic area of Indonesia	
Article Sub-Title		
Article CopyRight	The Author(s) (This will be the copyright line in the final PDF)	
Journal Name	Malaria Journal	
Corresponding Author	Family Name	**Hasyim**
	Particle	
	Given Name	**Hamzah**
	Suffix	
	Division	Institute for Occupational Medicine, Social Medicine and Environmental Medicine, Faculty of Medicine
	Organization	Goethe University
	Address	Frankfurt Am Main, Germany
	Division	Faculty of Public Health
	Organization	Sriwijaya University
	Address	Indralaya, South Sumatra, Indonesia
	Phone	+49 (0) 69 6301 6650
	Fax	
	Email	hamzah.hasyim@stud.uni-frankfurt.de; hamzah@fkm.unsri.ac.id
	URL	
	ORCID	http://orcid.org/0000-0002-2780-8902
Author	Family Name	**Dale**
	Particle	
	Given Name	**Pat**
	Suffix	
	Division	Environmental Futures Research Institute (EFRI), School of Environment & Science
	Organization	Griffith University
	Address	Nathan, QLD, Australia
	Phone	
	Fax	
	Email	
	URL	
	ORCID	
Author	Family Name	**Groneberg**
	Particle	
	Given Name	**David A.**
	Suffix	
	Division	Institute for Occupational Medicine, Social Medicine and Environmental Medicine, Faculty of Medicine
	Organization	Goethe University

	Address	Frankfurt Am Main, Germany
	Phone	
	Fax	
	Email	
	URL	
	ORCID	
Author	Family Name	**Kuch**
	Particle	
	Given Name	**Ulrich**
	Suffix	
	Division	Institute for Occupational Medicine, Social Medicine and Environmental Medicine, Faculty of Medicine
	Organization	Goethe University
	Address	Frankfurt Am Main, Germany
	Phone	
	Fax	
	Email	
	URL	
	ORCID	
Author	Family Name	**Müller**
	Particle	
	Given Name	**Ruth**
	Suffix	
	Division	Institute for Occupational Medicine, Social Medicine and Environmental Medicine, Faculty of Medicine
	Organization	Goethe University
	Address	Frankfurt Am Main, Germany
	Division	Unit of Medical Entomology
	Organization	Institute of Tropical Medicine
	Address	2000, Antwerp, Belgium
	Phone	
	Fax	
	Email	
	URL	
	ORCID	

Schedule	Received	16 November 2018
	Revised	
	Accepted	1 April 2019

Abstract

Background:
Malaria is an increasing concern in Indonesia. Socio-demographic factors were found to strongly influence malaria prevalence. This research aimed to explore the associations between socio-demographic factors and malaria prevalence in Indonesia.
Methods:
The study used a cross-sectional design and analysed relationships among the explanatory variables of malaria prevalence in five endemic provinces using multivariable logistic regression.
Results:
The analysis of baseline socio-demographic data revealed the following independent risk variables related to malaria prevalence: gender, age, occupation, knowledge of the availability of healthcare services,

measures taken to protect from mosquito bites, and housing condition of study participants. Multivariable analysis showed that participants who were unaware of the availability of health facilities were 4.2 times more likely to have malaria than those who were aware of the health facilities (adjusted odds ratio = 4.18; 95% CI 1.52–11.45; $P = 0.005$).
Conclusions:
Factors that can be managed and would favour malaria elimination include a range of prevention behaviours at the individual level and using the networks at the community level of primary healthcare centres. This study suggests that improving the availability of a variety of health facilities in endemic areas, information about their services, and access to these is essential.

Keywords (separated by '-') Multivariable analysis - Malaria prevalence - Social health determinants - Social epidemiology - Community health services

Footnote Information **Electronic supplementary material** The online version of this article (https://doi.org/10.1186/s12936-019-2760-8) contains supplementary material, which is available to authorized users.
Ulrich Kuch and Ruth Müller act as equivalent co-senior authors

Malaria Journal

RESEARCH Open Access

Social determinants of malaria in an endemic area of Indonesia

Hamzah Hasyim[1,2*], Pat Dale[3], David A. Groneberg[1], Ulrich Kuch[1†] and Ruth Müller[1,4†]

Abstract

Background: Malaria is an increasing concern in Indonesia. Socio-demographic factors were found to strongly influence malaria prevalence. This research aimed to explore the associations between socio-demographic factors and malaria prevalence in Indonesia.

Methods: The study used a cross-sectional design and analysed relationships among the explanatory variables of malaria prevalence in five endemic provinces using multivariable logistic regression.

Results: The analysis of baseline socio-demographic data revealed the following independent risk variables related to malaria prevalence: gender, age, occupation, knowledge of the availability of healthcare services, measures taken to protect from mosquito bites, and housing condition of study participants. Multivariable analysis showed that participants who were unaware of the availability of health facilities were 4.2 times more likely to have malaria than those who were aware of the health facilities (adjusted odds ratio = 4.18; 95% CI 1.52–11.45; $P = 0.005$).

Conclusions: Factors that can be managed and would favour malaria elimination include a range of prevention behaviours at the individual level and using the networks at the community level of primary healthcare centres. This study suggests that improving the availability of a variety of health facilities in endemic areas, information about their services, and access to these is essential.

Keywords: Multivariable analysis, Malaria prevalence, Social health determinants, Social epidemiology, Community health services

Background

Malaria is a significant public health problem especially in developing countries including Indonesia [1]. Research has shown an enhanced interest in the social aspects of the epidemiology of malaria prevalence [2]. Socio-demographic, environmental, economic, cultural and behavioural factors determine the frequency, severity and outcome of malaria infection [3, 4]. Based on the Indonesian basic health research (*Riskesdas*) the prevalence of malaria in 2013 was 6.0%. The distribution of the disease is focussed on eastern Indonesia [5, 6]. Of 497 districts/municipalities of Indonesia, 54% are endemic areas for malaria. The Ministry of Health (MoH) strategy plan for malaria morbidity targeted an Annual Parasite Incidence (API) of < 1 per 1000 population at risk by 2015 [7]. Nationally, malaria morbidity decreased from 4.1 per 1000 people in 2005 to 0.85 per 1000 by 2015 [7]. Reducing the anopheline vectors has been the subject of many meetings and public health initiatives for decades [8]. It has been proposed to eliminate malaria from Indonesia by 2030, with a variety of agendas particularly for endemic areas [9]. As the burden of malaria is very complicated, its elimination, implemented through an integrated approach, has become an integral part of national development [10]. This study attempts to identify socio-demographic factors that are related to malaria prevalence in Indonesia, such as the characteristics of participants, knowledge of the accessibility and utilization of health services, environmental health factors

*Correspondence: hamzah.hasyim@stud.uni-frankfurt.de; hamzah@fkm.unsri.ac.id
†Ulrich Kuch and Ruth Müller act as equivalent co-senior authors
[1] Institute for Occupational Medicine, Social Medicine and Environmental Medicine, Faculty of Medicine, Goethe University, Frankfurt Am Main, Germany
Full list of author information is available at the end of the article

Journal : BMCTwo 12936 | Dispatch : 3-4-2019 | Pages : 11
Article No : 2760 | ☐ LE | ☐ TYPESET
MS Code : MALJ-D-18-00607 | ☑ CP | ☑ DISK

including personal measures to protect from mosquito bites, and the condition of housing structures.

