BIDANG PENELITIAN ILMU KESEHATAN

PENELITIAN DASAR KOMPETITIF NASIONAL
(PDKN)

ANALISIS DETERMINAN DAN ELIMINASI MALARIA DI WILAYAH ENDEMIK SUMATERA SELATAN

Oleh :

Ketua Peneliti :

Dr. rer. med. Hamzah Hasyim, S.K.M., M.K.M. (NIDN : 0026127303)

Anggota Peneliti :

Dr.Iche Andriyani Liberty, SKM.,M.Kes (NIDN : 0007029001)
Dr. Rostika Flora, S.Kep.M.Kes (NIDN : 0227097101)

Dibiayai oleh
Direktorat Jenderal Pendidikan Tinggi
Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi

Sesuai Kontrak Penelitian
Nomor Surat Keputusan : 142/E5/PG.02.00.PT/2022 Tanggal 10 Mei 2022
Nomor Perjanjian / Kontrak : 0148/UN9.3.1/PL/2022 Tanggal 17 Mei 2022

FAKULTAS KESEHATAN MASYARAKAT
UNIVERSITAS SRIWIJAYA

TAHUN ANGGARAN 2022


UNIVERSITAS
SRIWIJAYA
ILMU ALAT PENGABDIAN

Pengisian poin C sampai dengan poin H mengikuti template berikut dan tidak dibatasi jumlah kata atau halaman namun disarankan seringkas mungkin. Dilarang menghapus/memodifikasi template ataupun menghapus penjelasan di setiap poin.

C. **HASIL PELAKSANAAN PENELITIAN:** Tuliskan secara ringkas hasil pelaksanaan penelitian yang telah dicapai sesuai tahun pelaksanaan penelitian. Penyajian meliputi data, hasil analisis, dan capaian luaran (wajib dan atau tambahan). Seluruh hasil atau capaian yang dilaporkan harus berkaitan dengan tahapan pelaksanaan penelitian sebagaimana direncanakan pada proposal. Penyajian data dapat berupa gambar, tabel, grafik, dan sejenisnya, serta analisis didukung dengan sumber pustaka primer yang relevan dan terkini.

Pada tahapan ini telah dilakukan pengumpulan, pengolahan dan analisis data berupa

Descriptive analysis

Analisis univariate bertujuan untuk mendeskripsikan variabel bebas dan variabel terikat..

Bivariate analysis

Hubungan antara masing-masing variabel bebas dan variabel terikat dianalisis menggunakan uji Chi-Square dengan membandingkan nilai probabilitas (p-value) dengan nilai alpha (α) = 0,05. Jika p-value (adalah < = 0,05, maka Ho ditolak. Artinya terdapat hubungan yang signifikan antara variabel bebas dan variabel terikat; jika p-value > (0,05), maka Ho diterima atau gagal ditolak, artinya tidak ada hubungan yang signifikan antara variabel bebas dan variabel terikat. Analisis univarate dan bivariate seperti yang terlihat pada tabel dibawah ini

Table 1. *Univariate and bivariate analysis of baseline socio-demographic characteristics of participants (n=92)*

Research variables	n=92	95% CI (lb-ub)[a]	PR; 95% CI (lb-ub)[b]	P-value
Malaria				
No	84.78			
Yes	15.22	0.08-0.24		
Age				
< 35 years old	38.04			
≥35 years old	61.96	0.51-0.71	1.33 (0.95-1.85	0.163
Gender				
Woman	32.61			
Man	67.39	0.56-0.76	1.07 (0.74-1.54)	0.724
Years of service				
< Five years	40.22			
≥ Five years	59.78	0.49-0.69	1.72 (1.34-2.21)	0.006
Length of working				
< Eight hours	43.48			
≥ Eight hours	56.52	0.45-0.66	1.67 (1.23-2.26)	0.017
Education				
High (senior high school)	34.78			
Low (primary school & junior high school)	65.22	0.54-0.74	0.61 (0.33-1.15)	0.054
Mosquito net				
Yes	53.26			
Not	46.74	0.36-0.57	0.41 (0.14-1.16)	0.033
Using mosquito repellent				
Yes	46.74			
Not	53.26	0.42-0.63	0.36 (0.13-1.00)	0.005
Out of the house				
Not	38.04			
Yes	61.96	0.51-0.71	1.33 (0.95-1.85)	0.163
Self-medication				
Yes	73.91			
Not	26.09	0.17-0.36	0.50 (0.13-1.91)	0.278
Knowledge				
High	57.61			
Low	42.39	0.32-0.53	0.30 (0.08-1.10)	0.028
Attitude				

Well	44.57			
Not good	55.43	0.44-0.65	0.47 (0.20-1.10)	0.021
Behavior				
Well	42.39			
Not good	57.61	0.46-0.67	0.84 (0.48-1.47)	0.535
Mosquito breeding				
No risk	39.13			
At risk	60.87	0.50-0.70	1.51 (1.13-2.02)	0.036
Resting place				
No risk	34.78			
At risk	65.22	0.54-0.74	1.54 (1.22-1.94)	0.014
House wall condition				
Eligible	38.04			
Not eligible	61.96	0.51-0.71	0.53 (0.26-1.10)	0.021
The Existence of the Sky of the House				
There is	55.40			
There aren't any	44.60	0.35-0.56	0.92 (0.48-1.77)	0.816
House floor condition				
Eligible	34.78			
Not eligible	65.22	0.54-0.74	0.61 (0.33-1.15)	0.054

lb Lower 95% confidence boundary of cell percentage, *ub* Upper 95% confidence boundary of cell percentage
[a]95% CI of percentage in univariate analysis
[b]95% CI of percentage in bivariate analysis

Multivariable analysis

Tujuan dari studi multivariabel adalah untuk mengidentifikasi model regresi logistik yang paling efisien. Metode enter digunakan, dengan faktor-faktor yang tidak signifikan dihilangkan secara bertahap (nilai-p > 0,05). Koefisien regresi dihitung ulang sampai tidak ada variabel bebas yang tidak signifikan. Namun, jika p-value > 0,05, variabel tersebut hanya dimasukkan dalam model multivariabel jika dianggap secara substansial diperlukan. Variabel yang analisis deskriptifnya menghasilkan temuan yang signifikan dipilih sebagai kandidat untuk model analisis multivariabel. Menggunakan *prevalence ratio* (PR) and *adjusted prevalence odds ratio* (POR), tingkat keparahan risiko malaria dievaluasi (uji regresi logistik bi- dan multivariabel). Jika PR lebih dari satu, kemungkinan berkembangnya malaria meningkat. Analisis multivariate seperti yang terlihat pada tabel 2

Table 2. *Factors associated with malaria prevalence in the low endemic area (n=92)*

Research variables	PR crude (95% CI)[a]	P-value	PR adjusted (95% CI)[b]	P-value
Age				
< 35 years old				
≥35 years old	1.33 (0.95-1.85)	0.163	7.98 (1.72-37.00)	0.008
Education				
High (senior high school)				
Low (primary school & junior high school)	0.61 (0.33-1.15)	0.054	0.10 (0.02-0.40)	0.001
Using mosquito repellent				
Yes				
Not	0.36 (0.13-1.00)	0.005	0.13 (0.03-0.54)	0.005
Mosquito breeding				
No risk				
At risk	1.51 (1.13-2.02)	0.036	7.68 (1.50-39.30)	0.014
House wall condition				
Eligible				
Not eligible	0.53 (0.26-1.10)	0.021	0.14 (0.04-0.51)	0.003

Ref.: The reference category is represented in the contrast matrix as a row of one
[a]Crude prevalence ratio (PR)
[b]Adjusted prevalence ratio (APR)

Hasil

Karakteristik peserta dan demografi.

Masing-masing variabel penelitian berikut diperiksa dengan menggunakan analisis univariat: usia, jenis kelamin, masa kerja, masa kerja, pendidikan, penggunaan kelambu, keberadaan tempat perkembangbiakan dan peristirahatan, Pengetahuan, sikap perilaku, dan faktor lingkungan rumah. Selanjutnya dilakukan analisis bivariat untuk mengetahui hubungan umur, jenis kelamin, lama kerja, masa kerja, pendidikan, kebiasaan penggunaan kelambu, keberadaan tempat perkembangbiakan dan peristirahatan, Pengetahuan, sikap perilaku, dan kondisi lingkungan rumah dan kejadian malaria pada penambang. Selain itu, dilakukan analisis multivariat untuk mengetahui faktor yang paling berpengaruh terhadap kejadian malaria. Berdasarkan *univariate study*, 15,22% dari 92 pekerja tambang di Kecamatan Tanjung Agung terkena malaria, dengan mayoritas (61,96%) berusia 35 tahun. Lebih banyak berjenis kelamin laki-laki (67,39%). Ada lebih banyak penambang dengan masa kerja lima tahun (59,78%) dan delapan jam kerja (56,52%) dari yang diharapkan. Selain itu, penambang lebih banyak yang berpendidikan rendah (65,22%), lebih banyak menggunakan kelambu (53,26%), tidak menggunakan obat nyamuk (53,26%), dan meninggalkan rumah pada malam hari (61,96%). Responden yang melakukan pengobatan sendiri lebih banyak (73,91%), memiliki tingkat Pengetahuan lebih tinggi (57,61%) tetapi menunjukkan sikap kurang positif (55,43%) dan perilaku buruk (57,61%). Keberadaan tempat perkembangbiakan menunjukkan bahwa lebih banyak pekerja tambang yang berisiko (60,87%), demikian pula ketersediaan tempat istirahat (65,22%) dan keadaan dinding rumah (61,96%) dan plafon (55,40%).

Gambar berikut memperlihatkan kondisi lingkungan rumah, tempat berkembang biak nyamuk, dan tempat peristirahatan nyamuk dilokasi penelitian.

Gambar 1. The home's environment

Gambar 2. Mosquito breeding

Gambar 3. Resting sites

Berdasarkan *bivariate analysis*, ada hubungan antara masa kerja (p-value 0,006), lama kerja (p-value 0,017), kebiasaan menggunakan kelambu (p-value 0,033), penggunaan obat nyamuk (p-value 0,005), pengetahuan (p-value 0,028), sikap (p-value 0,021), keberadaan tempat bertelur (p-value 0,036), keberadaan tempat peristirahatan (p-value 0,014), dan kondisi rumah Selanjutnya, penelitian saat ini mengungkapkan faktor-faktor yang terkait dengan malaria di daerah endemisitas rendah.

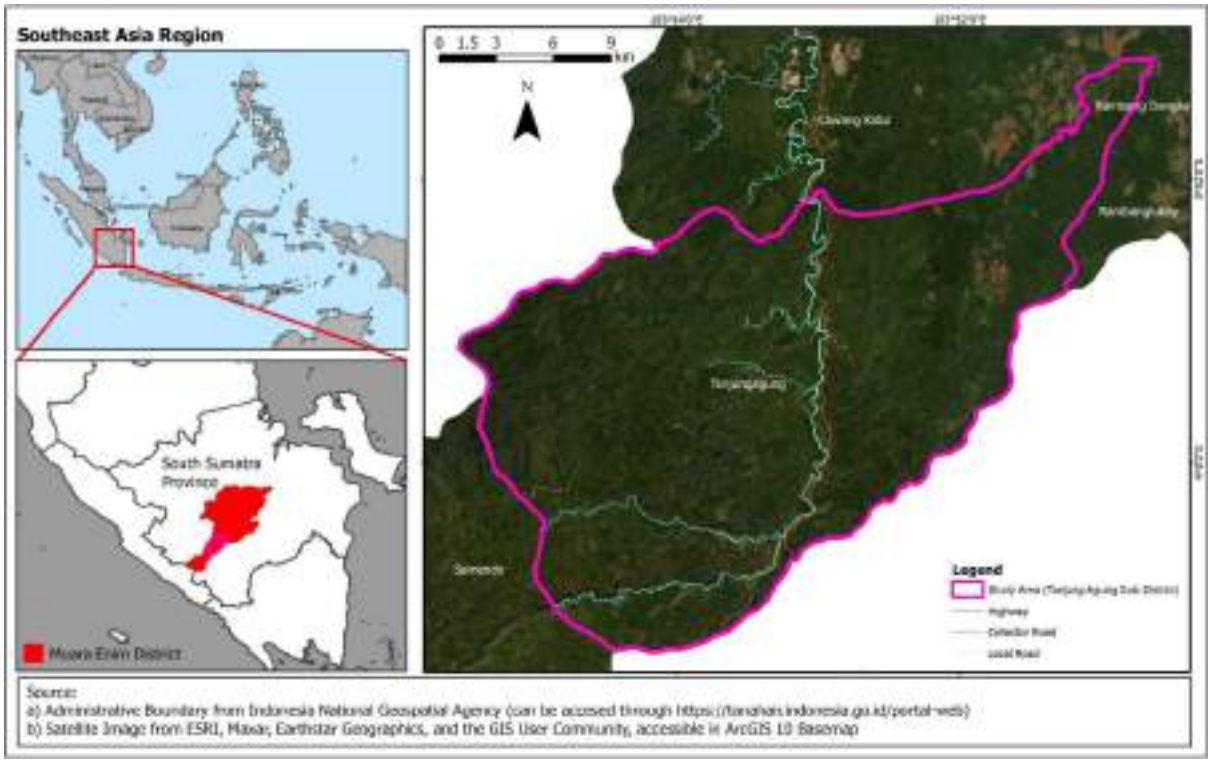
Penularan malaria di pertambangan rakyat menarik untuk dikaji, sejalan dengan penelitian sebelumnya yang menemukan bahwa masyarakat penambang di sekitar hutan yang berprofesi sebagai penambang skala kecil atau *small-scale miners (ASM)* merupakan populasi yang berisiko terkena penyakit malaria, termasuk penduduk di lokasi penelitian.

Hasil Multivariate analysis mengungkapkan bahwa usia responden adalah faktor risiko yang paling signifikan, dengan nilai p-value 0,008. Pendidikan tinggi, penggunaan obat nyamuk, dan kondisi dinding rumah yang memenuhi syarat merupakan faktor protektif, dengan PR < 1. Analisis multivariat mengungkapkan bahwa peserta berusia di atas 35 tahun 7,98 kali lebih mungkin menderita malaria dibandingkan mereka yang berusia di bawah 35 tahun (PR *adjusted*:: 7,98; 95% CI 1,72-37,00; p-value 0,008) setelah *adjusted* dengan pendidikan,

penggunaan obat nyamuk, tempat perkembangbiakan nyamuk, dan kondisi dinding rumah. Selain itu, obat nyamuk berhubungan erat dengan penurunan risiko malaria (PR *adjusted*: 0,13; 95% 0,03-0,54; nilai p 0,005).

Diskusi

Survei *cross-sectional* dilakukan pada bulan Mei - Juli 2022. Ada dua puluh kecamatan, sepuluh kabupaten, dan 245 desa di Kabupaten Muara Enim. Metode purposive dipilih desa Tanjung Lalang, Tanjung Agung, dan Penyandingan di Kecamatan Tanjung Agung. Pemilihan wilayah studi didasarkan pada API Puskesmas Tanjung Agung dan informasi wilayah dengan penambang rakyat terbanyak. Laman Dinas Kesehatan dan Pemkab Muara Enim menyediakan data tersebut. Terakhir, pemilihan sampel di setiap desa dilakukan dengan *cluster sampling.* Wilayah studi ditunjukkan pada gambar dibawah



Gambar 4. Area studi penelitian

Belum banyak dilakukan penelitian determinan malaria di kalangan pekerja tambang ilegal sebagai **populasi khusus**, yang merupakan populasi target, pencapaian eliminasi malaria oleh Kementerian Kesehatan. Sejalan dengan penelitian sebelumnya, vektor malaria tumbuh subur di tambang rakyat. Hanya sedikit data yang tersedia tentang konsekuensi penambangan rakyat terhadap malaria. Sehingga perlu dibuat regulasi pertambangan di masyarakat tersebut dan peningkatan pengendalian malaria dan upaya pendidikan kesehatan untuk mengurangi malaria dan mendorong pencarian kesehatan.[1] Pekerja migran musiman rentan terhadap malaria dan dapat memperkenalkan kembali malaria ke daerah-daerah sensitif. Di tujuh wilayah di Etiopia, pekerja migran musiman di pertanian budidaya tanaman skala besar, perkebunan tebu, hortikultura, pembangunan jalan dan rumah, penambangan emas, dan pendulangan berisiko terkena malaria.[2]

Penelitian lainnya menunjukkan bahwa pengetahuan, sikap, perkembangbiakan nyamuk, dan lantai rumah berhubungan dengan malaria di wilayah pertambangan. Penelitian ini sejalan dengan penelitian yang menganalisis pengetahuan dan pandangan kelompok nomaden tentang malaria dan strategi pencegahannya.[3] Selain itu, program berbasis luas mungkin perlu menargetkan ketidaksetaraan untuk meningkatkan pemahaman, pencegahan, dan pengobatan di antara populasi yang paling rentan untuk meningkatkan upaya pengurangan malaria.[4] Pengetahuan masyarakat yang tepat tentang malaria dan perilaku pencarian pengobatan yang cepat untuk diagnosis dan pengobatan dini sangat penting untuk menghilangkan penyakit. Untuk eliminasi malaria, pengetahuan masyarakat yang akurat dan perilaku pencarian pengobatan yang cepat untuk diagnosis dan pengobatan dini sangat penting.[5] Akses dan kepatuhan terhadap terapi kombinasi berbasis artemisinin (ACT) merupakan hambatan penting untuk pengembangan keberhasilan pengobatan malaria yang dipengaruhi oleh Pengetahuan, sikap, dan keyakinan pasien.[6] Di Kenya, prevalensi malaria sangat berkorelasi dengan kepadatan

tempat berkembang biak.[7] Selain itu, hubungan antara perkembangbiakan nyamuk dan malaria mengungkapkan bahwa perkembangbiakan nyamuk (terlepas dari spesiesnya) sangat terkait dengan kasus malaria di rumah tangga.[7] diamati berkembang biak bersama *An. culicifacies, An. subpictus*, and *An. Varuna*. *Anopheles stephensi* ditemukan berkembang biak secara besar-besaran di sumur yang dibangun yang digunakan untuk alasan perumahan. Upaya Kementerian Kesehatan untuk menghindari masuknya kembali penularan malaria di Tanah Air menghadapi kendala yang cukup berarti.[8] Oleh karena itu, disarankan agar tempat perkembangbiakan nyamuk dihilangkan.[9] Studi lain meneliti konsep bahwa perumahan yang lebih baik dapat mengurangi malaria. Rumah modern menunjukkan tingkat infeksi malaria 47% lebih rendah daripada rumah tradisional. Perumahan merupakan faktor risiko yang signifikan untuk malaria.[10]