Methods

Study area

The study area covered five out of 33 provinces of Indonesia (83 out of 497 districts and cities in 2013): Central Sulawesi, East Nusa Tenggara, Maluku, Papua, and West Papua Provinces (Fig. 1). These provinces were selected because they had been shown to be highly endemic for malaria both in the 2007 and 2013 basic health research of Indonesia [5, 6]. A "highly malaria endemic" area was defined as having > 5 cases of malaria diagnosed per 1000 population and year which is consistent with the API classification by the MoH of Indonesia. The software ArcGIS 10.3.1 was used for mapping, processing, analysis, and visualization of the data set, and WGS84 was used as the reference coordinate system.

Research design

The design of the Indonesian basic health research, which is called Riskesdas, is a descriptive cross-sectional survey to describe public health problems throughout Indonesia [6]. Figure 2 shows its framework for malaria research. The sample comprised 130,585 participants who represented the population in five highly malaria-endemic provinces.

Research variables

The dependent variable was malaria prevalence and is binary, that is, whether malaria was present or absent. The definition of disease used was diagnosis of the participants (D) with malaria by a physician or professional health worker. The data were obtained from a retrospective assessment by health surveyors using a standardised questionnaire. Participants who claimed to have never been diagnosed with malaria were asked whether they had suffered from the specific signs and clinical symptoms of the disease. The term "diagnosed/clinical symptoms" means that the prevalence of illness was based on the diagnosis by a physician or health worker in a health centre or based on the signs and symptoms experienced and reported by participants. The report referred to the disease information collected from interviews using questionnaires and clinically measured interviews [5, 6]. The dependent variable, malaria prevalence,

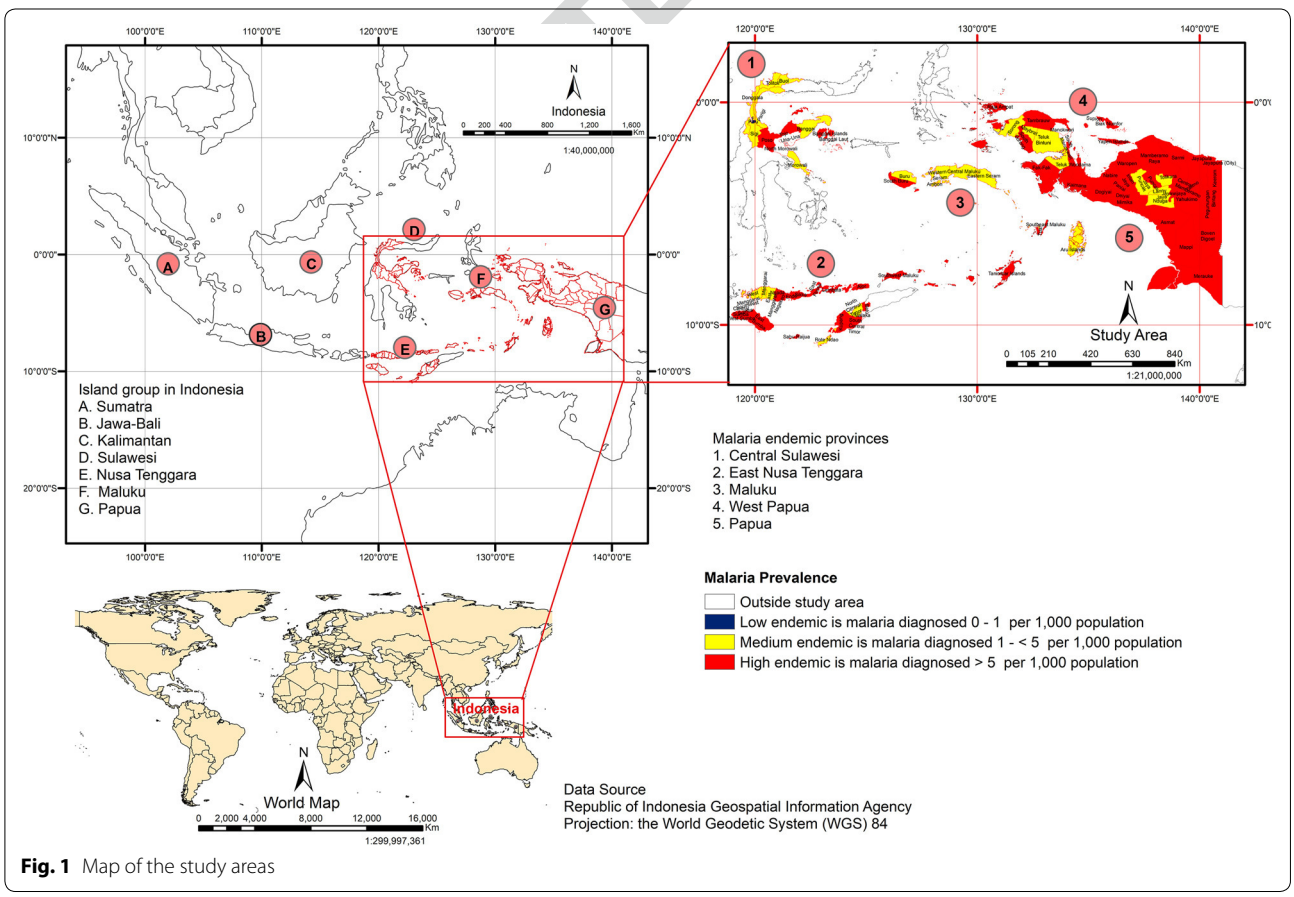


Fig. 1 Map of the study areas

Journal : BMCTwo 12936 | Dispatch : 3-4-2019 | Pages : 11
Article No : 2760 | ☐ LE | ☐ TYPESET
MS Code : MALJ-D-18-00607 | ☑ CP | ☑ DISK

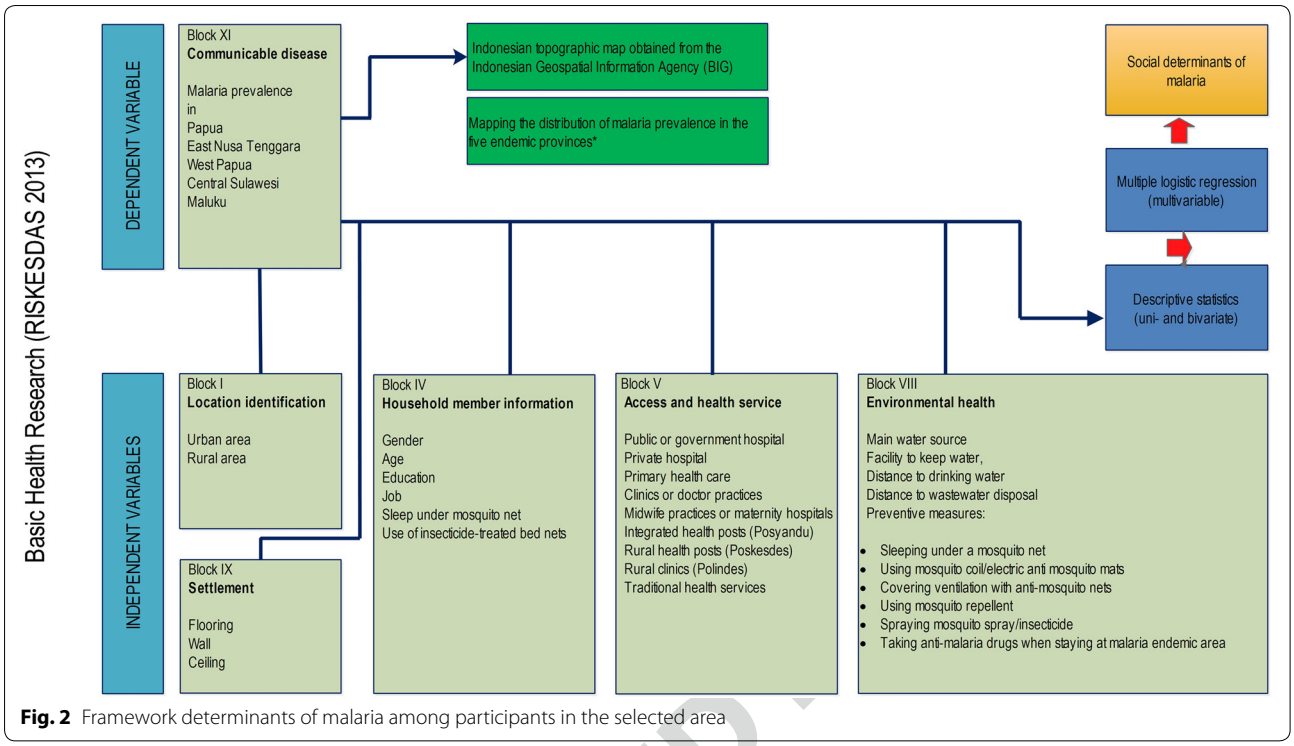


Fig. 2 Framework determinants of malaria among participants in the selected area

was summarized as a binary variable whose value was one if health experts assessed a participant as having had malaria within the past month [5, 6]. In general, rapid diagnostic tests (RDTs) and microscopy were used to diagnose the disease, but the surveyor did not examine for malaria infection [5, 6].

The explanatory variables consisted of several socio-demographic factors that could affect malaria prevalence including the characteristics of participants, the availability of healthcare services, environmental sanitation including behaviour to prevent mosquito bites, and settlement (Fig. 2). These variables were grouped into blocks based on the questionnaire: block I—location identification or household information; block IV—household member information includes sex, age group (year), education and job (occupation), use of bed nets for sleeping and net insecticide; block V—knowledge of available healthcare facilities; block VIII—environmental health including prevention measures against malaria; and block IX—settlement (condition of housing structure). These were the criteria for environmental health in Riskesdas 2013 (joint monitoring programme World Health Organization–the United Nations Children's Fund criteria). Using logistic regression, the independent variables were standardized and modified by considering the survey design [11]. Variables that were transformed into categorical variables were: knowledge of available healthcare facilities, environmental sanitation, prevention measures, and condition of housing structure. All variables were coded as binary dummy variables coded 0 as referent category and coded 1 for a response category of an explanatory variable. Stata was used for data management and analysis [12].

Descriptive analysis

The descriptive analysis aimed to identify the characteristics of the independent variables in relation to the dependent variable, malaria prevalence. The variables are summarized in Table 1 and show the baseline socio-demographic characteristics of study participants. The magnitude of risk for having malaria was assessed from the calculated odds ratio (OR) and AOR (bi- and multivariable logistic regression test). If an OR was higher than one, the likelihood of contracting malaria was increased.

Bivariate analysis

The connections between each explanatory variable and the response variable were analysed with bivariate statistics. The Wald test from logistic regression used a *P* cut-off point of 0.25 because statistical significance may not capture importance and the more traditional levels, such as *P* of 0.05, could fail to select variables known to be essential [13]. A cut-off value of 0.25 is supported by literature [14]. Decisions to keep a variable in the "best" model were based on clinical or statistical significance, or on the significance level of a confounder between 0.1

Journal : BMCTwo 12936 | Dispatch : 3-4-2019 | Pages : 11
Article No : 2760 | ☐ LE | ☐ TYPESET
MS Code : MALJ-D-18-00607 | ☑ CP | ☑ DISK

Table 1 Univariate and bivariate analysis of baseline socio–demographic characteristics of participants

Research variables	n = 130,585	95% CI (lb–ub)*	OR; 95% CI (lb–ub)**	P-value
Malaria				
No	116,073	89.90 (89.15–90.6)		
Yes	14,512	10.10 (9.40–10.85)		
Independent variables				
Location				
Urban	37,389	25.60 (23.07–28.31)		
Rural	93,196	74.40 (71.69–76.93)	0.91 (0.76–1.09)	0.305
Socio–demographic characteristics				
Gender				
Male	64,796	51.08 (50.76–51.40)		
Female	65,789	48.92 (48.60–49.24)	0.90 (0.85–0.94)	0.000
Age of participants in years				
0–4	10,109	8.52 (8.27–8.78)		
5–14	33,378	26.06 (25.60–26.52)	1.32 (1.18–1.49)	0.000
15–24	17,623	15.49 (15.09–15.90)	1.29 (1.14–1.47)	0.000
25–34	19,420	17.09 (16.70–17.47)	1.45 (1.29–1.64)	0.000
35–44	19,604	13.77 (13.47–14.09)	1.58 (1.39–1.80)	0.000
45–54	14,170	8.90 (8.65–9.17)	1.42 (1.24–1.62)	0.000
55–64	8312	4.84 (4.64–5.05)	1.27 (1.09–1.50)	0.003
65–74	3927	2.38 (2.25–2.52)	1.14 (0.96–1.36)	0.147
> 75	4042	2.94 (2.81–3.08)	1.33 (1.12–1.58)	0.001
Education				
Participants considered as higher educated	5935	4.193 (3.853–4.562)		
Participants who had not completed high school education	94,644	72.08 (71.33–72.83)	0.99 (0.83–1.18)	0.878
Participants under 10 years or in preschool	30,006	23.72 (22.93–24.54)	0.84 (0.69–1.03)	0.092
Job (occupation)				
Participants who were not working	77,533	60.12 (59.42–60.82)		
Participants who were working	53,052	39.88 (39.18–40.58)	1.20 (1.12–1.27)	0.000
Use of mosquito nets				
Participants who used mosquito nets at night	61,779	46.19 (44.12–48.27)		
Participants who did not use mosquito nets at night	68,806	53.81 (51.73–55.88)	1.09 (0.97–1.23)	0.153
Use of i nsecticide–treated mosquito nets				
Yes	32,150	23.26 (21.73–24.85)		
No	27,510	21.49 (20.03–23.02)	0.90 (0.78–1.04)	0.154
Participants who did not answer and others	70,925	55.26 (53.18–57.31)	1.05 (0.91–1.20)	0.517
Knowledge of households about the healthcare facilities closest to their residence				
Public hospital				
Known	64,817	48.97 (46.47–51.46)		
Not known	65,768	51.03 (48.54–53.53)	0.80 (0.69–0.92)	0.002
Private hospital				
Known	27,836	22.44 (20.32–24.70)		
Not known	102,749	77.56 (75.30–79.68)	0.65 (0.55–0.76)	0.000
Secondary or primary healthcare unit				
Known	116,609	88.92 (87.65–90.08)		
Not known	13,976	11.08 (9.92–12.35)	0.84 (0.70–1.00)	0.051
Clinics or practices of doctors				
Known	32,954	25.7 (23.73–27.77)		
Not known	97,631	74.3 (72.23–76.27)	0.84 (0.73–0.97)	0.019