Pekerja hutan merupakan faktor risiko malaria.[11] Di Aceh, pekerjaan hutan menyebabkan malaria. Penambang dan penebang menghabiskan waktu berminggu-minggu hingga berbulan-bulan di akomodasi sementara, jarang menggunakan perlindungan serangga, pengobatan sendiri, dan mengunjungi tabib atau apotek setempat alih-alih fasilitas kesehatan.[11]Meskipun upaya pengobatan, malaria tanpa komplikasi telah meningkat di Rwanda. Daerah pedesaan kekurangan pemantauan nyamuk nasional. Kematian akibat malaria harus diturunkan di wilayah-wilayah tersebut pada tahun 2020.[12] Prevalensi malaria yang tinggi di Ghana memiliki banyak penyebab. Sanitasi yang buruk, status sosial ekonomi rendah, konstruksi bangunan, dan perilaku individu.[13] Malaria merupakan masalah kesehatan masyarakat yang signifikan di Kabupaten Tengchong, Provinsi Yunnan, Cina. Petani muda dan pekerja migran sering menderita malaria. Kasus impor, pendidikan rendah, kurangnya pengobatan gigitan nyamuk, dan perilaku berisiko berkontribusi pada tingginya kejadian malaria. Pencegahan dan pengendalian malaria menekankan pada kelompok rentan.[14] Malaria mempengaruhi industri Cina di Afrika. Proyek bantuan dan infrastruktur Tiongkok memanfaatkan pekerja Tiongkok. Malaria dapat menurunkan produktivitas dan lapangan kerja. Menggabungkan upaya bantuan Cina dan konstruksi dengan pos internet yang dilokalkan secara geografis menunjukkan lebih sedikit orang Cina di zona rawan malaria[15] Nyamuk anopheles yang terinfeksi menyebarkan penyakit malaria.[16] Penggunaan lahan mempengaruhi penyebaran penyakit. Perubahan ini terkait dengan lebih banyak malaria zoonosis yang disebabkan oleh *Plasmodium knowlesi*. Paparan *Plasmodium knowlesi*-berhubungan dengan umur, jenis kelamin jantan, kontak dengan kera, penggunaan hutan, dan struktur rumah tinggi, tetapi ketinggian dan penggunaan insektisida melindungi. Penutupan lahan dan fragmentasi memprediksi paparan keluarga. *Plasmodium knowlesi*-mempengaruhi semua demografi dan pekerjaan. Fragmentasi pertanian dan hutan mendorong penularan *Plasmodium knowlesi*.[17] Di Anhui, menunda pengobatan gejala menyebabkan penyakit parah. Hindari penundaan dalam tindakan pencegahan kesehatan masyarakat.[18] Faktor sosial, budaya, dan lingkungan harus dipertimbangkan dalam pencegahan dan pengobatan penyakit yang ditularkan nyamuk. Obat-obatan khusus daerah dapat mengurangi risiko infeksi di tempat-tempat endemik. Obat malaria tunggal tidak efektif karena konteks sosial dan perilaku vektor.[19] Pendekatan biomedis dan kesehatan masyarakat mendominasi pengurangan risiko malaria.[20] Jadi, meluncurkan program pendidikan kesehatan malaria dan mendorong penggunaan kelambu berinsektisida, selimut, muffler, dan obat nyamuk adalah strategi untuk 'mengendalikan' malaria untuk mencegah malaria di kalangan migran.[21]

Penelitian yang berbeda bahwa dugaan malaria terinfeksi Plasmodium lebih banyak adalah kelompok usia muda 94%, laki-laki 88%, pendidikan rendah atau tidak berpendidikan 100%, serta nelayan 100%.[22] Penelitian yang serupa hasilnya adalah tingginya risiko terinfeksi penyakit malaria pada golongan umur >35 tahun di daerah kasus dan kontrol dipengaruhi oleh daya imunitas dan jika sering kontak dengan nyamuk Anopheles sp maka parasite plasmodium mudah menginfeksi kedalam tubuh orang berumur diatas usia 35 tahun tersebut. [23] Di Asia Tenggara dilaporkan bahwa penderita malaria sebagian besar adalah orang dewasa.[24] Penelitian ini menunjukkan bahwa faktor risiko potensial terjadinya malaria harus selalu diperhatikan, terutama untuk daerah yang menargetkan eliminasi Malaria.

Kesimpulan

Usia merupakan faktor risiko yang paling signifikan untuk penularan malaria pada pekerja tambang di Kecamatan Tanjung Agung Kabupaten Muara Enim. Ini menegaskan perlunya pemberian penyuluhan kepada kelompok usia berisiko untuk mengintegrasikan upaya pengendalian malaria, sebagai langkah krusial dalam pemberantasan malaria. Perlu dilakukan upaya preventif dan promotif, khususnya di wilayah pertambangan pada populasi khusus.

D. **STATUS LUARAN**: Tuliskan jenis, identitas dan status ketercapaian setiap luaran wajib dan luaran tambahan (jika ada) yang dijanjikan. Jenis luaran dapat berupa publikasi, perolehan kekayaan intelektual, hasil pengujian atau luaran lainnya yang telah dijanjikan pada proposal. Uraian status luaran harus didukung dengan bukti kemajuan ketercapaian luaran sesuai dengan luaran yang dijanjikan. Lengkapi isian jenis luaran yang dijanjikan serta mengunggah bukti dokumen ketercapaian luaran wajib dan luaran tambahan melalui BIMA.

Status Luaran Wajib penelitian, berupa paper yang saat ini masih *under review* di journal international bereputasi (Q1), Malaria Journal, yang dapat diakses oleh *principal investigator* di https://submission.nature.com/submission/73c9d1a5-b86a-4ec3-85a2-0f31af8fae62, dimana pada https://www.scimagojr.com/journalsearch.php?q=22911&tip=sid, malaria journal memiliki H Index 109, dan bersumber dari https://malariajournal.biomedcentral.com/ *Annual Journal Metrics* dari journal ini adalah sebagai berikut *Citation Impact 3.469 - 2-year Impact Factor (2021); 3.570 - 5-year Impact Factor (2021) ; 1.277 - Source Normalized Impact per Paper (SNIP) dan 1.307 - SCImago Journal Rank (SJR). The corresponding, submission process, dan manuscript* terlampir.

Luaran Tambahan yang sudah tercapai, adalah kegiatan presentasi aktif pada *Conference*/Seminar *Internasional* - Untuk kegiatan ini paper ini telah diterima di *conference international 53rd APACPH 2022 – Manila, Philippines* seperti yang ada di https://www.apacph.org/wp/2022/04/update-53rd-apacph-2022-manila-philippines/. Pada kegiatan ini telah dilakukan *poster presentation* hasil penelitian yang telah disajikan pada *conference international 53rd APACPH 2022 – Manila, Philippines* seperti yang ada di *the corresponding, submission process, dan poster dan* dan *Certificate of Participation of the 53rd Asia-Pacific Academic Consortium for Public Health Conference* dari panitia *conference terlampir.*

Gambar 5. Certificate of Participation of the 53rd Asia-Pacific Academic Consortium for Public Health Conference

Kemudian peneliti membuat *full paper* tambahan lainnya, dengan judul berbeda, tetapi masih merupakan bagian dari penelitian berjudul *Malaria in Mining Workers in Tanjung Agung Muara Enim District, South Sumatra, Indonesia: An Analysis of Environmental Risk Factors*. Paper ini **telah disajikan** *oral presentation* pada kegiatan *the 3rd Sriwijaya International Conference on Environmental Issues (SRICOENV 2022)*, di http://sricoenv.conf.unsri.ac.id/ . Peneliti utama mendapatkan penghargaan sebagai *the best presenter*. Bukti *the corresponding, full article, dan Certificate the best presenter* terlampir.

Gambar 6. Certificate the Best Presenter

Selain itu, bagian yang tidak terpisahkan dari penelitian ini, tetapi tidak dituliskan sebagai luaran tambahan, diproposal awal, peneliti juga berhasil, membuat luaran tambahan lainnya, yaitu dihasilkannya dua thesis, status mahasiswa S2 Lulus, dan dua *article* mahasiswa bimbingan, yang juga adalah sebagai enumerator dalam penelitian, dimana posisi peneliti utama sebagai pembimbing utama Thesis. Article pertama yang dihasilkan dengan Judul: Analisis Kejadian Malaria pada Pekerja di Pertambangan, http://ji.unbari.ac.id/index.php/ilmiah/article/view/2769. Penulis: Wita Citra Dewi, **Hamzah Hasyim,** Novrikasari dan Article kedua yang dihasilkan Judul : Faktor Risiko Kejadian Malaria pada Masyarakat Wilayah Pertambangan: Literature Review http://ji.unbari.ac.id/index.php/ilmiah/article/view/2766. Penulis : Risva Aprina Fitri Lestari, **Hamzah Hasyim**, Novrikasari. Sehingga target untuk **Luaran Tambahan *keynote speaker* di *International conference* sudah tercapai.**

E. **PERAN MITRA:** Tuliskan realisasi kerjasama dan kontribusi Mitra baik *in-kind* maupun *in-cash* (untuk Penelitian Terapan, Penelitian Pengembangan, PTUPT, PPUPT serta KRUPT). Bukti pendukung realisasi kerjasama dan realisasi kontribusi mitra dilaporkan sesuai dengan kondisi yang sebenarnya. Bukti dokumen realisasi kerjasama dengan Mitra diunggah melalui BIMA.

Peran mitra terbatas pada pemberian izin penelitian di lokasi study.

F. **KENDALA PELAKSANAAN PENELITIAN**: Tuliskan kesulitan atau hambatan yang dihadapi selama melakukan penelitian dan mencapai luaran yang dijanjikan, termasuk penjelasan jika pelaksanaan penelitian dan luaran penelitian tidak sesuai dengan yang direncanakan atau dijanjikan.

Luaran Wajib paper tahun 2022 ini, pada tahap ini s*ubmitted*, di jurnal international bereputasi (Q1), dan sudah dilakukan *under review*. Bukti *the corresponding, submission process, dan manuscript* serta *process review* terlampir.

Sebagaimana diketahui bahwa proses publish di journal international bereputasi, BMC, Malaria Journal, Q1, membutuhkan waktu. Untuk itu kami juga berupaya untuk mengatasinya dengan menghubungi *JEO Assistant, Journals Editorial Office (JEO)*, untuk menanyakan *progres paper* pasca *review*ed, dimana tulisan ini sudah mendapatkan ulasan dari *blind reviewer*, yang juga telah diberikan *feedback* oleh peneliti, serta mendapatkan tanggapan dari pihak journal atas pertanyaan kami *progres paper* pasca *review*ed sebagai berikut

Dear Dr. Hasyim,
I have now forwarded this to the relevant department in this regard and will notify you once a response is received.
Thank you very much.
With best regards,
Ayesha

Dear Dr. Hasyim,
Thank you for your enquiry.
We have received your submission in good order. It has been assigned to an Editor who has invited reviewers.
You are able to follow the status of your manuscript from your author dashboard here:
https://researcher.nature.com/your-submissions

Please let me know if you have any further questions.
With best regards,
Ayesha

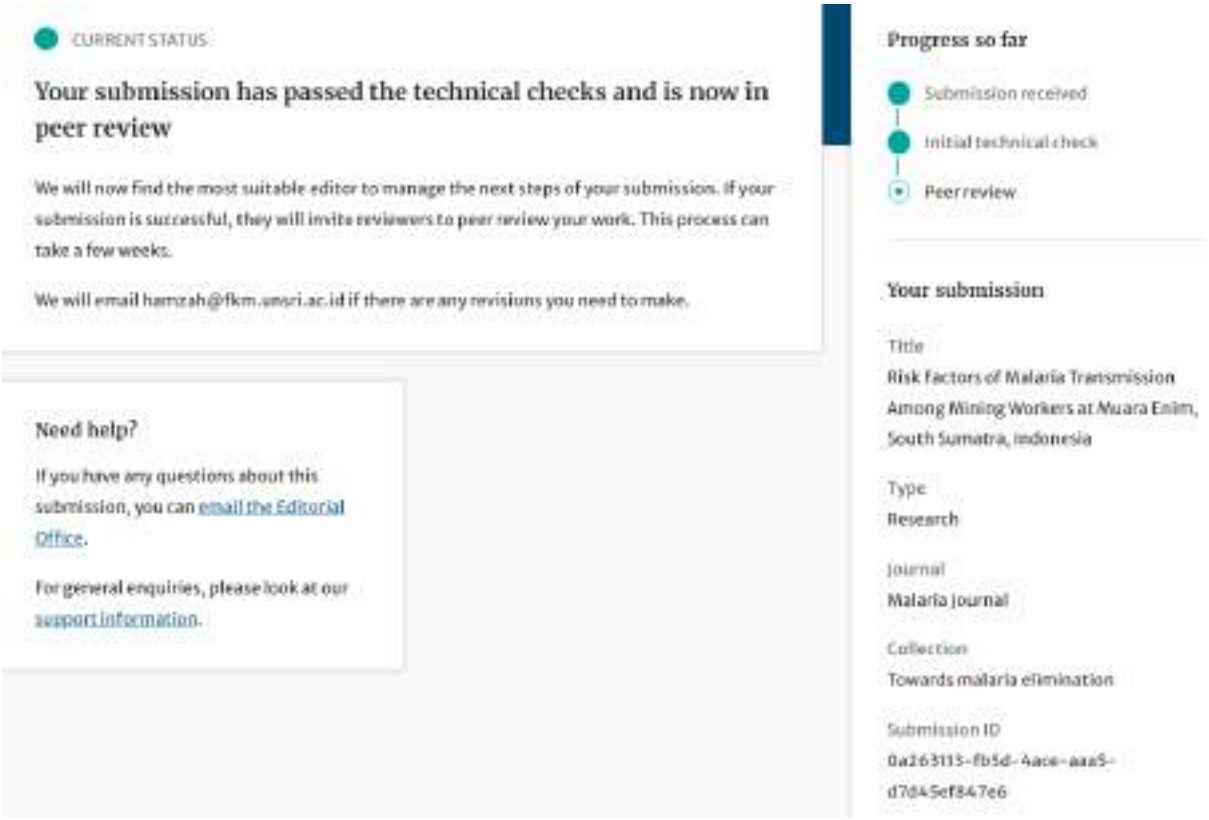
--
Ayesha Siddiqka (Ms.)
JEO Assistant
Journals Editorial Office (JEO)

Kemudian ditampilkan juga penguatan status *submission*, yang digambarkan, pada proses dibawah ini.

Gambar 7. *Tracking submission article*

Source : [*https://researcher.nature.com/your-submissions*](https://researcher.nature.com/your-submissions)

Selanjutnya gambar dibawah menunjukkan *submission process* the article yang saat ini proses *peer review.*



Gambar 8. Proses *submission article*

Source : https://submission.springernature.com/submission-details/0a263113-fb5d-4ace-aaa5-d7d45ef847e6

G**. RENCANA TAHAPAN SELANJUTNYA:** Tuliskan dan uraikan rencana penelitian di tahun berikutnya berdasarkan indikator luaran yang telah dicapai, rencana realisasi luaran wajib yang dijanjikan dan tambahan (jika ada) di tahun berikutnya serta *roadmap* penelitian keseluruhan. Pada bagian ini diperbolehkan untuk melengkapi penjelasan dari setiap tahapan dalam metoda yang akan direncanakan termasuk jadwal berkaitan dengan strategi untuk mencapai luaran seperti yang telah dijanjikan dalam proposal. Jika diperlukan, penjelasan dapat juga dilengkapi dengan gambar, tabel, diagram, serta pustaka yang relevan. Pada bagian ini dapat dituliskan rencana penyelesaian target yang belum tercapai.

Penelitian tahun ke dua di 2023, dilakukan dengan melakukan pendekatan kualitatif tahun 2023, dimana tujuan umum penelitian saat ini di tahun 2022, dilakukan dengan pendekatan kuantitatif, untuk menganalisis determinan kejadian malaria pada masyarakat di wilayah pertambangan Kabupaten Muara Enim. Dimana pada capaian tujuan khusus yang dilakukan adalah 1] Menganalisis distribusi frekuensi faktor karakteristik individu, faktor risiko perilaku, faktor risiko lingkungan, dan faktor risiko kondisi rumah 2] Menganalisis hubungan faktor risiko dengan kejadian malaria 3] Menganalisis dominan faktor risiko dengan kejadian malaria, dimana kegiatan ini sudah dilakukan.

Luaran Wajib tahun 2022 ini, *paper under review*, di BMC, Malaria Journal, Q1. Semoga proses selanjutnya bisa berjalan lancar. InsyaAllah kami sudah memberikan tanggapan yang sesuai masukan dari *peer review* sebelumnya dan untuk tujuan ini kami akan kembali menanyakan *progres* setelah paper ini sudah mendapatkan ulasan dari *peer reviewer*

Selanjutnya tujuan umum penelitian tahun 2023 adalah analisis eliminasi malaria di Kabupaten Muara Enim, dengan tujuan khusus yang akan dicapai: 1] Analisis Input meliputi SDM, anggaran, sarana, metode, kesanggupan dalam kebijakan eliminasi malaria 2] Analisis Process kebijakan eliminasi malaria meliputi diagnostik, pengobatan, surveilans, penanggulangan dan surveilans vektor, advokasi dan KIE pada program malaria. 3] Analisis Output yaitu hasil capaian analisis kebijakan eliminasi malaria dan Analisis Outcome penilaian eliminasi

malaria. Temuan yang ditargetkan untuk tahun 2022 adalah prediksi model kejadian malaria dan tahun 2023 adalah hasil analisis evaluasi eliminasi malaria.

Dengan memahami dua issue utama yaitu determinan kejadian malaria dengan variable faktor prediksi yang lebih komprehensif dan analisis eliminasi malaria, akan dihasilkan luaran yang nyata konstribusinya, berupa rekomendasi dalam eliminasi malaria di tingkat Kabupaten tahun 2023, menuju eliminasi malaria di Sumatera Selatan tahun 2025.

Target dan indikator capaian luaran tahun 2022 dan 2023, seperti pada tabel dibawah ini

Table 3. *Target dan Indikator Capaian Luaran.*

No	Jenis Luaran				Indikator Capaian	
	Kategori	Sub Kategori	Wajib	Tambahan	TS	TS+1
	Tahun I					
1	Artikel ilmiah dimuat di jurnal	Internasional bereputasi	V		Submitted	Published
2	Seminar Internasional			V	Sudah dilaksanakan	Published
3	Tingkat Kesiapan Teknologi (TKT)				3	3
	Tahun II					
1	Artikel ilmiah dimuat di jurnal	Internasional bereputasi	V		Submitted	Published
2	Seminar Nasional			V	Sudah dilaksanakan	Published
3	Tingkat Kesiapan Teknologi (TKT)				3	3

Di *road map* penelitian sebelumnya, ketua peneliti telah menghasilkan beberapa publikasi terkait issue malaria, dan diharapkan di tahun 2022 dan 2023. Melalui riset tahun 2022 ini, telah dihasilkan analisis determinan dan tahun 2023, akan dihasilkan analisis eliminasi malaria diwilayah kerja Dinas Kesehatan Kabupaten Muara Enim, dalam rekomendasi eliminasi malaria spesifik berbasis wilayah. Melalui pendanaan Penelitian Dasar Kompetitif Nasional (PDKN), akan dihasilkan luaran dengan Tingkat Kesiapterapan Teknologi (TKT) 3 di tahun pertama dan TKT 3 ditahun kedua, berupa luaran publikasi artikel di BMC, Malaria Journal, Q1. Sebagai tanbahan juga digunakan *reference manager EndNote licenced* untuk penulisan manuscripts.

Untuk mencapat tujuan tahun pertama, telah digunakan instrument kuesioner, yang *valid dan reliable*, serta telah dilakukan analisis data univariat, bivariat, dan multivariat, yang di sajikan dalam bentuk table dan narasi. Digunakan *software* IBM SPSS Base v26 dan STATA for Windows. Untuk analisis data kuantitatif yang sudah dilakukan pada tahapan kegiatan. Untuk Tahap Kedua tahun 2023, dilakukan dengan metode kualitatif

a. Design Penelitian

Pada tahapan tahun kedua dilakukan penelitian kualitatif, seperti gambar dibawah ini

Gambar 9. Kerangka Fikir

Informan Penelitian sebagai berikut , seperti pada tabel dibawah ini.

Table 4. Informan Penelitian

No.	Informan	Jumlah	Metode Pengumpulan Data
1	Kepala Dinkes Kab. Muara Enim	1	*In-Depth Interview*
2	Kabid Pelayanan RSUD	1	*In-Depth Interview*
3	Kepala Instalasi Farmasi RSUD	1	*In-Depth Interview*
4	Kabid P2P Dinkes	1	*In-Depth Interview*
5	Staf P2M Dinkes	1	*In-Depth Interview*
6	Kepala Puskesmas	1	*In-Depth Interview*
7	Pengelola Malaria Puskemas	7	FGD
8	Petugas Laboratorium Puskesmas	5	FGD
9	Petugas Laboratorium Puskesmas	2	*In-Depth Interview*
10	PetugasLaboratorium RumahSakit	1	*In-Depth Interview*
11	Staf P2P Dinkes Prov. Sumsel	1	*In-Depth Interview*
Jumlah		22	

Untuk mencapat tujuan tahun kedua, digunakan instrument *FGD dan Indepth Interview*, dengan menggunakan alat bantu ***NVivo Qualitative Research Data Analysis Software.*** Selanjutnya pada tahap ini akan dilakukan

b. Validasi Data. Dalam tahapan ini akan dilakukan uji *credibility, transferability, dependability, confirmability*.

c. Triangulasi, teknik/metode, sumber, dan peneliti

d. Alur Penelitian. Disajikan dalam gambar berikut

Gambar 10. Alur Penelitian Tahun Kedua

Direncanakan untuk kegiatan berikutnya, akan dilakukan diseminasi hasil penelitian melalui seminar hasil penelitian, *paket meeting fullboard* dengan mengundang perwakilan dinas kesehatan, rumah sakit, dan puskesmas di wilayah kerja Dinas Kesehatan Kabupaten Muara Enim serta Dinas Kesehatan Provinsi Sumatera Selatan, setelah melakukan pengambilan data dan FGD di Kab Muara Enim. Tim peneliti terdiri dari dua anggota dosen dengan latar belakang keilmuwan yang relevant, dan juga tetap akan menyertakan mahasiswa sebagai enumerator, bagian dari pembelajaran mahasiswa.

H. DAFTAR PUSTAKA: Penyusunan Daftar Pustaka berdasarkan sistem nomor sesuai dengan urutan pengutipan. Hanya pustaka yang disitasi pada laporan akhir yang dicantumkan dalam Daftar Pustaka.

1. Dao F, Djonor SK, Ayin CT, Adu GA, Sarfo B, Nortey P, et al. Burden of malaria in children under five and caregivers' health-seeking behaviour for malaria-related symptoms in artisanal mining communities in Ghana. Parasit Vectors. 2021;14(1):418.doi:10.1186/s13071-021-04919-8
2. Argaw MD, Woldegiorgis AG, Workineh HA, Akelom BA, Abebe ME, Abate DT, et al. Access to malaria prevention and control interventions among seasonal migrant workers: A multi-region formative assessment in Ethiopia. PLoS One. 2021;16(2):e0246251.doi:10.1371/journal.pone.0246251
3. Moukénet A, Honoré B, Smith H, Moundiné K, Djonkamla W-M, Richardson S, et al. Knowledge and social beliefs of malaria and prevention strategies among itinerant Nomadic Arabs, Fulanis and Dagazada groups in Chad: a mixed method study. Malaria Journal. 2022;21(1):56.doi:10.1186/s12936-022-04074-0
4. Clouston SAP, Yukich J, Anglewicz P. Social inequalities in malaria knowledge, prevention and prevalence among children under 5 years old and women aged 15–49 in Madagascar. Malaria Journal. 2015;14(1):499.doi:10.1186/s12936-015-1010-y
5. Hasabo EA, Khalid RI, Mustafa GE, Taha RE, Abdalla RS, Mohammed RA, et al. Treatment-seeking behaviour, awareness and preventive practice toward malaria in Abu Ushar, Gezira state, Sudan: a household survey experience from a rural area. Malaria Journal. 2022;21(1):182.doi:10.1186/s12936-022-04207-5
6. Banek K, Webb EL, Doogue EB, Smith SJ, Chandramohan D, Staedke SG. Factors associated with access and adherence to artemisinin-based combination therapy (ACT) for children under five: a secondary analysis of a national survey in Sierra Leone. Malaria Journal. 2021;20(1):56.doi:10.1186/s12936-021-03590-9
7. Thomas S, Ravishankaran S, Asokan A, Johnson Amala Justin NA, Maria Jusler Kalsingh T, Mathai MT, et al. Socio-demographic and household attributes may not necessarily influence malaria: evidence from a cross sectional study of households in an urban slum setting of Chennai, India. Malaria Journal. 2018;17(1):4.doi:10.1186/s12936-017-2150-z
8. Gayan Dharmasiri AG, Perera AY, Harishchandra J, Herath H, Aravindan K, Jayasooriya HTR, et al. First record of Anopheles stephensi in Sri Lanka: a potential challenge for prevention of malaria reintroduction. Malaria Journal. 2017;16(1):326.doi:10.1186/s12936-017-1977-7
9. Takarinda KP, Nyadundu S, Govha E, Gombe NT, Chadambuka A, Juru T, et al. Factors associated with a malaria outbreak at Tongogara refugee camp in Chipinge District, Zimbabwe, 2021: a case–control study. Malaria Journal. 2022;21(1):94.doi:10.1186/s12936-022-04106-9
10. 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. Malaria Journal. 2015;14(1):209.doi:10.1186/s12936-015-0724-1
11. Ekawati LL, Johnson KC, Jacobson JO, Cueto CA, Zarlinda I, Elyazar IRF, et al. Defining malaria risks among forest workers in Aceh, Indonesia: a formative assessment. Malaria Journal. 2020;19(1):441.doi:10.1186/s12936-020-03511-2
12. Murindahabi MM, Asingizwe D, Poortvliet PM, van Vliet AJH, Hakizimana E, Mutesa L, et al. A citizen science approach for malaria mosquito surveillance and control in Rwanda. NJAS - Wageningen Journal of Life Sciences. 2018;86-87:101-10.doi:https://doi.org/10.1016/j.njas.2018.07.005
13. Bempah S, Curtis A, Awandare G, Ajayakumar J. Appreciating the complexity of localized malaria risk in Ghana: Spatial data challenges and solutions. Health & Place. 2020;64:102382.doi:https://doi.org/10.1016/j.healthplace.2020.102382
14. Li C, Wu X, Cheng X, Fan C, Li Z, Fang H, et al. Identification and analysis of vulnerable populations for malaria based on K-prototypes clustering. Environmental Research. 2019;176:108568.doi:https://doi.org/10.1016/j.envres.2019.108568
15. Cervellati M, Esposito E, Sunde U, Yuan S. Malaria and Chinese economic activities in Africa. Journal of Development Economics. 2022;154:102739.doi:https://doi.org/10.1016/j.jdeveco.2021.102739
16. Adeboye NO, Abimbola OV, Folorunso SO. Malaria patients in Nigeria: Data exploration approach. Data in Brief. 2020;28:104997.doi:https://doi.org/10.1016/j.dib.2019.104997

17. Fornace KM, Brock PM, Abidin TR, Grignard L, Herman LS, Chua TH, et al. Environmental risk factors and exposure to the zoonotic malaria parasite Plasmodium knowlesi across northern Sabah, Malaysia: a population-based cross-sectional survey. Lancet Planet Health. 2019;3(4):e179-e86.doi:10.1016/s2542-5196(19)30045-2
18. Zhang T, Xu X, Jiang J, Yu C, Tian C, Xie Q, et al. Risk factors of severe imported malaria in Anhui province, China. 2019;197:104934
19. Moshi IR, Manderson L, Ngowo HS, Mlacha YP, Okumu FO, Mnyone LL. Outdoor malaria transmission risks and social life: a qualitative study in South-Eastern Tanzania. Malaria Journal. 2018;17(1):397.doi:10.1186/s12936-018-2550-8
20. Dunn CE, Le Mare A, Makungu C. Malaria risk behaviours, socio-cultural practices and rural livelihoods in southern Tanzania: Implications for bednet usage. Social Science & Medicine. 2011;72(3):408-17.doi:https://doi.org/10.1016/j.socscimed.2010.11.009
21. Soe HZ, Thi A, Aye NN. Socioeconomic and behavioural determinants of malaria among the migrants in gold mining, rubber and oil palm plantation areas in Myanmar. Infect Dis Poverty. 2017;6(1):142.doi:10.1186/s40249-017-0355-6
22. Arisandi D, Sohy SR, Nadifah F. Identification of Malaria Parasites in Chasan Boesoirie General Hospital Ternate East Nusa Tenggara. Journal of Health (JoH). 2016;3(1):39-44
23. Arsin AA. Malaria di Indonesia tinjauan aspek epidemiologi. Penerbit: Masagena Press IKAPI. 2012
24. Munizar M, Mudatsir M, Mulyadi M. Hubungan Faktor Umur Dan Status Gizi Dengan Kerentanan Fisik Masyarakat Terhadap Resiko Wabah Malaria di Kemukiman Lamteuba Kecamatan Seulimum Aceh Besar. Jurnal Kedokteran Syiah Kuala. 2015;15(1):29-35


UNIVERSITAS
SRIWIJAYA
ILMU ALAT PENGABDIAN

Department of Environmental Health
Faculty of Public Health, Universitas Sriwijaya, Indonesia
Jl. Palembang Prabumulih Km.32 Sumatera Selatan - Kampus Unsri Indralaya, Ogan Ilir 30662
Indonesia
Phone: (0711) 580068

TO

Editor-in-Chief
Prof Marcel Hommel, University of Liverpool, UK

Malaria Journal,

Response to the Comments of Peer Reviewers

Indonesia, 21.10.2022

Dear Editor,

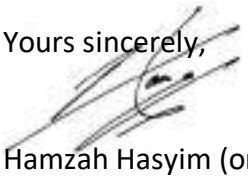
Thank you for considering publishing our manuscript titled "Risk Factors of Malaria Transmission Among Mining Workers at Muara Enim, South Sumatra, Indonesia."

Please find the revised manuscript which is edited according to the reviewers' and editors' comments, and all these changes are highlighted. The English were checked by Professor Patricia Dale, a native English speaker. However, if the journal requires professional revising of the manuscript has been requested. We can use any reputable English language editing service used by journal affiliates like Nature Research Editing Service (https://authorservices.springernature.com/go/sn/) and American Journal Experts (https://www.aje.com/go/springernature/) for help with English usage, particularly for the final version to improvements to the English language.

As recommended in this revised version, we have added a "Comments" section. A new reference and its summarized statement are also included. In this letter, you will also find our point-by-point responses to the reviewers' comments. We appreciate your valuable time in editing our manuscript. We hope this revised version is suitable for publication.

We look forward to hearing from you,

Yours sincerely,



Hamzah Hasyim (on behalf of all authors)

Author's Response to the Reviewer's Comment.

Reviewer 1

Review of " Risk Factors of Malaria Transmission Among Mining Workers at Muara Enim, South Sumatra, Indonesia," by Hamzah Hasyim et al.

Comments to the authors in the attached file
https://reviewer-feedback.nature.com/download/attachment/494a2883-2011-429b-ad00-b352f502684a

Reviewer's Comment:

This paper presents the results of a cross-sectional survey and risk analysis conducted in May - July 2022. in a sample of 92 miners in Muara Enim District, South Sumatra Province. What ought to be a straightforward presentation is marred by lack of clarity in the methods and lack of focus in the discussion.

Author's Response:

Thank you for your valuable input on our manuscript.
We have detailed the methods and improved of discussion in lines 96 -104

The cross-sectional survey was carried out in May - July 2022. Cross-sectional studies with binary outcomes evaluated by logistic regression are prevalent in the epidemiology literature[1]. There are twenty sub-districts, ten counties, and 245 villages in Muara Enim District. The purposive method selected Tanjung Lalang, Tanjung Agung, and Penyandingan villages in the Tanjung Agung sub-districts. The study area selection is based on the API of the PHC of Tanjung Agung and information about the area with the most artisanal miner. The Health Office and Muara Enim District Government's webpage provided the data. Finally, the sample selection in each village was carried out by cluster sampling.

Furthermore, Samples in lines 123-140

This study used a cross-sectional analysis of malaria transmission risk variables among miners. Researchers conducted an interview was applied with 92 miners living in three villages. Based on the API of Tanjung Agung PHC for five years, the API declined steadily in 2018 to 0.7, followed by 0.49 in 2019 and 0.05 in 2020. In 2021 and 2020, the API in PHC decreased rapidly to zero.

Reviewer's Comment:

How was the 'illegal' status of the miners determined? Might it not better to simply describe them as 'artisanal' miners and leave their legal status undetermined?

Author's Response:

Thank you for your valuable input on our manuscript; the author responds to each comment following

Illegal people's mines are illegal mining operations controlled by community collectives of local communities. Muara Enim region in South Sumatra has Indonesia's greatest coal reserves. Indonesia's Ministry of Energy and Mineral Resources claims there are 77,000 hectares of coal concessions in the one-million-hectare region. The land is thought to be used for unlawful mining, which is occupied by illegal mining operations controlled by community collectives of local communities. There are 13 permitted coal mines in South Sumatra, but with millions of tons of coal available, illegal mines have proliferated in the region. The labor is arduous, and there are few safety precautions in place. More than 4,000 people in Muara Enim depend on illegal mines, often called "**community mines**" or "**people's mines**," which are usually run by communal collectives of local inhabitants who don't legally own them but work together to organize and operate them. Community mining is somewhat of a legal gray area in Indonesian legislation, and the mines controlled by the local community in the Muara Enim District are illegal because they operate without a license. In the text, they described **The Illegal People's Mines**. Source: http://www.apbi-icma.org/news/5948/inside-the-illegal-peoples-mines-of-indonesia-where-coal-is-seen-as-a-gift-from-god
Illegal people's mines are similar to an **artisanal miner or small-scale miner** (ASM), a subsistence miner who is not officially employed by a mining company but works independently, mining minerals using their resources, usually by hand. Based on your suggestion, this paper can use **artisanal miners to describe** illegal people's mines, often called "**community mines**" or "**people's mines**,"

We have replaced term of "Illegal people's mines" with “artisanal miner" in the whole text

Reviewer's Comment:

It seems that 92 miners were selected 'purposively' meaning, in this case, that miners were selected from high-API villages are per MOH statistics. What was the API of the villages from which the samples were selected?

Author's Response:
Thank you for your insightful comments on our manuscript; the author responds to each one below.

We have composed this text between lines 96th and 104th.

The cross-sectional survey was carried out in May - July 2022. Cross-sectional studies with binary outcomes evaluated by logistic regression are prevalent in the epidemiology literature[1]. There are twenty sub-districts, ten counties, and 245 villages in Muara Enim District. The purposive method selected Tanjung Lalang, Tanjung Agung, and Penyandingan

villages in the Tanjung Agung sub-districts. The study area selection is based on the API of the PHC of Tanjung Agung and information about the area with the most artisanal miner. The Health Office and Muara Enim District Government's webpage provided the data. Finally, the sample selection in each village was carried out by cluster sampling.

We have composed this text between lines 123rd and 140th.

This study used a cross-sectional analysis of malaria transmission risk variables among miners. Researchers conducted an interview was applied with 92 miners living in three villages. Based on the API of Tanjung Agung PHC's for five years, the API declined steadily in 2018 to 0.7, followed by 0.49 in 2019 and 0.05 in 2020. In 2021 and 2020, the API in PHC decreased rapidly to zero.

The positive samples for malaria were recorded from a records search conducted after the miners were identified. In this study, the sample of miners, who were malaria positive, was not previously identified by the researcher because the characteristics of the cross-sectional study show the association between risk factors with consequences with data collection carried out simultaneously at the point time approach. RDT and microscopy were carried out to diagnose malaria by health personnel, and the cases were registered in E-SISMAL, Muara Enim District Health Office. Miners who reported that they were positive for malaria were re-crosschecked or confirmed through the data in E-SISMAL. It was found that several respondents said they had been exposed to malaria. However, when they were cross-checked with E-SISMAL data, the respondents' names were not found, so they were not grouped into positive malaria criteria. Finally, in this study, 14 malaria-infection were found in the study area. Based on the data obtained from E-SISMAL, the most abundant *Plasmodium* in Tanjung Agung sub-district was *Plasmodium falciparum.*

Reviewer's Comment:

What was the API of the villages from which the samples were selected?

Author's Response:

Thank you for your thoughtful feedback on our manuscript.

Regarding the API issues, the authors have written an introduction for API of District in lines 77 – 87 and discussed the API of PHC in Methods in lines 96 - 140

This current study used additional data from the Electronic Malaria Surveillance Information System [E-SISMAL]. This is based on E-SISMAL, the Annual Parasite Incidence (API) in Muara Enim District over the previous five years. In 2018, the API decreased steadily to 0.33, followed by APIs of 0.16 in 2019 and 0.04 in 2020, respectively. In 2021 declined dramatically to zero; However, in 2022, the API was 0.01. Besides, through E-SISMAL, researchers got a history of vector surveillance, particularly laboratory tests for diagnosing parasitic diseases and types of malaria parasites, useful for the researchers. Rapid Diagnostic Tests (RDT) and microscopy malaria diagnoses were 50% in the study site. Five *Plasmodium* species cause malaria, which is spread by anopheline mosquitoes. *Plasmodium falciparum* and *Plasmodium vivax* provide the most significant threat. In the study area, 85.7% of patients were infected with *Plasmodium falciparum*.