Journal : BMCTwo 12936 | Dispatch : 3-4-2019 | Pages : 11
Article No : 2760 | ☐ LE | ☐ TYPESET
MS Code : MALJ-D-18-00607 | ☑ CP | ☑ DISK

Table 1 (continued)

Research variables	n = 130,585	95% CI (lb–ub)*	OR; 95% CI (lb–ub)**	P-value
Midwife practices or maternity hospitals				
Known	18,387	16.59 (14.82–18.52)		
Not known	112,198	83.41 (81.48–85.18)	1.46 (1.24–1.72)	0.000
Integrated health posts (Posyandu)				
Known	56,129	43.23 (41.01–45.47)		
Not known	74,456	56.77 (54.53–58.99)	1.19 (1.06–1.35)	0.004
Village health posts (Poskesdes)				
Known	9932	7.85 (6.63–9.26)		
Not known	120,653	92.15 (90.74–93.37)	1.90 (1.46–2.47)	0.000
Village maternity clinic (Polindes)				
Known	17,312	14.61 (12.95–16.43)		
Not known	113,273	85.39 (83.57–87.05)	1.16 (0.97–1.40)	0.109
Environmental sanitation				
Main water source				
Improved	94,267	72.88 (70.77–74.88)		
Unimproved	36,318	27.12 (25.12–29.23)	1.10 (0.95–1.27)	0.226
Water storage facility				
Improved	127,808	97.56 (96.99–98.03)		
Unimproved	2777	2.44 (1.97–3.01)	1.32 (0.97–1.80)	0.076
Distance from drinking water (time needed to obtain water for drinking)				
Improved	108,053	82.1 (80.44–83.64)		
Unimproved	22,532	17.9 (16.36–19.56)	0.90 (0.77–1.06)	0.218
Wastewater disposal				
Improved	24,099	18.76 (17.35–20.25)		
Unimproved	106,486	81.24 (79.75–82.65)	1.12 (0.98–1.27)	0.089
Slept using a mosquito net				
Yes	63,333	47.44 (45.35–49.54)		
No	67,252	52.56 (50.46–54.65)	1.15 (1.03–1.29)	0.018
Using mosquito coil/electric anti–mosquito mats				
Yes	39,875	31.42 (29.60–33.29)		
No	90,710	68.58 (66.71–70.40)	1.27 (1.13–1.42)	0.000
Covering ventilation holes with anti–mosquito nets				
Yes	8582	6.25 (5.43–7.18)		
No	122,003	93.75 (92.82–94.57)	0.52 (0.43–0.62)	0.000
Using mosquito repellent				
Yes	6562	4.76 (4.18–5.43)		
No	124,023	95.24 (94.57–95.82)	1.06 (0.85–1.31)	0.616
Spraying mosquito spray/insecticide				
Yes	12,004	9.11 (8.10–10.22)		
No	118,581	90.90 (89.78–91.90)	0.66 (0.55–0.79)	0.000
Taking anti–malaria drugs when staying in a malaria endemic area				
Yes	1265	0.92 (0.73–1.16)		
No	129,320	99.08 (98.84–99.27)	0.48 (0.33–0.69)	0.000
Draining the bath water reservoir once a week				
Yes	55,702	41.89 (39.97–43.83)		
No	74,883	58.11 (56.17–60.03)	0.98 (0.87–1.10)	0.698
Settlement or housing condition				
Floors				
Improved	51,788	39.82 (37.95–41.73)		

Journal : BMCTwo 12936 | Dispatch : 3-4-2019 | Pages : 11
Article No : 2760 | ☐ LE | ☐ TYPESET
MS Code : MALJ-D-18-00607 | ☑ CP | ☑ DISK

Table 1 (continued)

Research variables	n = 130,585	95% CI (lb–ub)*	OR; 95% CI (lb–ub)**	P-value
Unimproved	78,797	60.18 (58.27–62.05)	1.23 (1.08–1.39)	0.001
Walls				
Improved	112,582	85.23 (83.59–86.72)		
Unimproved	18,003	14.77 (13.28–16.41)	1.32 (1.122–1.55)	0.001
Ceiling				
Improved	2192	1.75 (1.45–2.10)		
Unimproved	128,393	98.26 (97.90–98.55)	1.04 (0.72–1.50)	0.835

* Odds ratio (OR) and 95% CI of percentage

lb Lower 95% confidence boundary of cell percentage

ub Upper 95% confidence boundary of cell percentage

and 0.15 as it might, in combination with other variables, make an important contribution [13]. In the present study, variables could potentially be entered into the multivariable model if the results of the bivariate test had a value of $P < 0.25$.

Multivariable analysis

The multivariable analysis aimed to find the parsimonious logistic regression model. A backward technique was used with stepwise removal of non-significant variables ($P > 0.05$). The regression coefficient was repeatedly re-estimated until no further independent variables were insignificant. However, if $P > 0.05$, the variable was inserted into the multivariable model but only if considered substantially necessary. The variables that had significant results in the descriptive analysis of each variable were selected as candidates for the model for multivariable analysis.

Results

Figure 1 reveals a low prevalence of diagnosed malaria disease at Palu (0.85%) and Donggala (1.56%) districts in Central Sulawesi, and a high malaria prevalence at Intan Jaya (45.96%) and Kepulauan Yapen (38.95%) districts in Papua.

Descriptive analysis

The effect of social determinants on malaria prevalence in five malaria-endemic provinces of Indonesia is summarised in Table 1. A large percentage of participants (72.08%) had not completed high school education, and only 4.19% were considered higher educated. Overall the percentage of males (51.08%) was slightly higher than that of females (48.92%). An OR > 1 shows that the probability of the disease is greater for the response category than the referent category of an explanatory variable. The percentage of respondents who reported "do not know the availability of midwife practices, and village health post" was 83.41% and 92.15%, respectively. In the bivariate analysis, participants who were working were 1.2 times more likely to have malaria than those who were not (OR = 1.20; 95% CI 1.12–1.27; $P < 0.001$). The environmental sanitation variable was not statistically significantly associated with malaria prevalence (OR = 1.13; 95% CI 0.99–1.31; $P = 0.081$). Prevention measures against malaria were important: participants who did not take preventive measures were 1.2 times more likely to contract malaria than those who did (OR = 1.18; 95% CI 1.01–1.38; $P = 0.036$). The risk of having malaria was significantly higher for participants who did not know about the availability of healthcare services (OR = 4.22; 95% CI 1.53–11.59; $P = 0.005$). Further, housing conditions were also important: participants who lived in houses made of unimproved materials were 1.3 times more likely to have malaria than those in houses made of improved building materials (OR = 1.30; 95% CI 1.09–1.54; $P = 0.003$) as shown in Table 2.