Methods

The cross-sectional survey was carried out in May - July 2022. Cross-sectional studies with binary outcomes evaluated by logistic regression are prevalent in the epidemiology literature[1]. There are twenty sub-districts, ten counties, and 245 villages in Muara Enim District. The purposive method selected Tanjung Lalang, Tanjung Agung, and Penyandingan villages in the Tanjung Agung sub-districts. The study area selection is based on the API of the PHC of Tanjung Agung and information about the area with the most artisanal miner. The Health Office and Muara Enim District Government's webpage provided the data. Finally, the sample selection in each village was carried out by cluster sampling. The study areas are shown in figure 1.

Research variables

The dependent variable was the malaria case, a binary variable indicating whether malaria was present or absent. Respondents are artisanal miners who resided in the study site. The disease definition employed used in this study was malaria infection based on rapid diagnostic tests (RDTs) and microscopy methods documented or reported in the Muara Enim malaria E-SISMAL recommended by WHO as a malaria surveillance tool. Before collecting this data, researchers used a valid and reliable questionnaire. The researchers examined the validity and reliability of the questionnaire on thirty participants from different villages in Darmo village, with participants having the same characteristics as the sample. After obtaining a valid and reliable structured questionnaire, it is subsequently utilized for the sample.

Sample size calculation

The sample size is calculated using the hypothesis test for two population proportions (two-sided test) [2]

$$n = \frac{\left(Z_{1-\frac{a}{2}}\sqrt{2P\,(1-P)} + Z_{1-\beta}\sqrt{P_1(1-P_1)+P_2(1-P_2)}\right)^2}{(P_1-P_2)^2}$$

Samples

This study used a cross-sectional analysis of malaria transmission risk variables among miners. Researchers conducted an interview was applied with 92 miners living in three villages. Based on the API of Tanjung Agung PHC's for five years, the API declined steadily in 2018 to 0.7, followed by 0.49 in 2019 and 0.05 in 2020. In 2021 and 2020, the API in PHC decreased rapidly to zero.

The positive samples for malaria were recorded from a records search conducted after the miners were identified. In this study, the sample of miners, who were malaria positive, was not previously identified by the researcher because the characteristics of the cross-sectional study show the association between risk factors with consequences with data collection carried out simultaneously at the point time approach. RDT and microscopy were carried out to diagnose malaria by health personnel, and the cases were registered in E-SISMAL, Muara Enim District Health Office. Miners who reported that they were positive for malaria were re-crosschecked or confirmed through the data in E-SISMAL. It was found that several respondents said they had been exposed to malaria. However, when they were cross-checked with E-SISMAL data, the respondents' names were not found, so they were not grouped into positive malaria criteria. Finally, in this study, 14 malaria-infection were found in the study

area. Based on the data obtained from E-SISMAL, the most abundant *Plasmodium* in Tanjung Agung sub-district was *Plasmodium falciparum.*

Data analysis

Descriptive analysis

The objective of the descriptive analysis was to characterize the independent variables concerning the dependent variable, malaria prevalence. Using the derived prevalence ratio and adjusted prevalence ratio, the severity of the risk for malaria was evaluated (bi- and multivariate logistic regression test). If the PR was more than one, the probability of developing malaria was increased

Reviewer's Comment:

One of the risk factors identified is 'mosquito breeding,' but no details are provided as to how larval habitats were mapped and identified.

Author's Response:

Thank you for your insightful comments on our manuscript.

Concerning 'mosquito breeding issues,' the authors wrote justified Principal findings in lines 191-239 and Explanatory variables in lines 242-330

Principal findings

It is interesting to study malaria transmission in artisanal mining in line with research found that the people miners in the surrounding forest who work as small-scale miners (ASM) are the population at risk of malaria, including those in the study site.

Many risk factors increase the likelihood of malaria transmission. However, there is limited evidence of malaria transmission in artisanal mining as a unique population in the study site. This current study reveals age and breeding as risk factors for malaria. Besides, high education, mosquito repellent, and eligible house wall conditions were protective factors against malaria in the study site. Multivariate analysis revealed that participants over 35 years were 7.98 times more likely to have malaria than those under 35 years (PR adjusted: 7.98; 95% CI 1.72-37.00; p-value 0.008) after adjusted by education, using repellent, mosquitos breeding, and house wall condition. Besides, mosquito repellent was well associated with a decrease in the risk of malaria (PR adjusted: 0.13; 95% 0.03-0.54; p-value 0.005).
In concordance with the results of other studies, severe malaria presenting symptoms depend on age. Age independently increases illness mortality [3]. Besides, in India, housing factors are linked to malaria in persons over 45 [4].

A similar finding was reported among Brazilian gold miners in an Amazonian border area where the presence of a breeding site was creating artificial breeding areas for vector mosquitoes in mining activity [5]. If breeding sites are sparse, this affects anopheline larval habitats and adult production in the Gambia [6]. Pits and trenches are dug and then abandoned, resulting in stagnant water creates a condition that provides an ideal habitat for mosquito breeding and malaria transmission, exposing the surrounding people [7]. In addition, the association between mosquito breeding and malaria revealed that mosquito breeding (regardless of species) was strongly related to malaria cases in households [8]. Another research in southeastern Nigeria demonstrated that higher education improved

malaria knowledge and practice. Health campaigns can teach malaria causes, symptoms, and control [9].

Furthermore, another study showed that the spread of artemisinin-resistant malaria can only be eliminated if malaria is eradicated from the regio used spatial repellents (SR) [10]. An effort needs to convey the best and most up-to-date information on repellents to improve the scientific community's knowledge [11].

Consistent with the results of other studies, few clinical studies have examined housing and malaria [12]. Few clinical studies have examined housing and malaria [12]. Then, good house construction reduces malaria risk by limiting mosquito vector entry. The house design may explain some of Uganda's malaria transmission heterogeneity and is a promising target for future interventions, even in highly endemic areas [13].

Based on the findings, social, cultural, and environmental factors must be considered in mosquito-borne disease prevention and treatment [14]. Malaria control and prevention interventions prioritize those near mosquito breeding sites, increase bed net use among children under 15, and improve housing [15]. So, launching a malaria health education program and encouraging insecticide-treated bed nets and mosquito repellents are strategies to 'control' malaria to prevent malaria among migrants [16]. Besides, there is a need to regulate mining in these communities and increase malaria control and health education efforts to reduce malaria and encourage health-seeking [17].

Explanatory variables

In this research, a connection between age and malaria was associated with several other studies; some studies show an association between age and malaria, for example, in Malaysian Borneo. In all age groups except five years old, P. knowlesi predominated [18]. Young children's malaria has overshadowed teen malaria. Immunological and hormonal factors may affect younger teens [19]. Another study links age and transmission to severe childhood malaria [20]. Burkina Faso has a high malaria death rate, especially among young children [21]. Most of them conducted study malaria in children. This current research showed that infected study participants who worked in artisanal mining ranged in age from 18 to 65, averaging 43, and were exposed to malaria, with the majority (61.96%) being 35 years old.

This study revealed the importance of the presence of a mosquito breeding site. In Kenya, malaria prevalence was strongly correlated with the density of breeding sites [8]. Gem mining pits and aquatic habitats in Moneragala may increase malaria vector breeding [22]. Mosquito breeding sites near homes are common in sub-Saharan Africa and cause malaria infection [23]. Another study found that changes in land cover are a major cause of African highland temperature rise and malaria vector colonization. It has also increased sporogony development rate, adult vector survival, and malaria risk in the highlands [24]. Furthermore, eliminating puddles and removing breeding sites and marshes can drastically lower Anopheles mosquito populations [25]. Therefore, it was recommended that mosquito breeding places be eliminated [26].

This current research indicates knowledge connected with malaria transmission in people's mines study sites. In line with some studies, education has been related to malaria prevention. Another study demonstrated that community health education is essential to modern malaria control [27]. Another paper showed asymptomatic and *falciparum* malaria parasites correlated with academic performance in Donéguébougou, Mali [28]. This research aligns with the study that analyzed nomad groups' knowledge and views of malaria and preventive strategies [29]. Another study compared malaria of knowledge, attitudes, and practices (KAP) in three endemic Colombian communities to develop new intervention strategies for malaria elimination [30].

Similarly, in Tengchong County, Yunnan Province, China, Imported cases, low education, lack of mosquito bite treatment, and risky behaviors contribute to their high malaria incidence [31]. In line with this current research conducted in artisanal mining indicated that the respondents have low educational levels, and it there is a need to improve specific knowledge regarding the prevention of malaria transmission. In addition, broad-based programs may need to target inequalities to increase understanding, prevention, and treatment among the most vulnerable populations to enhance malaria reduction efforts [32]. For malaria elimination, accurate community knowledge and fast treatment-seeking behavior for early diagnosis and treatment are essential [33]. Access and adherence to artemisinin-based combination therapy (ACT) are crucial obstacles to the development of successful malaria treatment that are influenced by patient knowledge, attitudes, and beliefs [34].

Some studies show that the use of malaria repellents has an effect on malaria. In Africa, using insect-repellent plants (IRPs) is a centuries-old practice [35]. A study in Ethiopia looked at insect/mosquito repellent plants used by 97.2% of respondents. Hamlets have traditionally used insect/mosquito-repellent plants [36]. Besides, Ethiopians who use traditional repellent plants can potentially reduce vector-borne diseases [37]. However, another study presented that those topical repellents, on the other hand, did not affect malaria endemicity in the Greater Mekong subregion. It is difficult to use repellents daily [38]. People have used a variety of mosquito repellents, including liquid vaporizers, coils, and mats, to protect themselves from mosquitoes and the diseases they carry [39]. A laboratory study evaluated Tedh's repellency against the Afro-tropical malarial vector. Because Tedh essential oil is safe and inexpensive, it could be used to reduce the burden of insect-transmitted diseases, especially malaria [40]. Another study demonstrated the need to strengthen *Plasmodium* infection prevention and control strategies, specifically by changing the practice of spending the night in the forest and increasing personal mosquito repellent [41]. Mosquito coils are popular in malaria-endemic countries [42]. This current study demonstrated that more miners had a poor level of education (65.22%), did not use insect repellent (53.26%), and had a habit of leaving their homes at night (61.96%), so these are risk factors for malaria. Outdoor miners are also more prone to mosquito bites.

House modifications may effectively reduce malaria: This is being revisited, with new research now examining blocking house mosquito entry points or modifying house construction materials to minimize inhabitants' exposure to infectious bites [43]. House screening may reduce mosquito density. Sometimes, screening with insecticide and lure-and-kill devices has reduced malaria parasite prevalence and anemia [44]. Human habitation and living environment are often linked to malaria risk and endemicity. Malaria disappeared from

areas where it had been endemic for centuries, such as southern England's coast, due to better housing. Malaria transmission stopped in England without killing mosquitoes [45]. In Baringo County, researchers compared house structures and malaria vector abundance. Malaria vectors prefer open eaves. Grass-thatched roofs had more malaria vectors than metal ones. Due to their varied structures, riverine houses were linked to malaria vector abundance. Screening eaves, improving building materials, and building on stilts can reduce indoor malaria vector density [46]. Mosquito entry and indoor climate are affected by rural housing. Malaria vectors were kept out of metal-roofed houses with closed eaves by screened doors and ventilation in Sub-Saharan Africa [47]. Door and window screening may reduce disease transmission.

Furthermore, housing is a risk factor for malaria, despite low-quality evidence. Future research should evaluate the protective effect of specific house features and incremental housing improvements [48]. This current study demonstrated that the presence of breeding sites indicates that more mining workers are at risk (60.87%), as is the availability of resting areas (65.22%) and the state of the house's walls (61.96%), and the ceiling (55.40%). Another study examined the concept that better housing can reduce malaria. Modern houses showed 47% lower malaria infection rates than traditional houses [49]. Another study site denoted that malaria transmission has multiple causes. In Ghana, poor sanitation, low socio-economic status, building construction, and individual behaviors were multiple causes of high malaria prevalence [50].

Reviewer's Comment:

Were only anopheles habitats included? Were anopheles larvae present in the habitats identified? If so, were the larvae reared and identified to species?

Author's Response:

Thank you for your valuable input on our manuscript.

Concerning the issue, we made it in limitations of research in lines 333-344.

Malaria disease status was determined retrospectively by E-SISMAL data and not directly by researchers' diagnoses. Thus, malaria prevalence could only be determined from respondents who reported having had a professional malaria diagnosis. There may be additional factors affecting malaria transmission in the study area that E-SISMAL did not record; these could be the topic of future research. In this study, investigators not conduct vector survey methods for larvae and adult anopheles, nor did they perform a Human Landing Catch. These are the most important methods for detecting which Anopheles species attack humans (HLC). Nonetheless, the present study has the advantage of being based on E-SISMAL, one of the WHO-recommended techniques for malaria surveillance, and employing a structured questionnaire. The findings highlight risk variables for malaria transmission that could be used in the future design of malaria control programs, at least in the artisanal mining in three villages within the sub-district of Tanjung Agung.

Reviewer's Comment:

It seems clear that the malaria-positive miners were identified as such via the MOH's malaria database, E-SISMAL. Was a records search conducted after the miners were identified, or was a sample of malaria-positive miners identified beforehand?

Author's Response:

Thank you for your valuable input on our manuscript

Concerning the problem, we addressed it in lines 77-87.

This current study used additional data from the Electronic Malaria Surveillance Information System [E-SISMAL]. This is based on E-SISMAL, the Annual Parasite Incidence (API) in Muara Enim District over the previous five years. In 2018, the API decreased steadily to 0.33, followed by APIs of 0.16 in 2019 and 0.04 in 2020, respectively. In 2021 declined dramatically to zero; However, in 2022, the API was 0.01. Besides, through E-SISMAL, researchers got a history of vector surveillance, particularly laboratory tests for diagnosing parasitic diseases and types of malaria parasites, useful for the researchers. Rapid Diagnostic Tests (RDT) and microscopy malaria diagnoses were 50% in the study site. Five *Plasmodium* species cause malaria, which is spread by anopheline mosquitoes. *Plasmodium falciparum* and *Plasmodium vivax* provide the most significant threat. In the study area, 85.7% of patients were infected with *Plasmodium falciparum*.

Concerning the problem, we addressed it in lines 128-140.

The positive samples for malaria were a records search conducted after the miners were identified. In this study, the sample of miners, malaria positive, was not previously identified by the researcher because of the design of the study. A cross-sectional survey was conducted on 92 participants living in three villages. Sampling method, in which scores were obtained at one point in time. RDT and microscopy were carried out to diagnose malaria by health personnel, and the cases were registered in E-SISMAL, Muara Enim District Health Office. The author identified issues after the respondent experienced malaria and conducted survey research in that area. Miners who say that malaria is positive are re-crosschecked or confirmed through the data in E-SISMAL. It was found that several respondents said they had been exposed to malaria. However, when they were cross-checked with E-SISMAL data, the respondents' names were not found, so they were not grouped into positive malaria criteria. Finally, in this study, 14 malaria-infection were found in the study area. Based on the data obtained from E-SISMAL, the most abundant Plasmodium in Tanjung Agung sub-district is *Plasmodium falciparum*.

Reviewer's Comment:

Of the 14 malaria-positive miners, with what species were they infected? E-SISMAL may have case investigation results – if so, were the cases found to be indigenous or imported? If the cases were vivax malaria, then some consideration ought to be given to the possibility that these are relapse cases.

Author's Response:

Thank you for your valuable feedback on our manuscript.
In terms of the issue, we addressed it in lines 138-140.

Finally, in this study, 14 malaria-infection were found in the study area. Based on the data obtained from E-SISMAL, the most abundant *Plasmodium* in Tanjung Agung sub-district was *Plasmodium falciparum.*

Reviewer's Comment:

The authors make offhand reference to P. knowlesi in both the introduction and discussion. Were some of the cases indeed knowlesi infections? If so, this is important to impart this to the reader. If not, then suggest omitting references to this parasite, as Indonesia's elimination program is focused upon human malaria. To my knowledge, recording of knowlesi cases in E-SISMAL is uncommon at present.

Author's Response:

Thank you for your valuable input on our manuscript.

Based on E-SISMAL data for 2018 – 2022, revealing that in the study area, 60% of patients were infected with ***Plasmodium falciparum***, 24% were infected with ***Plasmodium vivax,*** and 15.6% were infected with ***Plasmodium mix.*** and we have deleted information about *P. knowlesi* in study area

In terms of the issue, we addressed it in lines 138-140.

Finally, in this study, 14 malaria-infection were found in the study area. Based on the data obtained from E-SISMAL, the most abundant *Plasmodium* in Tanjung Agung sub-district was *Plasmodium falciparum.*

Reviewer's Comment:

The discussion is unfocused and should revolve around malaria transmission in similar circumstances in Indonesia and elsewhere. We have reference to high endemic Kenya, zero-transmission Sri Lanka, China, Ethiopia, and multiple additional countries, but there is no theme to the discussion – it is just a list of papers. The purpose of the discussion is to show how the results of the present study inform and complement existing research. The authors should reformulate the discussion to this end.

Author's Response:

Thank you for your valuable input on our manuscript. We appreciate your positive thoughts and recommendation.

We addressed the issue in the Discussion, Principal findings, and Explanatory variables lines 191 - 330.

Discussion

Principal findings

It is interesting to study malaria transmission in artisanal mining in line with research found that the people miners in the surrounding forest who work as small-scale miners (ASM) are the population at risk of malaria, including those in the study site.

Many risk factors increase the likelihood of malaria transmission. However, there is limited evidence of malaria transmission in artisanal mining as a unique population in the study site. This current study reveals age and breeding as risk factors for malaria. Besides, high education, mosquito repellent, and eligible house wall conditions were protective factors against malaria in the study site. Multivariate analysis revealed that participants over 35 years were 7.98 times more likely to have malaria than those under 35 years (PR adjusted: 7.98; 95% CI 1.72-37.00; p-value 0.008) after adjusted by education, using repellent, mosquitos breeding, and house wall condition. Besides, mosquito repellent was well associated with a decrease in the risk of malaria (PR adjusted: 0.13; 95% 0.03-0.54; p-value 0.005).
In concordance with the results of other studies, severe malaria presenting symptoms depend on age. Age independently increases illness mortality [3]. Besides, in India, housing factors are linked to malaria in persons over 45 [4].

A similar finding was reported among Brazilian gold miners in an Amazonian border area where the presence of a breeding site was creating artificial breeding areas for vector mosquitoes in mining activity [5]. If breeding sites are sparse, this affects anopheline larval habitats and adult production in the Gambia [6]. Pits and trenches are dug and then abandoned, resulting in stagnant water creates a condition that provides an ideal habitat for mosquito breeding and malaria transmission, exposing the surrounding people [7]. In addition, the association between mosquito breeding and malaria revealed that mosquito breeding (regardless of species) was strongly related to malaria cases in households [8]. Another research in southeastern Nigeria demonstrated that higher education improved malaria knowledge and practice. Health campaigns can teach malaria causes, symptoms, and control [9].

Furthermore, another study showed that the spread of artemisinin-resistant malaria can only be eliminated if malaria is eradicated from the regio used spatial repellents (SR) [10]. An effort needs to convey the best and most up-to-date information on repellents to improve the scientific community's knowledge [11].

Consistent with the results of other studies, few clinical studies have examined housing and malaria [12]. Few clinical studies have examined housing and malaria [12]. Then, good house construction reduces malaria risk by limiting mosquito vector entry. The house design may explain some of Uganda's malaria transmission heterogeneity and is a promising target for future interventions, even in highly endemic areas [13].

Based on the findings, social, cultural, and environmental factors must be considered in mosquito-borne disease prevention and treatment [14]. Malaria control and prevention

interventions prioritize those near mosquito breeding sites, increase bed net use among children under 15, and improve housing [15]. So, launching a malaria health education program and encouraging insecticide-treated bed nets and mosquito repellents are strategies to 'control' malaria to prevent malaria among migrants [16]. Besides, there is a need to regulate mining in these communities and increase malaria control and health education efforts to reduce malaria and encourage health-seeking [17].

Explanatory variables

In this research, a connection between age and malaria was associated with several other studies; some studies show an association between age and malaria, for example, in Malaysian Borneo. In all age groups except five years old, P. knowlesi predominated [18]. Young children's malaria has overshadowed teen malaria. Immunological and hormonal factors may affect younger teens [19]. Another study links age and transmission to severe childhood malaria [20]. Burkina Faso has a high malaria death rate, especially among young children [21]. Most of them conducted study malaria in children. This current research showed that infected study participants who worked in artisanal mining ranged in age from 18 to 65, averaging 43, and were exposed to malaria, with the majority (61.96%) being 35 years old.

This study revealed the importance of the presence of a mosquito breeding site. In Kenya, malaria prevalence was strongly correlated with the density of breeding sites [8]. Gem mining pits and aquatic habitats in Moneragala may increase malaria vector breeding [22]. Mosquito breeding sites near homes are common in sub-Saharan Africa and cause malaria infection [23]. Another study found that changes in land cover are a major cause of African highland temperature rise and malaria vector colonization. It has also increased sporogony development rate, adult vector survival, and malaria risk in the highlands [24]. Furthermore, eliminating puddles and removing breeding sites and marshes can drastically lower Anopheles mosquito populations [25]. Therefore, it was recommended that mosquito breeding places be eliminated [26].

This current research indicates knowledge connected with malaria transmission in people's mines study sites. In line with some studies, education has been related to malaria prevention. Another study demonstrated that community health education is essential to modern malaria control [27]. Another paper showed asymptomatic and *falciparum* malaria parasites correlated with academic performance in Donéguébougou, Mali [28]. This research aligns with the study that analyzed nomad groups' knowledge and views of malaria and preventive strategies [29]. Another study compared malaria of knowledge, attitudes, and practices (KAP) in three endemic Colombian communities to develop new intervention strategies for malaria elimination [30].

Similarly, in Tengchong County, Yunnan Province, China, Imported cases, low education, lack of mosquito bite treatment, and risky behaviors contribute to their high malaria incidence [31]. In line with this current research conducted in artisanal mining indicated that the respondents have low educational levels, and it there is a need to improve specific knowledge regarding the prevention of malaria transmission. In addition, broad-based programs may need to target inequalities to increase understanding, prevention, and treatment among the most vulnerable populations to enhance malaria reduction efforts [32]. For malaria elimination, accurate community knowledge and fast treatment-seeking behavior for early diagnosis and treatment are essential [33]. Access and adherence to artemisinin-based combination therapy (ACT) are crucial obstacles to the development of successful malaria treatment that are influenced by patient knowledge, attitudes, and beliefs [34].

Some studies show that the use of malaria repellents has an effect on malaria. In Africa, using insect-repellent plants (IRPs) is a centuries-old practice [35]. A study in Ethiopia looked at insect/mosquito repellent plants used by 97.2% of respondents. Hamlets have traditionally used insect/mosquito-repellent plants [36]. Besides, Ethiopians who use traditional repellent plants can potentially reduce vector-borne diseases [37]. However, another study presented that those topical repellents, on the other hand, did not affect malaria endemicity in the Greater Mekong subregion. It is difficult to use repellents daily [38]. People have used a variety of mosquito repellents, including liquid vaporizers, coils, and mats, to protect themselves from mosquitoes and the diseases they carry [39]. A laboratory study evaluated Tedh's repellency against the Afro-tropical malarial vector. Because Tedh essential oil is safe and inexpensive, it could be used to reduce the burden of insect-transmitted diseases, especially malaria [40]. Another study demonstrated the need to strengthen *Plasmodium* infection prevention and control strategies, specifically by changing the practice of spending the night in the forest and increasing personal mosquito repellent [41]. Mosquito coils are popular in malaria-endemic countries [42]. This current study demonstrated that more miners had a poor level of education (65.22%), did not use insect repellent (53.26%), and had a habit of leaving their homes at night (61.96%), so these are risk factors for malaria. Outdoor miners are also more prone to mosquito bites.

House modifications may effectively reduce malaria: This is being revisited, with new research now examining blocking house mosquito entry points or modifying house construction materials to minimize inhabitants' exposure to infectious bites [43]. House screening may reduce mosquito density. Sometimes, screening with insecticide and lure-and-kill devices has reduced malaria parasite prevalence and anemia [44]. Human habitation and living environment are often linked to malaria risk and endemicity. Malaria disappeared from areas where it had been endemic for centuries, such as southern England's coast, due to better housing. Malaria transmission stopped in England without killing mosquitoes [45]. In Baringo County, researchers compared house structures and malaria vector abundance. Malaria vectors prefer open eaves. Grass-thatched roofs had more malaria vectors than metal ones. Due to their varied structures, riverine houses were linked to malaria vector abundance. Screening eaves, improving building materials, and building on stilts can reduce indoor malaria vector density [46]. Mosquito entry and indoor climate are affected by rural housing. Malaria vectors were kept out of metal-roofed houses with closed eaves by screened doors and ventilation in Sub-Saharan Africa [47]. Door and window screening may reduce disease transmission.

Furthermore, housing is a risk factor for malaria, despite low-quality evidence. Future research should evaluate the protective effect of specific house features and incremental housing improvements [48]. This current study demonstrated that the presence of breeding sites indicates that more mining workers are at risk (60.87%), as is the availability of resting areas (65.22%) and the state of the house's walls (61.96%), and the ceiling (55.40%). Another study examined the concept that better housing can reduce malaria. Modern houses showed 47% lower malaria infection rates than traditional houses [49]. Another study site denoted that malaria transmission has multiple causes. In Ghana, poor sanitation, low socio-economic status, building construction, and individual behaviors were multiple causes of high malaria prevalence [50].

Author's Response to the Reviewer's Comment

Reviewer 2

Manuscript no:
Risk Factors of Malaria Transmission Among Mining Workers at Muara Enim, South Sumatra, Indonesia."

Attachments:
• https://reviewer-feedback.nature.com/download/attachment/0cb9eb51-88eb-4b7e-b484-06c692c9ccab

Reviewer's Comment:

General comment:
The authors analyse risk factors associated with malaria transmission among mining workers in South Sumatra Province, an interesting issue that represent one of the residual malaria foci in the western part of Indonesia and may deserve publication if the manuscript is systematically written and the following major caveats are addressed:

1. Introduction: Additional information regarding the malaria situation in the study site and history of vector surveillance may add clarity to the aim of the study

Author's Response:

Thank you for your valuable input on our manuscript. We have taken your suggestion with additional information regarding the malaria situation at the study site.

We addressed the issue in background lines 45-93.

Malaria infects around 200 million people and kills 400,000 yearly in 90 countries. The World Health Organization (WHO) has set a target of eliminating malaria in 35 countries by 2030 [51]. The elimination of malaria by 2030 is stated in the third goal of the Sustainable Development Goals (SDGs). On the other hand, malaria is a significant public health issue in Indonesia. Malaria is still endemic in the area surrounding Muara Enim, South Sumatra [52-56].

This current study used additional data from the Electronic Malaria Surveillance Information System [E-SISMAL]. This is based on E-SISMAL, the Annual Parasite Incidence (API) in Muara Enim District over the previous five years. In 2018, the API decreased steadily to 0.33, followed by APIs of 0.16 in 2019 and 0.04 in 2020, respectively. In 2021 declined dramatically to zero; However, in 2022, the API was 0.01. Besides, through E-SISMAL, researchers got a history of vector surveillance, particularly laboratory tests for diagnosing parasitic diseases and types of malaria parasites, useful for the researchers. Rapid Diagnostic Tests (RDT) and microscopy malaria diagnoses were 50% in the study site. Five *Plasmodium* species cause malaria, which is spread by anopheline mosquitoes. *Plasmodium falciparum* and *Plasmodium vivax* provide the most significant threat. In the study area, 85.7% of patients were infected with *Plasmodium falciparum*.

Coal mining, plantations, agriculture, and fisheries Muara Enim is suitable for *Anopheles* mosquito breeding sites such as ponds, rice fields, ditches, and former open pit mines. This condition triggers malaria in Muara Enim. Irrigation channels, rice fields, paddy water flow, fishponds, buffalo pools, marshes, and lakes are *Anopheles* habitats. *Anopheles barbisrostris*, *An. tesselatus*, *An. subpictus*, *An. nigerrimus*, *An. kochi*, *An. umbrosus*, *An. barbumbrosus*, and *An. maculatus* was captured [57]. Other risk factors that cause malaria include artisanal mining's socio-economic and behavioral drivers of malaria among gold mining, rubber, and oil palm migrant workers [16]. Malaria and anemia are more prevalent in artisanal mining communities of East Akim District than in non-artisanal sites [17]. Land use changes impact malaria spread by disrupting ecosystems [58, 59]. In one study, age, gender, degree of education, season, and temperature were examples of attributes relevant to malaria transmission [60]. Research has consistently shown that these malaria vectors thrive in mined areas. Studi offers malaria transmission in the mining area in Western Kenya Highlands [61]. In Aceh, Indonesian miners risked malaria [62]. Small-scale mining is a serious risk for malaria, including in Chinese miners [63]. This research aligns with the study that other mining areas are susceptible to malaria and can reintroduce malaria into sensitive areas [64]. Despite being a malaria elimination priority population, little is known about miners and malaria in Guyana's hinterland [65]. Although some research has been carried out on malaria transmission in artisanal mining, no single study exists which malaria transmission in the study site.

No previous study has investigated malaria transmission in the Tanjung Agung sub-district, which had the most malaria cases in the past three years (2018-2020). Puskesmas or Primary Health Care (PHC) of Tanjung Enim had the most issues in their operational areas. Therefore, this study aims to analyze the risk factors associated with malaria transmission among mining employees in the Tanjung Agung Sub-District of the Muara Enim District.

Reviewer's Comment:

Methods: The authors seem to use malaria case definition using the electronic malaria case data (E-SISMAL) at the primary health center. If this true, the authors have to declare it as it. Avoid to detail unnecessary things such as sample size as it may refer to previous publication.

Author's Response:

Thank you for your comments. We appreciate your positive thoughts and recommendation
In lines 89-93, we provided our response to the issue.

No previous study has investigated malaria transmission in the Tanjung Agung sub-district, which had the most malaria cases in the past three years (2018-2020). Puskesmas or Primary Health Care (PHC) of Tanjung Enim had the most issues in their operational areas. Therefore, this study aims to analyze the risk factors associated with malaria transmission among mining employees in the Tanjung Agung Sub-District of the Muara Enim District.

In lines 107-117, we provided our response to the issue.

The dependent variable was the malaria case, a binary variable indicating whether malaria was present or absent. Respondents are artisanal miners who resided in the study site. The

disease definition employed used in this study was malaria infection based on rapid diagnostic tests (RDTs) and microscopy methods documented or reported in the Muara Enim malaria E-SISMAL recommended by WHO as a malaria surveillance tool. Before collecting this data, researchers used a valid and reliable questionnaire. The researchers examined the validity and reliability of the questionnaire on thirty participants from different villages in Darmo village, with participants having the same characteristics as the sample. After obtaining a valid and reliable structured questionnaire, it is subsequently utilized for the sample.

In lines 123–127, we provided our response to the issue.

This study used a cross-sectional analysis of malaria transmission risk variables among miners. Researchers conducted an interview was applied with 92 miners living in three villages. Based on the API of Tanjung Agung PHC's for five years, the API declined steadily in 2018 to 0.7, followed by 0.49 in 2019 and 0.05 in 2020. In 2021 and 2020, the API in PHC decreased rapidly to zero.

As suggested by the reviewer, we have removed unnecessary things, such as sample size, as it may refer to the previous publication in this study

Reviewer's Comment:

The authors should also provide methods used for vector surveillance such as larva and adult's anopheles. The authors seem did not perform the most important method to determine which anopheles' species that come to bite human, Human Landing catch (HLC).

In this study, investigators didn't disclose vector survey methods like larvae and adult anopheles, nor did they perform a Human Landing Catch. Although, the most important method for detecting which Anopheles species attack humans (HLC). However, the researchers used additional E-SISMAL data recommended by WHO to describe malaria surveillance in this study site. So, the author convinces the reader that the malaria case in this current study was positive for malaria based on microscopic and RDT examination by health professionals.

We responded in lines 333–344 of Research Limitations
Malaria disease status was determined retrospectively by E-SISMAL data and not directly by researchers' diagnoses. Thus, malaria prevalence could only be determined from respondents who reported having had a professional malaria diagnosis. There may be additional factors affecting malaria transmission in the study area that E-SISMAL did not record; these could be the topic of future research. In this study, investigators not conduct vector survey methods for larvae and adult anopheles, nor did they perform a Human Landing Catch. These are the most important methods for detecting which Anopheles species attack humans (HLC). Nonetheless, the present study has the advantage of being based on E-SISMAL, one of the WHO-recommended techniques for malaria surveillance, and employing a structured questionnaire. The findings highlight risk variables for malaria transmission that could be used in the future design of malaria control programs, at least in the artisanal mining in three villages within the sub-district of Tanjung Agung.

Reviewer's Comment:

The authors need to rewrite the manuscript systematically along the study aim and provide additional data to strengthen the claim of malaria transmission in the study site.

Author's Response:

Thank you for pointing this out. We appreciate your positive thoughts and recommendation
The authors have rewritten the manuscript systematically along the study aim and provide additional data to strengthen the claim of malaria transmission in the study site.

We responded in whole un revise manuscript

Reviewer's Comment:

Recommendation. Reconsideration after rewriting

Author's Response:

Thank you for pointing this out. We appreciate your positive thoughts and recommendation
We hope that after revising, the manuscript can be published in the malaria journal.

References

1. Barros AJD, Hirakata VN: **Alternatives for logistic regression in cross-sectional studies: an empirical comparison of models that directly estimate the prevalence ratio.** *BMC Medical Research Methodology* 2003, **3:**21.
2. Lwanga SK, Lemeshow S, Organization WH: *Sample size determination in health studies: a practical manual.* World Health Organization; 1991.
3. Dondorp AM, Lee SJ, Faiz MA, Mishra S, Price R, Tjitra E, Than M, Htut Y, Mohanty S, Yunus EB, et al: **The relationship between age and the manifestations of and mortality associated with severe malaria.** *Clin Infect Dis* 2008, **47:**151-157.
4. Mohan I, Kodali NK, Chellappan S, Karuppusamy B, Behera SK, Natarajan G, Balabaskaran Nina P: **Socio-economic and household determinants of malaria in adults aged 45 and above: analysis of longitudinal ageing survey in India, 2017–2018.** *Malaria Journal* 2021, **20:**306.
5. Murta FL, Marques LL, Santos AP, Batista TS, Mendes MO, Silva ED, Neto AV, Fabiano M, Rodovalho SR, Monteiro WM: **Perceptions about malaria among Brazilian gold miners in an Amazonian border area: perspectives for malaria elimination strategies.** *Malaria journal* 2021, **20:**1-14.
6. Fillinger U, Sombroek H, Majambere S, van Loon E, Takken W, Lindsay SW: **Identifying the most productive breeding sites for malaria mosquitoes in The Gambia.** *Malaria Journal* 2009, **8:**62.
7. Organization WH: **Environmental and occupational health hazards associated with artisanal and small-scale gold mining.** 2016.
8. Thomas S, Ravishankaran S, Asokan A, Johnson Amala Justin NA, Maria Jusler Kalsingh T, Mathai MT, Valecha N, Eapen A: **Socio-demographic and household attributes may not necessarily influence malaria: evidence from a cross sectional study of households in an urban slum setting of Chennai, India.** *Malaria Journal* 2018, **17:**4.
9. Dike N, Onwujekwe O, Ojukwu J, Ikeme A, Uzochukwu B, Shu E: **Influence of education and knowledge on perceptions and practices to control malaria in Southeast Nigeria.** *Soc Sci Med* 2006, **63:**103-106.
10. Charlwood JD, Hall T, Nenhep S, Rippon E, Branca-Lopes A, Steen K, Arca B, Drakeley C: **Spatial repellents and malaria transmission in an endemic area of Cambodia with high mosquito net usage.** *Malariaworld J* 2017, **8:**11.
11. Islam J, Zaman K, Duarah S, Raju PS, Chattopadhyay P: **Mosquito repellents: An insight into the chronological perspectives and novel discoveries.** *Acta Tropica* 2017, **167:**216-230.
12. Sikalima J, Schue JL, Hill SE, Mulenga M, Handema R, Daka V, Chileshe J, Kasongo W, Chaponda M, Bukasa Kabuya JB, et al: **House Structure Is Associated with Malaria among Febrile Patients in a High-Transmission Region of Zambia.** *Am J Trop Med Hyg* 2021, **104:**2131-2138.
13. Wanzirah H, Tusting LS, Arinaitwe E, Katureebe A, Maxwell K, Rek J, Bottomley C, Staedke SG, Kamya M, Dorsey G, Lindsay SW: **Mind the gap: house structure and the risk of malaria in Uganda.** *PLoS One* 2015, **10:**e0117396.