Logistic multivariable regression

The OR and AOR of factors affecting malaria prevalence are shown in Table 2. The participants who were unaware of the availability of or did not utilize health facilities were more likely to have malaria than those who did (AOR = 4.18; 95% CI 1.52–11.45; $P = 0.005$; adjusted by other covariates). The logistic multivariable regression provides an additional dimension to the research results (Table 2). The final model includes the following significant explanatory variables for malaria prevalence: characteristics of participants (gender, age, and job in block IV), knowledge of the availability of health services (in block V), and settlement (condition of housing structure in block IX).

Discussion

Principal findings

Many risk factors increase the likelihood of contracting malaria, particularly the accessibility and utilization of primary healthcare facilities. This study reveals a 4.2-fold

Journal : BMCTwo 12936 | Dispatch : 3-4-2019 | Pages : 11
Article No : 2760 | ☐ LE | ☐ TYPESET
MS Code : MALJ-D-18-00607 | ☑ CP | ☑ DISK

Table 2 Factors associated with malaria prevalence in the endemic area

Research variables	Simple logistic regression analysis		Multiple logistic regression analysis	
	OR (95% CI)[a]	P-value	AOR (95% CI)[b]	P-value
Gender				
Males (Ref.)				
Females	0.90 (0.85–0.94)	0.000	0.91 (0.87–0.96)	0.000
Age of participants in years				
More than 5 years of age (Ref.)				
Children under 5 years of age	0.72 (0.65–0.81)	0.000	0.74 (0.67–0.83)	0.000
Job (occupation)				
Participants who were not working (Ref.)				
Participants who were working	1.20 (1.12–1.27)	0.000	1.13 (1.06–1.20)	0.000
Use of mosquito nets				
Participants who used mosquito nets (Ref.)				
Participants who did not use mosquito nets	1.09 (0.97–1.23)	0.153	–	–
Knowledge about healthcare services				
Healthcare facilities closest to the residence				
Known (Ref.)				
Not known	4.22 (1.53–11.59)	0.005	4.18 (1.52–11.45)	0.005
Environmental health				
Improved (Ref.)				
Unimproved	1.13 (0.99–1.31)	0.081	–	–
Preventive measures				
Using preventive measures (Ref.)				
Not using preventive measures	1.18 (1.01–1.38)	0.036	–	–
Settlement or housing condition				
Improved (Ref.)				
Unimproved	1.30 (1.09–1.54)	0.003	1.30 (1.09–1.54)	0.003

Ref.: The reference category is represented in the contrast matrix as a row of zeros

[a] Crude odds ratio

[b] Adjusted odds ratio

increase in the odds of malaria prevalence for participants who do not know about the availability of healthcare facilities compared to those who do know, adjusted by other covariates. The kind of healthcare facilities in this study included government hospitals, private hospitals, primary healthcare (*puskesmas*), clinics, midwife practices, integrated health posts (*posyandu*), village health posts (*poskesdes*), and village maternity clinics (*polindes*). Health services at the primary level in the community as well as their networks are essential for malaria elimination. Healthcare services, particularly for pregnant women, can be delivered during antenatal care (ANC) as pregnant women, infants, and toddlers are especially vulnerable groups for the disease. Malaria is a significant global health issue, especially among pregnant women [15]. Midwives also play a crucial role in health reporting [16]. Although there are physicians and nurses in public and private hospitals, midwives are also needed at the primary level of healthcare and at the community level. Thus, they also need to be equipped with expertise and skills to effectively provide information and promote the prevention of malaria. Particularly at the community level such health promotion and malaria prevention programmes are essential [17]. The findings of this study are consistent with those of one in Uganda where midwives provide malaria-related health promotion and education to pregnant women during every prenatal clinic visit, including direct supervision on how to consume drugs [18]. In sub-Saharan Africa, it has long been recognized that pregnant women are an especially vulnerable group for malaria infection, and that there is a need for active management of the disease in pregnancy as a fundamental part of antenatal care in endemic areas [19]. In Malawi, pregnant women are significant reservoirs of gametocyte transmission which is present in 5% at their first antenatal care visit, and this should not be overlooked in elimination efforts [20].

Journal : BMCTwo 12936 | Dispatch : 3-4-2019 | Pages : 11
Article No : 2760 | ☐ LE | ☐ TYPESET
MS Code : MALJ-D-18-00607 | ☑ CP | ☑ DISK

Explanatory variables

In the present study, the estimated odds of malaria in females was 10% lower than in males. Similarly, in Lundu district, Sarawak, Malaysia, malaria infection was associated in male than a female with seven-fold risk to be malaria-infected [21]. This is consistent with a previous study showing that females performed a protective function in malaria control [22]. In contrast, in Bungoma county, western Kenya, the risk of clinical malaria was related to being female. As well, *Plasmodium falciparum* infection was connected with being male, poorer, and malnourished [23]. Malaria prevalence differs among age groups. In this study, the estimated odds of malaria for the age group from 35 to 44 years were higher than for others. In a similar study in sub-Saharan Africa, a positive microscopic result was significantly associated with being in the age group of 35–44 years compared to 45 years or older [24]. Also, in South Africa malaria is a significant public health problem among adults and more pronounced in the economically active adult male population [25]. Another study in rural Hausa communities in Nigeria showed that malaria was significantly associated with the participant's knowledge, age, and gender [26]. In the present study, the risk of having malaria was 1.2 to 1.13 times higher for those who were working (simple logistic and multiple logistic analysis, respectively) compared to those who were not. Conversely, in a study in Blantyre, Malawi, employment status did not differ between the groups [27].

Several other factors are related to malaria prevalence. These include the lack of prevention measures against malaria, such as bed nets, insecticide treatment and knowledge deficits. In spite of a widespread use of mosquito nets at night and insecticide-treated mosquito nets (ITNs), this is not always significantly associated with reduced malaria prevalence. Nevertheless, the present study indicates that participants in endemic provinces of Indonesia who did not use mosquito nets at night were more likely to have malaria than those who did. Similarly, not using ITNs predicted an increased occurrence of clinical malaria in a study in urban Kano, northwestern Nigeria [28], and an Indian study found that a persistent use of nets resulted in a substantial reduction in malaria cases [29]. Illustrating the variability of the relationship between bed-net use and malaria incidence, a study in southern Ethiopia, where the use of bed-nets was frequent, showed that the prevalence of malaria was also high [30]. Obstacles to the use of ITNs include lack of promotion information and lack of knowledge [31]. A survey in Orissa, India, indicated that appropriate communication strategies should be built up and imparted alongside ITN distribution to promote ITN adoption [31]. A similar finding was reported for south-eastern Nigeria where, despite the community having good knowledge about the use of mosquito nets, few knew about the existence of ITNs [32]. Another investigation in Ghana revealed that participants did not have sufficient knowledge about the behaviour of mosquitoes, which weakened their knowledge of the relationship between malaria control and the use of ITNs [33].

Lack of both information and vector control measures to protect people from malaria have been reported as being related to higher malaria risk [34]. Unquestionably, the dissemination of information and health education for preventive measures against malaria are essential. In a South African study, most participants were confident that indoor residual spraying killed mosquitoes and prevented infection. Their sources of malaria information were from the local health facility, radio, and community meetings [35]. The latter study considered that providing health education on malaria and knowledge about risk factors might change health-related behaviour, and thereupon the spreading of knowledge could decrease malaria infection [30]. The present research in the context of Indonesia concludes that preventive measures against malaria in the environment are important.

Knowledge about the availability of health facilities is also important. This study revealed a 4.2-fold increase of malaria prevalence in participants who did not know about the availability of health facilities compared to participants who did. Increasing distance from the place of residence to the nearest health centre was related to delays in seeking treatment for severe malaria at Jinja Hospital, Uganda [30, 36]. In Cambodia, knowledge about malaria symptoms differed significantly between a village with a health centre and an area that had only village malaria workers. Thus, governments need to enhance community knowledge about malaria symptoms and case management in rural areas [37].

Similarly, in sub-Saharan Africa malaria transmission was determined by knowledge of and access to malaria prevention tools as well as healthcare services [38]. In Mali, knowledge and perceptions related to health condition have an important influence on care-seeking behaviour in the formal health sector [39]. The government of Ghana improved access to healthcare, particularly in a primary healthcare programme, and that was an important contribution towards malaria elimination [40]. In the Asia–Pacific region, the use of traditional medicine and/or traditional healers to treat malaria was related to lack of access to health services (due to geographical or economic barriers), belief in traditional medicine, and a perception that symptoms of malaria were less severe a disease [41]. In central Cameroon, rural populations tended to visit traditional practitioners more than urban healthcare providers for geographical and financial

Journal : BMCTwo 12936 | Dispatch : 3-4-2019 | Pages : 11
Article No : 2760 | ☐ LE | ☐ TYPESET
MS Code : MALJ-D-18-00607 | ☑ CP | ☑ DISK

reasons [42]. Optimizing the role of the "alert village" where the people of the village can easily access health services through village health posts or other health facilities in the area will reduce malaria risk. The alert village is a strategic effort that was created to accelerate the achievement of the millennium development goals to combat malaria [43]. As noted above, the present study concludes that participants who were unaware of available health facilities were more likely to have malaria than those who did know about these.

Even though environmental sanitation was not significantly associated with malaria prevalence in this study, participants who lived in environments with unimproved sanitation more frequently had malaria than those living in environments with improved sanitation. In a Nigerian study, the majority of respondents believed that bushes around the house were significant facilitators of malaria. Some of them stated that the presence of stagnant water was associated with malaria while others mentioned unclean drainage systems [29]. Keeping the outside environment clean can reduce the risk of malaria as shown in a study in rural Nigeria where reductions of malaria prevalence were significantly associated with periodic cleaning of the external environment [44].

With regards to housing condition, the estimated odds ratio of malaria prevalence for participants who lived in houses made of unimproved materials showed that they were 1.3 times more likely to have malaria than those living in houses made of improved building materials. This is consistent with the results of a study in Nigeria where the odds of malaria infection were significantly higher among participants who lived in unimproved houses [45]. A recent review noted that low-quality housing was consistently associated with malaria prevalence, and the authors recommended that this should be further explored along with housing improvements, especially those that reduce mosquito access [46]. A study in the Ananindeua municipality, State of Pará (Brazil), showed an association between poverty and poor living conditions and highlighted that these need to be considered in malaria prevention and control strategies [47]. Another study, conducted in Equatorial Guinea, showed connections between improved building materials over time, housing quality (closed eaves and door/window screens), and reduced malaria incidence [48]. A study in Krogwe, Tanzania, showed that children living in high-quality housing had only a third of the malaria infections compared to those living in poor quality housing [49]. In addition, location is important with households that are very close to the border of forests and swamps being at high risk for malaria [4, 50]. To sum up, unimproved conditions of housing structure were associated with higher malaria prevalence.

Limitations of research

Malaria disease status was retrospectively assessed by a standard Riskesdas questionnaire and not directly based on diagnoses made by healthcare professionals. Thus, the prevalence of malaria could only be estimated from respondents who reported that they had been diagnosed with malaria by professional health workers. There may be other factors which affect malaria prevalence but were not monitored in the Riskesdas survey; these could be the subject of further research. Nevertheless, the present study has the strength of being based on a large sample size, and its analyses were novel and robust and identified relationships that could be useful in the future design of malaria control strategies, at least in the five highly endemic provinces of Indonesia (Additional file 1: Appendix S1; Additional file 2: Appendix S2).

Conclusions

This study estimated the socio-demographic factors affecting malaria prevalence in the five highly endemic provinces of Indonesia. These factors included the characteristics of participants, lack of knowledge about the availability of healthcare services, and unimproved housing. Recommendations include increasing community health education regarding the utilization of healthcare facilities, improving community healthcare knowledge, and practices relating to malaria prevention, such as improving the condition of housing structures. These should be considered in upcoming malaria management control strategies.

Additional files

Additional file 1: Appendix 1. Detailed explanation of the scope of variables and analytical method.

Additional file 2: Appendix 2. Detailed description of descriptive analysis.

Abbreviations

ANC: antenatal care; AOR: adjusted odds ratio; API: annual parasite incidence (number of slides positive for parasite × 1000/total population); ArcGIS: aeronautical reconnaissance coverage geographic information system; Balitbangkes: Badan Penelitian dan Pengembangan Kesehatan (National Institute for Health Research and Development); CI: confidence interval; HDI: Health Development Index; ITNs: insecticide-treated mosquito nets; MoH: Ministry of Health; OR: odds ratio/unadjusted odds ratio; Polindes: Pos bersalin desa (village maternity clinic); Poskesdes: Pos kesehatan desa (village health post); Posyandu: Pos pelayanan terpadu (integrated health post); Puskesmas: Pusat kesehatan masyarakat (primary health care centre); Pv: P-values; RDTs: rapid diagnostic tests; Riskesdas: Riset kesehatan dasar (Basic Health Research).

Authors' contributions

HH designed and performed the collection and analysis of the data and managed the study. PD, RM, DAG and UK contributed to the interpretation

Journal : BMCTwo 12936 | Dispatch : 3-4-2019 | Pages : 11
Article No : 2760 | ☐ LE | ☐ TYPESET
MS Code : MALJ-D-18-00607 | ☑ CP | ☑ DISK

and visualization of the results. HH, PD, RM, DAG and UK wrote the paper. All authors read and approved the final manuscript.

Author details
[1] Institute for Occupational Medicine, Social Medicine and Environmental Medicine, Faculty of Medicine, Goethe University, Frankfurt Am Main, Germany. [2] Faculty of Public Health, Sriwijaya University, Indralaya, South Sumatra, Indonesia. [3] Environmental Futures Research Institute (EFRI), School of Environment & Science, Griffith University, Nathan, QLD, Australia. [4] Unit of Medical Entomology, Institute of Tropical Medicine, 2000 Antwerp, Belgium.

Acknowledgements
The authors are grateful to the Ministry of Research, Technology and Higher Education of the Republic of Indonesia for supporting the first author (HH) with a PhD scholarship in the context of the cooperation between Sriwijaya University and Goethe University. The authors thank the Balitbangkes who kindly permitted us to do further analyses of the Riskesdas 2013 data, and the Head of the Geospatial Information Agency of Indonesia for access to the digitized map.

Competing interests
The authors declare that they have no competing interests.

Availability of data and materials
The basic dataset of Riskesdas has been set up at the Balitbangkes of MoH, and the secondary data is available upon request from the corresponding author (HH).

Consent for publication
Not applicable.