14. Moshi IR, Manderson L, Ngowo HS, Mlacha YP, Okumu FO, Mnyone LL: **Outdoor malaria transmission risks and social life: a qualitative study in South-Eastern Tanzania.** *Malaria Journal* 2018, **17:**397.
15. Gari T, Solomon T, Lindtjørn B: **Older children are at increased risk of Plasmodium vivax in south-central Ethiopia: a cohort study.** *Malar J* 2021, **20:**251.
16. Soe HZ, Thi A, Aye NN: **Socioeconomic and behavioural determinants of malaria among the migrants in gold mining, rubber and oil palm plantation areas in Myanmar.** *Infect Dis Poverty* 2017, **6:**142.
17. Dao F, Djonor SK, Ayin CT, Adu GA, Sarfo B, Nortey P, Akuffo KO, Danso-Appiah A: **Burden of malaria in children under five and caregivers' health-seeking behaviour for malaria-related symptoms in artisanal mining communities in Ghana.** *Parasit Vectors* 2021, **14:**418.
18. Barber BE, William T, Dhararaj P, Anderios F, Grigg MJ, Yeo TW, Anstey NM: **Epidemiology of Plasmodium knowlesi malaria in north-east Sabah, Malaysia: family clusters and wide age distribution.** *Malar J* 2012, **11:**401.
19. Lalloo DG, Olukoya P, Olliaro P: **Malaria in adolescence: burden of disease, consequences, and opportunities for intervention.** *Lancet Infect Dis* 2006, **6:**780-793.
20. Ilunga-Ilunga F, Levêque A, Dramaix M: **[Influence of the age and the level of transmission on the clinical and biological expression of severe malaria in children].** *Arch Pediatr* 2016, **23:**455-460.
21. Zoungrana A, Chou YJ, Pu C: **Socioeconomic and environment determinants as predictors of severe malaria in children under 5 years of age admitted in two hospitals in Koudougou district, Burkina Faso: a cross sectional study.** *Acta Trop* 2014, **139:**109-114.
22. Hewavitharane M, Ranawaka G, Saparamadu M, Premaratne R, Jayasooriya HTR: *Prevalence and bionomics of Anopheles species in a gem mining area in Moneragala District of Sri Lanka.*2017.
23. Imbahale SS, Fillinger U, Githeko A, Mukabana WR, Takken W: **An exploratory survey of malaria prevalence and people's knowledge, attitudes and practices of mosquito larval source management for malaria control in western Kenya.** *Acta Trop* 2010, **115:**248-256.
24. Kweka EJ, Kimaro EE, Munga S: **Effect of deforestation and land use changes on mosquito productivity and development in Western Kenya Highlands: implication for malaria risk.** *Frontiers in Public Health* 2016, **4:**238.
25. Mattah PAD, Futagbi G, Amekudzi LK, Mattah MM, de Souza DK, Kartey-Attipoe WD, Bimi L, Wilson MD: **Diversity in breeding sites and distribution of Anopheles mosquitoes in selected urban areas of southern Ghana.** *Parasites & vectors* 2017, **10:**1-15.
26. Takarinda KP, Nyadundu S, Govha E, Gombe NT, Chadambuka A, Juru T, Tshimanga M: **Factors associated with a malaria outbreak at Tongogara refugee camp in Chipinge District, Zimbabwe, 2021: a case–control study.** *Malaria Journal* 2022, **21:**94.
27. Huang F, Wang XD, Jiang L, Qiu HY: **[Evaluation of the effectiveness of community health education for the prevention and control of retransmission of imported malaria in Zhangjiagang City].** *Zhongguo Xue Xi Chong Bing Fang Zhi Za Zhi* 2021, **33:**308-310.

28. Thuilliez J, Sissoko MS, Toure OB, Kamate P, Berthélemy JC, Doumbo OK: **Malaria and primary education in Mali: a longitudinal study in the village of Donéguébougou.** *Soc Sci Med* 2010, **71:**324-334.
29. Moukénet A, Honoré B, Smith H, Moundiné K, Djonkamla W-M, Richardson S, Dormbaye M, Ngarasta N, Seck I: **Knowledge and social beliefs of malaria and prevention strategies among itinerant Nomadic Arabs, Fulanis and Dagazada groups in Chad: a mixed method study.** *Malaria Journal* 2022, **21:**56.
30. Forero DA, Chaparro PE, Vallejo AF, Benavides Y, Gutiérrez JB, Arévalo-Herrera M, Herrera S: **Knowledge, attitudes and practices of malaria in Colombia.** *Malaria Journal* 2014, **13:**165.
31. Li C, Wu X, Cheng X, Fan C, Li Z, Fang H, Shi C: **Identification and analysis of vulnerable populations for malaria based on K-prototypes clustering.** *Environmental Research* 2019, **176:**108568.
32. Clouston SAP, Yukich J, Anglewicz P: **Social inequalities in malaria knowledge, prevention and prevalence among children under 5 years old and women aged 15–49 in Madagascar.** *Malaria Journal* 2015, **14:**499.
33. Hasabo EA, Khalid RI, Mustafa GE, Taha RE, Abdalla RS, Mohammed RA, Haroun MS, Adil R, Khalil RA, Mansour RM, et al: **Treatment-seeking behaviour, awareness and preventive practice toward malaria in Abu Ushar, Gezira state, Sudan: a household survey experience from a rural area.** *Malaria Journal* 2022, **21:**182.
34. Banek K, Webb EL, Doogue EB, Smith SJ, Chandramohan D, Staedke SG: **Factors associated with access and adherence to artemisinin-based combination therapy (ACT) for children under five: a secondary analysis of a national survey in Sierra Leone.** *Malaria Journal* 2021, **20:**56.
35. Karunamoorthi K, Hailu T: **Insect repellent plants traditional usage practices in the Ethiopian malaria epidemic-prone setting: an ethnobotanical survey.** *J Ethnobiol Ethnomed* 2014, **10:**22.
36. Karunamoorthi K, Adane M, Fentahun W: **Assessment of knowledge and usage custom of traditional insect/mosquito repellent plants in Addis Zemen Town, South Gonder, North Western Ethiopia.** *Journal of Ethnopharmacology* 2009, **121:**49-53.
37. Karunamoorthi K, Ilango K, Endale A: **Ethnobotanical survey of knowledge and usage custom of traditional insect/mosquito repellent plants among the Ethiopian Oromo ethnic group.** *Journal of Ethnopharmacology* 2009, **125:**224-229.
38. Sluydts V, Durnez L, Heng S, Gryseels C, Canier L, Kim S, Van Roey K, Kerkhof K, Khim N, Mao S, et al: **Efficacy of topical mosquito repellent (picaridin) plus long-lasting insecticidal nets versus long-lasting insecticidal nets alone for control of malaria: a cluster randomised controlled trial.** *The Lancet Infectious Diseases* 2016, **16:**1169-1177.
39. Naz M, Rehman N, Nazam Ansari M, Kamal M, Ganaie MA, Awaad AS, Alqasoumi SI: **Comparative study of subchronic toxicities of mosquito repellents (coils, mats and liquids) on vital organs in Swiss albino mice.** *Saudi Pharmaceutical Journal* 2019, **27:**348-353.
40. Kaliyaperumal K, Askual G, Samuel Fekadu H: **Mosquito repellent activity of essential oil of Ethiopian ethnomedicinal plant against Afro-tropical malarial vector Anopheles arabiensis.** *Journal of King Saud University - Science* 2014, **26:**305-310.

41. Chin AZ, Avoi R, Atil A, Awang Lukman K, Syed Abdul Rahim SS, Ibrahim MY, Ahmed K, Jeffree MS: **Risk factor of plasmodium knowlesi infection in Sabah Borneo Malaysia, 2020: A population-based case-control study.** *PLoS One* 2021, **16:**e0257104.
42. Hogarh JN, Antwi-Agyei P, Obiri-Danso K: **Application of mosquito repellent coils and associated self-reported health issues in Ghana.** *Malaria Journal* 2016, **15:**61.
43. Furnival-Adams J, Olanga EA, Napier M, Garner P: **House modifications for preventing malaria.** *Cochrane Database Syst Rev* 2021, **1:**Cd013398.
44. Fox T, Furnival-Adams J, Chaplin M, Napier M, Olanga EA: **House modifications for preventing malaria.** *Cochrane Database Syst Rev* 2022, **10:**Cd013398.
45. Jumbam DT, Stevenson JC, Matoba J, Grieco JP, Ahern LN, Hamainza B, Sikaala CH, Chanda-Kapata P, Cardol EI, Munachoonga P, Achee NL: **Knowledge, attitudes and practices assessment of malaria interventions in rural Zambia.** *BMC Public Health* 2020, **20:**216.
46. Ondiba IM, Oyieke FA, Ong'amo GO, Olumula MM, Nyamongo IK, Estambale BBA: **Malaria vector abundance is associated with house structures in Baringo County, Kenya.** *PLoS One* 2018, **13:**e0198970.
47. Jatta E, Jawara M, Bradley J, Jeffries D, Kandeh B, Knudsen JB, Wilson AL, Pinder M, D'Alessandro U, Lindsay SW: **How house design affects malaria mosquito density, temperature, and relative humidity: an experimental study in rural Gambia.** *Lancet Planet Health* 2018, **2:**e498-e508.
48. Tusting LS, Ippolito MM, Willey BA, Kleinschmidt I, Dorsey G, Gosling RD, Lindsay SW: **The evidence for improving housing to reduce malaria: a systematic review and meta-analysis.** *Malar J* 2015, **14:**209.
49. Tusting LS, Ippolito MM, Willey BA, Kleinschmidt I, Dorsey G, Gosling RD, Lindsay SW: **The evidence for improving housing to reduce malaria: a systematic review and meta-analysis.** *Malaria Journal* 2015, **14:**209.
50. Bempah S, Curtis A, Awandare G, Ajayakumar J: **Appreciating the complexity of localized malaria risk in Ghana: Spatial data challenges and solutions.** *Health & Place* 2020, **64:**102382.
51. Lindblade KA, Li Xiao H, Tiffany A, Galappaththy G, Alonso P: **Supporting countries to achieve their malaria elimination goals: the WHO E-2020 initiative.** *Malar J* 2021, **20:**481.
52. Hasyim H, Nursafingi A, Haque U, Montag D, Groneberg DA, Dhimal M, Kuch U, Muller R: **Spatial modelling of malaria cases associated with environmental factors in South Sumatra, Indonesia.** *Malar J* 2018, **17:**87.
53. Hasyim H, Dhimal M, Bauer J, Montag D, Groneberg DA, Kuch U, Muller R: **Does livestock protect from malaria or facilitate malaria prevalence? A cross-sectional study in endemic rural areas of Indonesia.** *Malar J* 2018, **17:**302.
54. Hasyim H, Firdaus F, Prabawa A, Dale P, Harapan H, Groneberg DA, Kuch U, Muller R: **Potential for a web-based management information system to improve malaria control: An exploratory study in the Lahat District, South Sumatra Province, Indonesia.** *PLoS One* 2020, **15:**e0229838.
55. Budiyanto A, Ambarita LP, Salim M: **Konfirmasi Anopheles sinensis dan Anopheles vagus sebagai vektor malaria di Kabupaten Muara Enim Provinsi Sumatera Selatan.** *ASPIRATOR-Journal of Vector-borne Disease Studies* 2017, **9:**51-60.

56. Hasyim H, Dale P, Groneberg DA, Kuch U, Muller R: **Social determinants of malaria in an endemic area of Indonesia.** *Malar J* 2019, **18:**134.
57. Yahya Y, Haryanto D, Pahlevi RI, Budiyanto A: **keanekaragaman jenis nyamuk Anopheles di sembilan kabupaten (tahap pre-eliminasi malaria) di Provinsi Sumatera Selatan.** *Vektora: Jurnal Vektor dan Reservoir Penyakit* 2020, **12:**41-52.
58. Fornace KM, Brock PM, Abidin TR, Grignard L, Herman LS, Chua TH, Daim S, William T, Patterson C, Hall T, et al: **Environmental risk factors and exposure to the zoonotic malaria parasite Plasmodium knowlesi across northern Sabah, Malaysia: a population-based cross-sectional survey.** *Lancet Planet Health* 2019, **3:**e179-e186.
59. Naik DG: **Plasmodium knowlesi-mediated zoonotic malaria: A challenge for elimination.** *Trop Parasitol* 2020, **10:**3-6.
60. Dunn CE, Le Mare A, Makungu C: **Malaria risk behaviours, socio-cultural practices and rural livelihoods in southern Tanzania: Implications for bednet usage.** *Social Science & Medicine* 2011, **72:**408-417.
61. Mukabane K, Kitungulu N, Ogutu P, Cheruiyot J, Tavasi N, Mulama D: **Bed net use and malaria treatment-seeking behavior in artisanal gold mining and sugarcane growing areas of Western Kenya highlands.** *Scientific African* 2022, **16:**e01140.
62. Ekawati LL, Johnson KC, Jacobson JO, Cueto CA, Zarlinda I, Elyazar IRF, Fatah A, Sumiwi ME, Noviyanti R, Cotter C, et al: **Defining malaria risks among forest workers in Aceh, Indonesia: a formative assessment.** *Malaria Journal* 2020, **19:**441.
63. Thornton P: **Chinese miners and Ghana's golden reform opportunity.** *International Growth Centre Blog* 2014.
64. Argaw MD, Woldegiorgis AG, Workineh HA, Akelom BA, Abebe ME, Abate DT, Ashenafi EG: **Access to malaria prevention and control interventions among seasonal migrant workers: A multi-region formative assessment in Ethiopia.** *PLoS One* 2021, **16:**e0246251.
65. Olapeju B, Adams C, Hunter G, Wilson S, Simpson J, Mitchum L, Davis T, Orkis J, Cox H, Trotman N: **Malaria prevention and care seeking among gold miners in Guyana.** *Plos one* 2020, **15:**e0244454.

Review

Risk Factors of Malaria Transmission Among Mining Workers at Muara Enim, South Sumatra, Indonesia

1. Files
2. Details
3. Authors
4. Declarations
5. Review

Review

Files

Edit

6 files added

Manuscript 28-10-2022-Manuscript_cleaned .docx

Figure 1 study area.jpeg
Table 1 Table 1.docx
Table 2 Table 2.docx
Supplementary File 1 Additional file 1 Appendix S1.docx
Supplementary File 2 28-10-2022-Manuscript_tracked changes.docx
Point-by-point Response To Reviewers File 1 response to reviewers.pdf

Details

Edit
Article typeResearchCollectionTowards malaria eliminationTitle

Risk Factors of Malaria Transmission Among Mining Workers at Muara Enim, South Sumatra, Indonesia

Abstract

Background: The elimination of malaria by 2030 is stated in the third goal of the United Nations Sustainable Development Goals (SDGs). However, malaria is a significant public health problem in Indonesia. Mineral mining, plantations, agriculture, and fisheries are all practiced in the Tanjung Enim sub-district, Muara Enim, South Sumatra, Indonesia, and these are characteristics of malaria-endemic locations. This research aimed to determine the factors that put mining workers at a higher risk for malaria.

Methods: A cross-sectional study design was used to identify malaria risk factors in the study site. A total of 92 study participants were included in this study. Both bivariable and multivariate logistic regression models were fitted to identify factors associated with malaria transmission in the study site. Finally, multivariate logistic regression with a p-value less than 0.05 was used to identify risk factors of malaria transmission.

Results: Of 92 participants, 14 (15.21%) had malaria. Multivariate analysis revealed that age (PR=7.989 with 95% CI=1,724-37.002) and breeding (7.685 with 95% CI=1.502-39.309) was a risk factor for malaria. High education (PR=0.104 with 95%

CI=0.027-0.403), using mosquito repellent (PR=0.138 with 95% CI=0.035-0.549), and house wall conditions (PR=0.145 with 95% CI 0.0414-0.511) were protective factor.

Conclusions: This current study reveals age and breeding as risk factors for malaria. Besides, high education, mosquito repellent, and house wall conditions were protective factors against malaria in the study site. Therefore, reducing risk factors and control measures is highly recommended to alleviate the problem of malaria transmission in the mining area.

Keywords: Malaria elimination, mining workers, risk factors.

Cover letterCover Letter.docx

Authors

Edit

Hamzah Hasyim (corresponding author) <hamzah@fkm.unsri.ac.id>,
Faculty of Public Health, Universitas Sriwijaya
The Directorate General of Higher Education funded the research of this article, Ministry of Education, Culture, Research, and Technology, the Republic of Indonesia with the Fiscal Year 2022 following the Penelitian Dasar Kompetitif Nasional (PDKN), contract number: 142/E5/PG.02.00.PT/2022
Wita Citra Dewi <witacitradewiadi@gmail.com>,
Faculty of Public Health, Universitas Sriwijaya
Risva Aprina Fitri Lestari <risvaprina@gmail.com>,
Faculty of Public Health, Universitas Sriwijaya
Rostika Flora <rostikaflora@gmail.com>,
Faculty of Public Health, Universitas Sriwijaya
The Directorate General of Higher Education funded the research of this article, Ministry of Education, Culture, Research, and Technology, the Republic of Indonesia with the Fiscal Year 2022 following the Penelitian Dasar Kompetitif Nasional (PDKN), contract number: 142/E5/PG.02.00.PT/2022
Novrikasari - <novrikasari@fkm.unsri.ac.id>,
Faculty of Public Health, Universitas Sriwijaya
Iche Andriyani Liberty <Icheandriyaniliberty@fk.unsri.ac.id>,
Department of Public Health and Community Medicine, Medical Faculty, Universitas Sriwijaya
The Directorate General of Higher Education funded the research of this article, Ministry of Education, Culture, Research, and Technology, the Republic of Indonesia with the Fiscal Year 2022 following the Penelitian Dasar Kompetitif Nasional (PDKN), contract number: 142/E5/PG.02.00.PT/2022

Heni Marini <10012682125016@student.unsri.ac.id>,
Faculty of Public Health, Universitas Sriwijaya
Zemenu Tadesse Tessema <zemenut1979@gmail.com>,
Department of Epidemiology and Biostatistics, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Gondar
Siti Herlinda <sitiherlinda@unsri.ac.id>,
Department of Plant Protection, Faculty of Agriculture, Universitas Sriwijaya
Fadhilah Eka Maharani <fadhilah.em94@gmail.com>
Biology Department, Faculty of Mathematics and Natural Sciences, Universitas Sriwijaya

HH, RF, IAL, and ZTT study validation and conceptualization. WCR, RAFL, HM, FEM, collecting, investigation, and study validation. HH, ZTT, and SH wrote the main manuscript text. HH, IAL, N, and ZTT editing and writing draft, and all authors contributed to interpreting the results. All authors reviewed the manuscript.

Declarations

Edit

I confirm that I understand Malaria Journal is an open access journal that levies an article processing charge per articles accepted for publication. By submitting my article I agree to pay this charge in full if my article is accepted for publication.
No, I declare that the authors have no competing interests as defined by BMC, or other interests that might be perceived to influence the results and/or discussion reported in this paper.
The results/data/figures in this manuscript have not been published elsewhere, nor are they under consideration (from you or one of your Contributing Authors) by another publisher.
I have read the BMC journal policies on author responsibilities and submit this manuscript in accordance with those policies.
All of the material is owned by the authors and/or no permissions are required.