Ethics approval and consent to participate
The ethical clearance for the collection and use of the primary data as the data source for this study was given to Riskesdas 2013 with the number LB.02.01/5.2/KE.006/2013. Ethical clearance was obtained from the National Ethical Committee of the Indonesian Ministry of Health (Balitbangkes) in Jakarta (official name: Komisi Nasional Etik Penelitian Kesehatan).

Funding
The Ministry of Research Technology and Higher Education of the Republic of Indonesia (number 124.63/E4.4/2014) funded the study of HH. The work of RM, UK and DAG was supported by the Federal Ministry of Education and Research of Germany under the project AECO (number 01KI1717).

Publisher's Note

Received: 16 November 2018 Accepted: 1 April 2019

References

1. Aimone AM, Perumal N, Cole DC. A systematic review of the application and utility of geographical information systems for exploring disease-disease relationships in paediatric global health research: the case of anaemia and malaria. Int J Health Geogr. 2013;12:1–13.
2. Bannister-Tyrrell M, Verdonck K, Hausmann-Muela S, Gryseels C, Muela Ribera J, Peeters Grietens K. Defining micro-epidemiology for malaria elimination: systematic review and meta-analysis. Malar J. 2017;16:164.
3. Manh BH, Clements AC, Thieu NQ, Hung NM, Hung LX, Hay SI, et al. Social and environmental determinants of malaria in space and time in Viet Nam. Int J Parasitol. 2011;41:109–16.
4. Hasyim H, Nursafingi A, Haque U, Montag D, Groneberg DA, Dhimal M, et al. Spatial modelling of malaria cases associated with environmental factors in South Sumatra, Indonesia. Malar J. 2018;17:87.
5. National Institute of Health Research and Development. Indonesia Basic Health Research (RISKESDAS) 2007. Jakarta: Ministry of Health (Indonesia); 2008.
6. National Institute of Health Research and Development (NIHRD). Indonesia Basic Health Research (RISKESDAS) 2013. Jakarta: Ministry of Health (Indonesia); 2014.
7. Kementerian Kesehatan Republic of Indonesia. Profil kesehatan Indonesia tahun 2015. Jakarta: Kementerian Kesehatan RI; 2016.
8. Elyazar I, Hay SI, Baird JK. Malaria distribution, prevalence, drug resistance and control in Indonesia. Adv Parasitol. 2011;74:41.
9. Murhandarwati EEH, Fuad A, Wijayanti MA, Bia MB, Widartono BS, Lobo NF, et al. Change of strategy is required for malaria elimination: a case study in Purworejo District, Central Java Province, Indonesia. Malar J. 2015;14:318.
10. Ministry of Health Republic of Indonesia. Decree Number 293/Menkes/SK/IV/2009 concerning malaria elimination in Indonesia (Ministry of Health Republic of Indonesia ed. 2009.
11. Roberts G, Rao N, Kumar S. Logistic regression analysis of sample survey data. Biometrika. 1987;74:1–12.
12. Stata. Stata Survey Data Reference Manual Release 13. A Stata Press Publication, StataCorp LP, College Station, Texas; 2011.
13. Bursac Z, Gauss CH, Williams DK, Hosmer DW. Purposeful selection of variables in logistic regression. Source Code Biol Med. 2008;3:17.
14. Bendel RB, Afifi AA. Comparison of stopping rules in forward "stepwise" regression. J Am Stat Assoc. 1977;72:46–53.
15. Corrêa G, Das M, Kovelamudi R, Jaladi N, Pignon C, Vysyaraju K, et al. High burden of malaria and anemia among tribal pregnant women in a chronic conflict corridor in India. Confl Health. 2017;11:10.
16. Ngana FR, Myers BA, Belton S. Health reporting system in two subdistricts in Eastern Indonesia: highlighting the role of village midwives. Midwifery. 2012;28:809–15.
17. Mahendradhata Y, Trisnantoro L, Listyadewi S, Soewondo P, Marthias T, Harimurti P, et al. The Republic of Indonesia health system review. In: Health Systems in Transition India; World Health Organization, 2017.
18. Bbosa RS, Ehlers VJ. Midwives' provision of antimalaria services to pregnant women in Uganda. Midwifery. 2017;47:36–42.
19. Scott S, Mens PF, Tinto H, Nahum A, Ruizendaal E, Pagnoni F, et al. Community-based scheduled screening and treatment of malaria in pregnancy for improved maternal and infant health in The Gambia, Burkina Faso and Benin: study protocol for a randomized controlled trial. Trials. 2014;15:340.
20. Boudová S, Cohee LM, Kalilani-Phiri L, Thesing PC, Kamiza S, Muehlenbachs A, et al. Pregnant women are a reservoir of malaria transmission in Blantyre, Malawi. Malar J. 2014;13:506.
21. Jusoh N, Shah SA. Influence of risk perception, preventive behavior, movement and environment on malaria infection in Lundu district, Sarawak, Malaysia. Med J Indonesia. 2007;16:267–76.
22. Hasyim H, Dhimal M, Bauer J, Montag D, Groneberg DA, Kuch U, et al. Does livestock protect from malaria or facilitate malaria prevalence? A cross-sectional study in endemic rural areas of Indonesia. Malar J. 2018;17:302.
23. Kepha S, Nikolay B, Nuwaha F, Mwandawiro CS, Nankabirwa J, Ndibazza J, et al. *Plasmodium falciparum* parasitaemia and clinical malaria among school children living in a high transmission setting in western Kenya. Malar J. 2016;15:157.
24. Tadesse F, Fogarty AW, Deressa W. Prevalence and associated risk factors of malaria among adults in East Shewa Zone of Oromia Regional State, Ethiopia: a cross-sectional study. BMC Public Health. 2017;18:25.
25. Adeola AM, Botai O, Olwoch JM, Rautenbach CW, Adisa O, Taiwo O, et al. Environmental factors and population at risk of malaria in Nkomazi municipality, South Africa. Trop Med Int Health. 2016;21:675–86.
26. Dawaki S, Al-Mekhlafi HM, Ithoi I, Ibrahim J, Atroosh WM, Abdulsalam AM, et al. Is Nigeria winning the battle against malaria? Prevalence, risk factors and KAP assessment among Hausa communities in Kano State. Malar J. 2016;15:351.
27. Abrams ET, Kwiek JJ, Mwapasa V, Kamwendo DD, Tadesse E, Lema VM, et al. Malaria during pregnancy and foetal haematological status in Blantyre, Malawi. Malar J. 2005;4:39.
28. Iliyasu Z, Babashani M, Abubakar IS, Salahudeen AA, Aliyu MH. Clinical burden and correlates of HIV and malaria co-infection, in northwest Nigeria. Acta Trop. 2013;128:630–5.