Before you submit your manuscript please review your submission thoroughly, including any text that we may have entered for you, as you will not be able to make any further changes.

Submit manuscript

- ← Declarations
-

Give Feedback(opens in a new window)

SPRINGER NATURE SNAPP Malaria Journal

My account

Submission received

Thank you for submitting to Malaria Journal

Your submission is now at our initial Technical Check stage. If there are any points that need to be addressed we will send you a detailed email. Otherwise, your submission will proceed into peer review.

You can check the status of your submission by using the link below. Please note it may take a couple of minutes for your submission to appear.

Track submission progress(opens in a new window)

Give Feedback(opens in a new window)

Title Page:

Risk Factors of Malaria Transmission Among Mining Workers at Muara Enim, South Sumatra, Indonesia

Authors:

Hamzah Hasyim§[1], Wita Citra Dewi[1], Risva Aprina Fitri Lestari[1], Rostika Flora[1], Novrikasari[1], Iche Andriyani Liberty[2,], Heni Marini[1], Zemenu Tadesse Tessema[3,4] Siti Herlinda[5,6] Fadhilah Eka Maharani[7]

Affiliations and contact data:

[1]Faculty of Public Health, Universitas Sriwijaya, Indonesia.

[2]Department of Public Health and Community Medicine, Medical Faculty, Universitas Sriwijaya, Indonesia

[3]Department of Epidemiology and Preventive Medicine, School of Public Health and Preventive Medicine, Monash University, Melbourne, Australia

[4]Department of Epidemiology and Biostatistics, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia

[5]Department of Plant Protection, Faculty of Agriculture, Universitas Sriwijaya, Indonesia.

[6]Research Center for Sub-optimal Lands (PUR-PLSO), Universitas Sriwijaya, Indonesia.

[7] Biology Department, Faculty of Mathematics and Natural Sciences, Universitas Sriwijaya, Indonesia.

§**Corresponding author:** hamzah@fkm.unsri.ac.id

Abstract

Background: The elimination of malaria by 2030 is stated in the third goal of the United Nations Sustainable Development Goals (SDGs). However, malaria is a significant public health problem in Indonesia. Mineral mining, plantations, agriculture, and fisheries are all practiced in the Tanjung Enim sub-district, Muara Enim, South Sumatra, Indonesia, and these are characteristics of malaria-endemic locations. This research aimed to determine the factors that put mining workers at a higher risk for malaria.

Methods: A cross-sectional study design was used to identify malaria risk factors in the study site. A total of 92 study participants were included in this study. Both bivariable and multivariate logistic regression models were fitted to identify factors associated with malaria transmission in the study site. Finally, multivariate logistic regression with a p-value less than 0.05 was used to identify risk factors of malaria transmission.

Results: Of 92 participants, 14 (15.21%) had malaria. Multivariate analysis revealed that age (PR=7.989 with 95% CI=1,724-37.002) and breeding (7.685 with 95% CI=1.502-39.309) was risk factor for malaria. High education (PR=0.104 with 95% CI=0.027-0.403), using mosquito repellent (PR=0.138 with 95% CI=0.035-0.549), and house wall conditions (PR=0.145 with 95% CI 0.0414-0.511) were protective factor.

Conclusions: This current study reveals age and breeding as risk factors for malaria. Besides, high education, mosquito repellent, and house wall conditions were protective factors against malaria in the study site. Therefore, reducing risk factors and control measures is highly recommended to alleviate the problem of malaria transmission in the mining area.

Keywords: Malaria elimination, mining workers, risk factors.

Background

Malaria infects around 200 million people and kills 400,000 yearly in 90 countries. The World Health Organization (WHO) has set a target of eliminating malaria in 35 countries by 2030 [1]. The elimination of malaria by 2030 is stated in the third goal of the Sustainable Development Goals (SDGs). On the other hand, malaria is a significant public health issue in Indonesia. Malaria is still endemic in the area surrounding Muara Enim, South Sumatra [2-6]. WHO certifies an area as malaria-free when a country demonstrates, with thorough, convincing evidence, that indigenous malaria transmission by Anopheles mosquitoes has ceased for at least three years. A country must also prevent reinfection. The WHO Director-General decides on malaria-free certification based on the Malaria Elimination Certification Panel (MECP).

Coal mining, plantations, agriculture, and fisheries Muara Enim is suitable for *Anopheles* mosquitoes breeding sites such as ponds, rice fields, ditches, and former open pit mines. This condition triggers malaria in Muara Enim. Irrigation channels, rice fields, paddy water flow, fishponds, buffalo pools, marshes, and lakes are *Anopheles* habitats. *Anopheles barbisrostris*, *An. tesselatus*, *An. subpictus*, *An. nigerrimus*, *An. kochi*, *An. umbrosus*, *An. barbumbrosus*, and *An. maculatus* was captured [7]. Other risk factors that cause malaria include artisanal mining's socio-economic and behavioral drivers of malaria among gold mining, rubber, and oil palm migrant workers [8]. Malaria and anemia are more prevalent in artisanal mining communities of East Akim District than in non-artisanal sites [9]. Land use changes impact malaria spread by disrupting ecosystems [10, 11]. In one study, age, gender, degree of education, season, and temperature were examples of attributes relevant to malaria transmission [12]. Research has consistently shown that these malaria vectors thrive in mined areas. Studi offers malaria transmission in the mining area in Western Kenya

Highlands [13]. In Aceh, Indonesian miners risked malaria [14]. Small-scale mining is a serious risk for malaria, including in Chinese miners [15]. This research aligns with the study that other mining areas are susceptible to malaria and can reintroduce malaria into sensitive areas [16]. Despite being a malaria elimination priority population, little is known about miners and malaria in Guyana's hinterland [17]. Although some research has been carried out on malaria transmission in artisanal mining, no single study exists which malaria transmission in the study site.

This current study used additional data from the Electronic Malaria Surveillance Information System [E-SISMAL]. It is based on E-SISMAL, the Annual Parasite Incidence (API) in Muara Enim District over the previous five years. In 2018, the API decreased steadily to 0.33, followed by APIs of 0.16 in 2019 and 0.04 in 2020, respectively. In 2021 declined dramatically to zero; However, in 2022, the API was 0.01. Besides, through E-SISMAL, researchers got a history of vector surveillance, particularly laboratory tests for diagnosing parasitic diseases and types of malaria parasites, which is helpful for the researchers. Rapid Diagnostic Tests (RDT) and microscopy malaria diagnoses were 50% in the study site. Five *Plasmodium* species cause malaria, which is spread by anopheline mosquitoes. *Plasmodium falciparum* and *Plasmodium vivax* provide the most significant threat. In the study area, 85.7% of patients were infected with *Plasmodium falciparum*.

No previous study has investigated malaria transmission in the Tanjung Agung sub-district, which had the most malaria cases in the past three years (2018-2020). Puskesmas or Primary Health Care (PHC) of Tanjung Enim had the most issues in their operational areas. Therefore, this study aims to analyze the risk factors associated with malaria transmission among mining employees in the Tanjung Agung Sub-District of the Muara Enim District.

Methods

Study design and setting

The cross-sectional survey was carried out in May - July 2022. Cross-sectional studies with binary outcomes evaluated by logistic regression are prevalent in the epidemiology literature[18]. There are twenty sub-districts, ten counties, and 245 villages in Muara Enim District. The purposive method selected Tanjung Lalang, Tanjung Agung, and Penyandingan villages in the Tanjung Agung sub-districts. The study area selection is based on the API of the PHC of Tanjung Agung and information about the area with the most artisanal miner. The Health Office and Muara Enim District Government's webpage provided the data. Finally, the sample selection in each village was carried out by cluster sampling. The study areas are shown in Figure 1.

Research variables

The dependent variable was the malaria case, a binary variable indicating whether malaria was present or absent. Respondents are artisanal miners who resided in the study site. The disease definition employed in this study was malaria infection based on rapid diagnostic tests (RDTs) and microscopy methods documented or reported in the Muara Enim E-SISMAL recommended by WHO as a malaria surveillance tool. (Additional file 1: Appendix S1).

Before collecting this data, researchers used a valid and reliable questionnaire. The researchers examined the validity and reliability of the questionnaire on thirty participants from different villages in Darmo village, with participants having the same characteristics as the sample. After obtaining a valid and reliable structured questionnaire, it is subsequently utilized for the sample.

Sample size calculation

The sample size is calculated using the hypothesis test for two population proportions (two-sided test) [19]

$$n = \frac{\left(Z_{1-\frac{a}{2}}\sqrt{2P\,(1-P)} + Z_{1-\beta}\sqrt{P_1(1-P_1)+P_2(1-P_2)}\right)^2}{(P_1-P_2)^2}$$

Samples

This study used a cross-sectional analysis of malaria transmission risk variables among miners. Researchers conducted an interview was applied with 92 miners living in three villages. Based on Tanjung Agung PHC's API for five years, the API declined steadily in 2018 to 0.7, followed by 0.49 in 2019 and 0.05 in 2020. In 2021 and 2020, the API in PHC decreased rapidly to zero.

The positive samples for malaria were recorded from a records search conducted after the miners were identified. In this study, the sample of miners, who were malaria positive, was not previously identified by the researcher because the characteristics of the cross-sectional study show the association between risk factors with consequences with data collection carried out simultaneously at the point time approach. RDT and microscopy were carried out to diagnose malaria by health personnel, and the cases were registered in E-SISMAL, Muara Enim District Health Office. Miners who reported that they were positive for malaria were re-crosschecked or confirmed through the data in E-SISMAL. It was found that several respondents said they had been exposed to malaria. However, when they were cross-checked with E-SISMAL data, the respondents' names were not found, so they were not grouped into positive malaria criteria. Finally, in this study, 14 malaria-infection were found in the study area. Based on the data obtained from E-SISMAL, the most abundant *Plasmodium* in the Tanjung Agung sub-district was *Plasmodium falciparum.*

Data analysis

Descriptive analysis

The objective of the descriptive analysis was to characterize the independent variables concerning the dependent variable, malaria prevalence.

Bivariate analysis

The association between each independent variable and the dependent variable was analyzed using the Chi-Square test by comparing the probability value (p-value) to the alpha value (α) = 0.05. If the p-value is ˂ 0.005, then Ho means it is rejected. It means that there is a significant association between the independent and dependent variables; if the p-value > (0.05), then Ho is accepted or failed to be rejected, meaning that there is no significant association between the independent and dependent variables.

Multivariate analysis

The multivariate study's goal was to identify factors associated with malaria transmission. The severity of the malaria risk was assessed using the derived adjusted prevalence ratio. Malaria was more likely to develop if the PR was greater than one. Finally, multivariate logistic regression was used to identify risk factors for malaria transmission if the p-value was less than 0.05.

Results

Characteristics of the participants and demographics

Each of the following study variables was examined using univariate analysis: age, gender, length of employment, working mass, education, the usage of mosquito nets, the presence of breeding and resting sites, knowledge, behavioral attitudes, and home environmental factors. Next, bivariate analysis was used to examine the association between age, sex, length of

work, working mass, education, the habit of using mosquito nets, the presence of a breeding and resting place, knowledge, behavioral attitudes, and home environmental conditions and the incidence of malaria in miners. In addition, a multivariate analysis was performed to discover the most influential factor in malaria occurrence. Table 1. summarizes the factors that illustrate the socio-demographic characteristics of research participants at baseline.

According to the univariate study, 15.21% of the 92 mine workers in the Tanjung Agung District were exposed to malaria, with the majority (61.96%) being 35 years or older. More were male (67.39%). There were more miners who had been working for five years or more (59.78%) and eight hours of labor/day or more (56.52%) than expected. In addition, more miners had a poor level of education (65.22%), used more mosquito nets (53.26%), did not use insect repellent (53.26%), and left their homes at night (61.96%). More respondents engaged in self-medication (73.91%) and had good knowledge (57.61%) but exhibited less positive attitudes (55.43%) and poor behavior (57.61%). The presence of breeding sites indicates that more mining workers are at risk (60.87%), as is the availability of mosquito resting areas (65.22%) and the state of the house's walls (61.96%), and the ceiling (55.40%).

According to the results of the bivariate analysis, there was an association between working period (p-value 0.006), daily length of work (p-value 0.017), the habit of using mosquito nets (p-value 0.033), use of mosquito repellent (p-value 0.005), knowledge (p-value 0.028), attitude (p-value 0.021), presence of breeding place (p-value 0.036), presence of resting place (p-value 0.014), and condition of the house. Multivariate analysis revealed that age was the most significant risk factor, with a p-value of 0.008. High education, mosquito repellent, and house wall conditions were protective factors, with PR <1. Furthermore, this current research revealed factors linked with malaria in low-endemicity areas, as shown in Table 2.

Discussion

Principal findings

It is interesting to study malaria transmission in artisanal mining in line with research found that the people miners in the surrounding forest who work as small-scale miners (ASM) are the population at risk of malaria, including those in the study site.

Many risk factors increase the likelihood of malaria transmission in artisanal mining. However, there is limited evidence of malaria in miners as the unique population for malaria elimination. This current study reveals age and breeding as risk factors for malaria. Besides, high education, mosquito repellent, and house wall conditions were protective factors against malaria in the study site. Multivariate analysis revealed that participants over 35 years were 7.98 times more likely to have malaria than those under 35 years (PR adjusted: 7.98; 95% CI 1.72-37.00; p-value 0.008) after adjusted by education, using repellent, mosquitos breeding, and house wall conditions. Besides, mosquito repellent was well associated with a decrease in the risk of malaria (PR adjusted: 0.13; 95% 0.03-0.54; p-value 0.005).

In concordance with the results of other studies, severe malaria presenting symptoms depend on age. Age independently increases illness mortality [20]. Besides, in India, housing factors are linked to malaria in persons over 45 [21].

A similar finding was reported among Brazilian gold miners in an Amazonian border area where the presence of a breeding site was creating artificial breeding areas for vector mosquitoes in mining activity [22]. If breeding sites are sparse, this affects anopheline larval habitats and adult production in the Gambia [23]. Pits and trenches are dug and then abandoned, resulting in stagnant water, creating a condition that provides an ideal habitat for

mosquito breeding and malaria transmission, exposing the surrounding people [24]. In addition, the association between mosquito breeding and malaria revealed that mosquito breeding (regardless of species) was strongly related to malaria cases in households [25]. Another research in southeastern Nigeria demonstrated that higher education improved malaria knowledge and practice. Health campaigns can teach malaria causes, symptoms, and control [26].

Furthermore, another study showed that the spread of artemisinin-resistant malaria can only be eliminated if malaria is eradicated from the regio used spatial repellents (SR) [27]. An effort needs to convey the best and most up-to-date information on repellents to improve the scientific community's knowledge [28].

Consistent with the results of other studies, few clinical studies have examined housing and malaria [29]. Few clinical studies have examined housing and malaria [29]. Then, good house construction reduces malaria risk by limiting mosquito vector entry. The house design may explain some of Uganda's malaria transmission heterogeneity and is a promising target for future interventions, even in highly endemic areas [30].

Based on the findings, social, cultural, and environmental factors must be considered in mosquito-borne disease prevention and treatment [31]. Malaria control and prevention interventions prioritize those near mosquito breeding sites, increase bed net use among children under 15, and improve housing [32]. So, launching a malaria health education program and encouraging insecticide-treated bed nets and mosquito repellents are strategies to 'control' malaria to prevent malaria[8]. Besides, there is a need to regulate mining in these communities and increase malaria control and health education efforts to reduce malaria and

encourage health-seeking [9].

Explanatory variables

In this research, a connection between age and malaria was associated with several other studies; some studies show an association between age and malaria, for example, in Malaysian Borneo. In all age groups except five years old, *P. knowlesi* predominated [33]. Young children's malaria has overshadowed teen malaria. Immunological and hormonal factors may affect younger teens [34]. Another study links age and transmission to severe childhood malaria [35]. Burkina Faso has a high malaria death rate, especially among young children [36]. Most of them conducted study malaria in children. This current research showed that infected study participants who worked in artisanal mining ranged in age from 18 to 65, averaging 43, and were exposed to malaria, with the majority (61.96%) being 35 years old.

This study revealed the importance of the presence of a mosquito breeding site. In Kenya, malaria prevalence was strongly correlated with the density of breeding sites [25]. Gem mining pits and aquatic habitats in Moneragala may increase malaria vector breeding [37]. Mosquito breeding sites near homes are common in sub-Saharan Africa and cause malaria infection [38]. Another study found that changes in land cover are a major cause of African highland temperature rise and malaria vector colonization. It has also increased sporogony development rate, adult vector survival, and malaria risk in the highlands [39]. Furthermore, eliminating puddles and removing breeding sites and marshes can drastically lower Anopheles mosquito populations [40]. Therefore, it was recommended that mosquito breeding places be eliminated [41].

This current research indicates knowledge connected with malaria transmission in people's mines study sites. In line with some studies, education has been related to malaria prevention. Another study demonstrated that community health education is essential to modern malaria control [42]. Another paper showed asymptomatic and *falciparum* malaria parasites correlated with academic performance in Donéguébougou, Mali [43]. This research aligns with the study that analyzed nomad groups' knowledge and views of malaria and preventive strategies [44]. Another study compared malaria of knowledge, attitudes, and practices (KAP) in three endemic Colombian communities to develop new intervention strategies for malaria elimination [45].

Similarly, in Tengchong County, Yunnan Province, China, Imported cases, low education, lack of mosquito bite treatment, and risky behaviors contribute to their high malaria incidence [46]. This current research conducted in artisanal mining indicated that the respondents have low educational levels, and there is a need to improve specific knowledge regarding the prevention of malaria transmission. In addition, broad-based programs may need to target inequalities to increase understanding, prevention, and treatment among the most vulnerable populations to enhance malaria reduction efforts [47]. For malaria elimination, accurate community knowledge and fast treatment-seeking behavior for early diagnosis and treatment are essential [48]. Access and adherence to artemisinin-based combination therapy (ACT) are crucial obstacles to the development of successful malaria treatment that are influenced by patient knowledge, attitudes, and beliefs [49].

Some studies show that the use of malaria repellents influences malaria. In Africa, using insect-repellent plants (IRPs) is a centuries-old practice [50]. A study in Ethiopia looked at insect/mosquito repellent plants used by 97.2% of respondents. Hamlets have traditionally

used insect/mosquito-repellent plants [51]. Besides, Ethiopians who use traditional repellent plants can potentially reduce vector-borne diseases [52]. However, another study presented that those topical repellents, on the other hand, did not affect malaria endemicity in the Greater Mekong subregion. It is difficult to use repellents daily [53]. People have used a variety of mosquito repellents, including liquid vaporizers, coils, and mats, to protect themselves from mosquitoes and the diseases they carry [54]. A laboratory study evaluated Tedh's repellency against the Afro-tropical malarial vector. Because Tedh essential oil is safe and inexpensive, it could be used to reduce the burden of insect-transmitted diseases, especially malaria [55]. Another study demonstrated the need to strengthen *Plasmodium* infection prevention and control strategies, specifically by changing the practice of spending the night in the forest and increasing personal mosquito repellent [56]. Mosquito coils are popular in malaria-endemic countries [57]. This current study demonstrated that more miners had a poor level of education (65.22%), did not use insect repellent (53.26%), and had a habit of leaving their homes at night (61.96%), so these are risk factors for malaria. Outdoor miners are also more prone to mosquito bites.