Journal : BMCTwo 12936 | Dispatch : 3-4-2019 | Pages : 11
Article No : 2760 | ☐ LE | ☐ TYPESET
MS Code : MALJ-D-18-00607 | ☑ CP | ☑ DISK

29. Ansari M, Razdan R. Bio-efficacy and operational feasibility of alphacypermethrin (Fendona) impregnated mosquito nets to control rural malaria in northern India. J Vector Borne Dis. 2003;40:33–42.
30. Debo GW, Kassa DH. Prevalence of malaria and associated factors in Benna Tsemay district of pastoralist community, Southern Ethiopia. Trop Dis Travel Med Vaccines. 2016;2:16.
31. Vijayakumar KN, Gunasekaran K, Sahu SS, Jambulingam P. Knowledge, attitude and practice on malaria: a study in a tribal belt of Orissa state, India with reference to use of long lasting treated mosquito nets. Acta Trop. 2009;112:137–42.
32. Onwujekwe OE, Akpala CO, Ghasi S, Shu EN, Okonkwo PO. How do rural households perceive and prioritise malaria and mosquito nets? A study in five communities of Nigeria. Public Health. 2000;114:407–10.
33. Kudom AA, Mensah BA. The potential role of the educational system in addressing the effect of inadequate knowledge of mosquitoes on use of insecticide-treated nets in Ghana. Malar J. 2010;9:256.
34. Forero DA, Chaparro PE, Vallejo AF, Benavides Y, Gutiérrez JB, Arévalo-Herrera M, et al. Knowledge, attitudes and practices of malaria in Colombia. Malar J. 2014;13:165.
35. Manana PN, Kuonza L, Musekiwa A, Mpangane HD, Koekemoer LL. Knowledge, attitudes and practices on malaria transmission in Mamfene, KwaZulu-Natal Province, South Africa 2015. BMC Public Health. 2018;18:41.
36. Mpimbaza A, Ndeezi G, Katahoire A, Rosenthal PJ, Karamagi C. Demographic, socioeconomic, and geographic factors leading to severe malaria and delayed care seeking in Ugandan children: a case-control study. Am J Trop Med Hyg. 2017;97:1513–23.
37. Lim S, Yasuoka J, Poudel KC, Ly P, Nguon C, Jimba M. Promoting community knowledge and action for malaria control in rural Cambodia: potential contributions of Village Malaria Workers. BMC Res Notes. 2012;5:405.
38. Chitunhu S, Musenge E. Direct and indirect determinants of childhood malaria morbidity in Malawi: a survey cross-sectional analysis based on malaria indicator survey data for 2012. Malar J. 2015;14:265.
39. Do M, Babalola S, Awantang G, Toso M, Lewicky N, Tompsett A. Associations between malaria-related ideational factors and care-seeking behavior for fever among children under five in Mali, Nigeria, and Madagascar. PLoS ONE. 2018;13:e0191079.
40. Dalaba MA, Welaga P, Oduro A, Danchaka LL, Matsubara C. Cost of malaria treatment and health seeking behaviour of children under-five years in the Upper West Region of Ghana. PLoS ONE. 2018;13:e0195533.
41. Suswardany DL, Sibbritt DW, Supardi S, Chang S, Adams J. A critical review of traditional medicine and traditional healer use for malaria and among people in malaria-endemic areas: contemporary research in low to middle-income Asia-Pacific countries. Malar J. 2015;14:98.
42. Louis JP, Trebucq A, Hengy C, Djin-Djon F, Job HC, Fokoua C, et al. [Health care accessibility and adequacy of health care system in the Sanaga basin (Central Cameroon)](in French). Med Trop (Mars). 1991;51:327–33.
43. Ministry of Health Republic of Indonesia. General guidelines for alert village active. Jakarta: Health Promotion Center, Secretary General of the Indonesian Ministry of Health; 2010.
44. Amoran OE, Onwumbe OO, Salami OM, Mautin GB. The influence of environmental sanitation on prevalence of malaria in a rural town in south-western Nigeria. Niger J Med. 2014;23:254–62.
45. Morakinyo OM, Balogun FM, Fagbamigbe AF. Housing type and risk of malaria among under-five children in Nigeria: evidence from the malaria indicator survey. Malar J. 2018;17:311.
46. Tusting LS, Ippolito MM, Willey BA, Kleinschmidt I, Dorsey G, Gosling RD, et al. The evidence for improving housing to reduce malaria: a systematic review and meta-analysis. Malar J. 2015;14:209.
47. Monteiro TH, Chaves Tdo S, Matos HJ, Sofffiatti NF, Guimaraes RJ, Guimaraes LH, et al. Basic sanitation, socioeconomic conditions, and degree of risk for the presence and maintenance of malaria in a low-transmission area in the Brazilian Amazon. Rev Soc Bras Med Trop. 2015;48:573–9.
48. Bradley J, Rehman AM, Schwabe C, Vargas D, Monti F, Ela C, et al. Reduced prevalence of malaria infection in children living in houses with window screening or closed eaves on Bioko Island, equatorial Guinea. PLoS ONE. 2013;8:e80626.
49. Liu JX, Bousema T, Zelman B, Gesase S, Hashim R, Maxwell C, et al. Is housing quality associated with malaria incidence among young children and mosquito vector numbers? Evidence from Korogwe, Tanzania. PLoS ONE. 2014;9:e87358.
50. Ernst KC, Lindblade KA, Koech D, Sumba PO, Kuwuor DO, John CC, et al. Environmental, socio-demographic and behavioural determinants of malaria risk in the western Kenyan highlands: a case–control study. Trop Med Int Health. 2009;14:1258–65.

Journal : **BMCTwo 12936** | Dispatch : **3-4-2019** | Pages : **11**
Article No : **2760** | ☐ LE | ☐ TYPESET
MS Code : **MALJ-D-18-00607** | ☑ CP | ☑ DISK

Journal:	**12936**
Article:	**2760**

Author Query Form

Please ensure you fill out your response to the queries raised below and return this form along with your corrections

Author Proof

Dear Author

During the process of typesetting your article, the following queries have arisen. Please check your typeset proof carefully against the queries listed below and mark the necessary changes either directly on the proof/online grid or in the 'Author's response' area provided below

Query	Details Required	Author's Response
AQ1	Author details: Kindly check and confirm the processed corresponding affiliation for author "Hamzah Hasyim" was appropriate.	
AQ2	Figure: The image of Figure 1 seems to be truncated in the manuscript and author submitted package. Please provide the missing part of the figure.	
AQ3	Table: Please specify the significance of the symbol "**" reflected inside Table 1 by providing a description in the form of a table footnote. Otherwise, kindly amend if deemed necessary.	
AQ4	Additional file: Additional files 1 and 2 was received; however, no citation was provided in the manuscript. Please check and confirm the inserted citation. Otherwise, kindly advise us on how to proceed. Please note that additional files should be cited in ascending numerical order in the main body of the text.	

Submissions with an Editorial Office Decision for Author

Page: 1 of 1 (3 total completed submissions)

Action	Manuscript Number	Title	Initial Date Submitted	Status Date	Current Status
View Submission Author Response View Decision Letter View Attachments View Publication Charges Information Send E-mail	MALJ-D-17-00578	Spatial modelling of malaria case associated with environmental factors in South Sumatra, Indonesia	11 Sep 2017	13 Feb 2018	Final Decision Accept
View Submission Author Response View Decision Letter View Attachments View Publication Charges Information Send E-mail	MALJ-D-18-00208	Does livestock protect from malaria or facilitate malaria prevalence? A cross-sectional study in endemic rural areas of Indonesia	20 Apr 2018	05 Aug 2018	Final Decision Accept
View Submission Author Response View Decision Letter View Attachments View Publication Charges Information Send E-mail	MALJ-D-18-00607	Social determinants of malaria in an endemic area of Indonesia	16 Nov 2018	01 Apr 2019	Final Decision Accept

Page: 1 of 1 (3 total completed submissions)