House modifications may effectively reduce malaria: This is being revisited, with new research now examining blocking house mosquito entry points or modifying house construction materials to minimize inhabitants' exposure to infectious bites [58]. House screening may reduce mosquito density. Sometimes, screening with insecticide and lure-and-kill devices has reduced malaria parasite prevalence and anemia [59]. Human habitation and living environment are often linked to malaria risk and endemicity. Malaria disappeared from areas where it had been endemic for centuries, such as southern England's coast, due to better housing. Malaria transmission stopped in England without killing mosquitoes [60]. In Baringo County, researchers compared house structures and malaria vector abundance.

Malaria vectors prefer open eaves. Grass-thatched roofs had more malaria vectors than metal ones. Due to their varied structures, riverine houses were linked to malaria vector abundance. Screening eaves, improving building materials, and building on stilts can reduce indoor malaria vector density [61]. Mosquito entry and indoor climate are affected by rural housing. Malaria vectors were kept out of metal-roofed houses with closed eaves by screened doors and ventilation in Sub-Saharan Africa [62]. Door and window screening may reduce disease transmission.

Furthermore, housing is a risk factor for malaria, despite low-quality evidence. Future research should evaluate the protective effect of specific house features and incremental housing improvements [63]. This current study demonstrated that the presence of breeding sites indicates that more mining workers are at risk (60.87%), as is the availability of resting areas (65.22%) and the state of the house's walls (61.96%), and the ceiling (55.40%). Another study examined the concept that better housing can reduce malaria. Modern houses showed 47% lower malaria infection rates than traditional houses [64]. Another study site denoted that malaria transmission has multiple causes. In Ghana, poor sanitation, low socio-economic status, building construction, and individual behaviors were multiple causes of high malaria prevalence [65].

Limitations of research

Malaria disease status was determined retrospectively by E-SISMAL data and not directly by researchers' diagnoses. Thus, malaria prevalence could only be determined from respondents who reported having had a professional malaria diagnosis. There may be additional factors affecting malaria transmission in the study area that E-SISMAL did not record; these could be the topic of future research. In this study, investigators did not

conduct vector survey methods for larvae and adult anopheles, nor did they perform a Human Landing Catch. These are the most essential methods for detecting which Anopheles species attack humans (HLC). Nonetheless, the present study has the advantage of being based on E-SISMAL, one of the WHO-recommended techniques for malaria surveillance, and employing a structured questionnaire. The findings highlight risk variables for malaria transmission that could be used in the future design of malaria control programs, at least in the artisanal mining in three villages within the sub-district of Tanjung Agung.

Conclusions

multivariate analyses revealed age and mosquito breeding as risk factors for malaria. High educational level, use of mosquito repellent, and house wall conditions were protective factors. Eliminating breeding places in the mining area or avoiding direct contact between artisanal miners and vectors around the breeding sites can be facilitated by increasing knowledge, using mosquito repellent or protective clothing, and improving house conditions as protective factors. As a crucial step toward eliminating malaria in the study site, it is essential to conduct preventative and promotional measures.

List of Abbreviations used

ACT	:	Artemisinin-based combination therapy
An.	:	*Anopheles*
API's	:	Annual Parasite Incidence
E-SISMAL	:	Electronic Malaria Surveillance Information System
IRPs	:	Insect-Repellent Plants
KAP	:	Knowledge, attitudes, and practices
MAP	:	Malaria Awareness Program
MECP	:	Malaria Elimination Certification Panel
p-value	:	the probability value

PR	:	Prevalence ratio
POR	:	Prevalence odds ratio
RDT	:	Rapid Diagnostic Test
SDGs	:	Sustainable Development Goals
SR	:	Spatial Repellents

Competing interests

The authors declare that they have no competing interests.

Ethical considerations

The study protocol was approved by the Health Research Ethics Committee, Faculty of Public Health Sriwijaya University, with Ethical Approval No: 313/UN9.FKM/TU.KKE/2022. In the field, participation in the study was strictly voluntary. All analyses were performed using the participant's identification code to ensure maximum confidentiality.

Availability of data and materials

The authors have full access to all the data in the study and take responsibility for the data integrity.

Authors' contributions

HH, RF, IAL, and ZTT study validation and conceptualization. WCR, RAFL, HM, FEM, collecting, investigation, and study validation. HH, ZTT, and SH wrote the main manuscript text. HH, IAL, N, and ZTT editing and writing draft, and all authors contributed to interpreting the results. All authors reviewed the manuscript.

Acknowledgment

The authors would like to thank the management of the Tanjung Agung Sub-District and the clinic staff for their assistance in recruiting eligible subjects and supplying data to ensure the success of this study. The English was checked by Professor Patricia Dale, a native English speaker.

Funding

The Directorate General of Higher Education funded the research of this article, Ministry of Education, Culture, Research, and Technology, the Republic of Indonesia with the Fiscal Year 2022 following the Penelitian Dasar Kompetitif Nasional (PDKN) contract number: 142/E5/PG.02.00.PT/2022.

References

1. Lindblade KA, Li Xiao H, Tiffany A, Galappaththy G, Alonso P: **Supporting countries to achieve their malaria elimination goals: the WHO E-2020 initiative.** *Malar J* 2021, **20:**481.
2. Hasyim H, Nursafingi A, Haque U, Montag D, Groneberg DA, Dhimal M, Kuch U, Muller R: **Spatial modelling of malaria cases associated with environmental factors in South Sumatra, Indonesia.** *Malar J* 2018, **17:**87.
3. Hasyim H, Dhimal M, Bauer J, Montag D, Groneberg DA, Kuch U, Muller R: **Does livestock protect from malaria or facilitate malaria prevalence? A cross-sectional study in endemic rural areas of Indonesia.** *Malar J* 2018, **17:**302.
4. Hasyim H, Firdaus F, Prabawa A, Dale P, Harapan H, Groneberg DA, Kuch U, Muller R: **Potential for a web-based management information system to improve malaria control: An exploratory study in the Lahat District, South Sumatra Province, Indonesia.** *PLoS One* 2020, **15:**e0229838.
5. Budiyanto A, Ambarita LP, Salim M: **Konfirmasi Anopheles sinensis dan Anopheles vagus sebagai vektor malaria di Kabupaten Muara Enim Provinsi Sumatera Selatan.** *ASPIRATOR-Journal of Vector-borne Disease Studies* 2017, **9:**51-60.
6. Hasyim H, Dale P, Groneberg DA, Kuch U, Muller R: **Social determinants of malaria in an endemic area of Indonesia.** *Malar J* 2019, **18:**134.
7. Yahya Y, Haryanto D, Pahlevi RI, Budiyanto A: **keanekaragaman jenis nyamuk Anopheles di sembilan kabupaten (tahap pre-eliminasi malaria) di Provinsi Sumatera Selatan.** *Vektora: Jurnal Vektor dan Reservoir Penyakit* 2020, **12:**41-52.
8. Soe HZ, Thi A, Aye NN: **Socio-economic and behavioural determinants of malaria among the migrants in gold mining, rubber and oil palm plantation areas in Myanmar.** *Infect Dis Poverty* 2017, **6:**142.
9. Dao F, Djonor SK, Ayin CT, Adu GA, Sarfo B, Nortey P, Akuffo KO, Danso-Appiah A: **Burden of malaria in children under five and caregivers' health-seeking behaviour for**

malaria-related symptoms in artisanal mining communities in Ghana. *Parasit Vectors* 2021, **14:**418.
10. Fornace KM, Brock PM, Abidin TR, Grignard L, Herman LS, Chua TH, Daim S, William T, Patterson C, Hall T, et al: **Environmental risk factors and exposure to the zoonotic malaria parasite Plasmodium knowlesi across northern Sabah, Malaysia: a population-based cross-sectional survey.** *Lancet Planet Health* 2019, **3:**e179-e186.
11. Naik DG: **Plasmodium knowlesi-mediated zoonotic malaria: A challenge for elimination.** *Trop Parasitol* 2020, **10:**3-6.
12. Dunn CE, Le Mare A, Makungu C: **Malaria risk behaviours, socio-cultural practices and rural livelihoods in southern Tanzania: Implications for bednet usage.** *Social Science & Medicine* 2011, **72:**408-417.
13. Mukabane K, Kitungulu N, Ogutu P, Cheruiyot J, Tavasi N, Mulama D: **Bed net use and malaria treatment-seeking behavior in artisanal gold mining and sugarcane growing areas of Western Kenya highlands.** *Scientific African* 2022, **16:**e01140.
14. Ekawati LL, Johnson KC, Jacobson JO, Cueto CA, Zarlinda I, Elyazar IRF, Fatah A, Sumiwi ME, Noviyanti R, Cotter C, et al: **Defining malaria risks among forest workers in Aceh, Indonesia: a formative assessment.** *Malaria Journal* 2020, **19:**441.
15. Thornton P: **Chinese miners and Ghana's golden reform opportunity.** *International Growth Centre Blog* 2014.
16. Argaw MD, Woldegiorgis AG, Workineh HA, Akelom BA, Abebe ME, Abate DT, Ashenafi EG: **Access to malaria prevention and control interventions among seasonal migrant workers: A multi-region formative assessment in Ethiopia.** *PLoS One* 2021, **16:**e0246251.
17. Olapeju B, Adams C, Hunter G, Wilson S, Simpson J, Mitchum L, Davis T, Orkis J, Cox H, Trotman N: **Malaria prevention and care seeking among gold miners in Guyana.** *Plos one* 2020, **15:**e0244454.
18. Barros AJD, Hirakata VN: **Alternatives for logistic regression in cross-sectional studies: an empirical comparison of models that directly estimate the prevalence ratio.** *BMC Medical Research Methodology* 2003, **3:**21.
19. Lwanga SK, Lemeshow S, Organization WH: *Sample size determination in health studies: a practical manual*. World Health Organization; 1991.
20. Dondorp AM, Lee SJ, Faiz MA, Mishra S, Price R, Tjitra E, Than M, Htut Y, Mohanty S, Yunus EB, et al: **The relationship between age and the manifestations of and mortality associated with severe malaria.** *Clin Infect Dis* 2008, **47:**151-157.
21. Mohan I, Kodali NK, Chellappan S, Karuppusamy B, Behera SK, Natarajan G, Balabaskaran Nina P: **Socio-economic and household determinants of malaria in adults aged 45 and above: analysis of longitudinal ageing survey in India, 2017–2018.** *Malaria Journal* 2021, **20:**306.
22. Murta FL, Marques LL, Santos AP, Batista TS, Mendes MO, Silva ED, Neto AV, Fabiano M, Rodovalho SR, Monteiro WM: **Perceptions about malaria among Brazilian gold miners in an Amazonian border area: perspectives for malaria elimination strategies.** *Malaria journal* 2021, **20:**1-14.
23. Fillinger U, Sombroek H, Majambere S, van Loon E, Takken W, Lindsay SW: **Identifying the most productive breeding sites for malaria mosquitoes in The Gambia.** *Malaria Journal* 2009, **8:**62.
24. Organization WH: **Environmental and occupational health hazards associated with artisanal and small-scale gold mining.** 2016.
25. Thomas S, Ravishankaran S, Asokan A, Johnson Amala Justin NA, Maria Jusler Kalsingh T, Mathai MT, Valecha N, Eapen A: **Socio-demographic and household attributes may not necessarily influence malaria: evidence from a cross sectional study of households in an urban slum setting of Chennai, India.** *Malaria Journal* 2018, **17:**4.
26. Dike N, Onwujekwe O, Ojukwu J, Ikeme A, Uzochukwu B, Shu E: **Influence of education and knowledge on perceptions and practices to control malaria in Southeast Nigeria.** *Soc Sci Med* 2006, **63:**103-106.

27. Charlwood JD, Hall T, Nenhep S, Rippon E, Branca-Lopes A, Steen K, Arca B, Drakeley C: **Spatial repellents and malaria transmission in an endemic area of Cambodia with high mosquito net usage.** *Malariaworld J* 2017, **8:**11.
28. Islam J, Zaman K, Duarah S, Raju PS, Chattopadhyay P: **Mosquito repellents: An insight into the chronological perspectives and novel discoveries.** *Acta Tropica* 2017, **167:**216-230.
29. Sikalima J, Schue JL, Hill SE, Mulenga M, Handema R, Daka V, Chileshe J, Kasongo W, Chaponda M, Bukasa Kabuya JB, et al: **House Structure Is Associated with Malaria among Febrile Patients in a High-Transmission Region of Zambia.** *Am J Trop Med Hyg* 2021, **104:**2131-2138.
30. Wanzirah H, Tusting LS, Arinaitwe E, Katureebe A, Maxwell K, Rek J, Bottomley C, Staedke SG, Kamya M, Dorsey G, Lindsay SW: **Mind the gap: house structure and the risk of malaria in Uganda.** *PLoS One* 2015, **10:**e0117396.
31. Moshi IR, Manderson L, Ngowo HS, Mlacha YP, Okumu FO, Mnyone LL: **Outdoor malaria transmission risks and social life: a qualitative study in South-Eastern Tanzania.** *Malaria Journal* 2018, **17:**397.
32. Gari T, Solomon T, Lindtjørn B: **Older children are at increased risk of Plasmodium vivax in south-central Ethiopia: a cohort study.** *Malar J* 2021, **20:**251.
33. Barber BE, William T, Dhararaj P, Anderios F, Grigg MJ, Yeo TW, Anstey NM: **Epidemiology of Plasmodium knowlesi malaria in north-east Sabah, Malaysia: family clusters and wide age distribution.** *Malar J* 2012, **11:**401.
34. Lalloo DG, Olukoya P, Olliaro P: **Malaria in adolescence: burden of disease, consequences, and opportunities for intervention.** *Lancet Infect Dis* 2006, **6:**780-793.
35. Ilunga-Ilunga F, Levêque A, Dramaix M: **[Influence of the age and the level of transmission on the clinical and biological expression of severe malaria in children].** *Arch Pediatr* 2016, **23:**455-460.
36. Zoungrana A, Chou YJ, Pu C: **Socio-economic and environment determinants as predictors of severe malaria in children under 5 years of age admitted in two hospitals in Koudougou district, Burkina Faso: a cross sectional study.** *Acta Trop* 2014, **139:**109-114.
37. Hewavitharane M, Ranawaka G, Saparamadu M, Premaratne R, Jayasooriya HTR: *Prevalence and bionomics of Anopheles species in a gem mining area in Moneragala District of Sri Lanka.*2017.
38. Imbahale SS, Fillinger U, Githeko A, Mukabana WR, Takken W: **An exploratory survey of malaria prevalence and people's knowledge, attitudes and practices of mosquito larval source management for malaria control in western Kenya.** *Acta Trop* 2010, **115:**248-256.
39. Kweka EJ, Kimaro EE, Munga S: **Effect of deforestation and land use changes on mosquito productivity and development in Western Kenya Highlands: implication for malaria risk.** *Frontiers in Public Health* 2016, **4:**238.
40. Mattah PAD, Futagbi G, Amekudzi LK, Mattah MM, de Souza DK, Kartey-Attipoe WD, Bimi L, Wilson MD: **Diversity in breeding sites and distribution of Anopheles mosquitoes in selected urban areas of southern Ghana.** *Parasites & vectors* 2017, **10:**1-15.
41. Takarinda KP, Nyadundu S, Govha E, Gombe NT, Chadambuka A, Juru T, Tshimanga M: **Factors associated with a malaria outbreak at Tongogara refugee camp in Chipinge District, Zimbabwe, 2021: a case–control study.** *Malaria Journal* 2022, **21:**94.
42. Huang F, Wang XD, Jiang L, Qiu HY: **[Evaluation of the effectiveness of community health education for the prevention and control of retransmission of imported malaria in Zhangjiagang City].** *Zhongguo Xue Xi Chong Bing Fang Zhi Za Zhi* 2021, **33:**308-310.
43. Thuilliez J, Sissoko MS, Toure OB, Kamate P, Berthélemy JC, Doumbo OK: **Malaria and primary education in Mali: a longitudinal study in the village of Donéguébougou.** *Soc Sci Med* 2010, **71:**324-334.
44. Moukénet A, Honoré B, Smith H, Moundiné K, Djonkamla W-M, Richardson S, Dormbaye M, Ngarasta N, Seck I: **Knowledge and social beliefs of malaria and prevention strategies among itinerant Nomadic Arabs, Fulanis and Dagazada groups in Chad: a mixed method study.** *Malaria Journal* 2022, **21:**56.

45. Forero DA, Chaparro PE, Vallejo AF, Benavides Y, Gutiérrez JB, Arévalo-Herrera M, Herrera S: **Knowledge, attitudes and practices of malaria in Colombia.** *Malaria Journal* 2014, **13:**165.
46. Li C, Wu X, Cheng X, Fan C, Li Z, Fang H, Shi C: **Identification and analysis of vulnerable populations for malaria based on K-prototypes clustering.** *Environmental Research* 2019, **176:**108568.
47. Clouston SAP, Yukich J, Anglewicz P: **Social inequalities in malaria knowledge, prevention and prevalence among children under 5 years old and women aged 15–49 in Madagascar.** *Malaria Journal* 2015, **14:**499.
48. Hasabo EA, Khalid RI, Mustafa GE, Taha RE, Abdalla RS, Mohammed RA, Haroun MS, Adil R, Khalil RA, Mansour RM, et al: **Treatment-seeking behaviour, awareness and preventive practice toward malaria in Abu Ushar, Gezira state, Sudan: a household survey experience from a rural area.** *Malaria Journal* 2022, **21:**182.
49. Banek K, Webb EL, Doogue EB, Smith SJ, Chandramohan D, Staedke SG: **Factors associated with access and adherence to artemisinin-based combination therapy (ACT) for children under five: a secondary analysis of a national survey in Sierra Leone.** *Malaria Journal* 2021, **20:**56.
50. Karunamoorthi K, Hailu T: **Insect repellent plants traditional usage practices in the Ethiopian malaria epidemic-prone setting: an ethnobotanical survey.** *J Ethnobiol Ethnomed* 2014, **10:**22.
51. Karunamoorthi K, Adane M, Fentahun W: **Assessment of knowledge and usage custom of traditional insect/mosquito repellent plants in Addis Zemen Town, South Gonder, North Western Ethiopia.** *Journal of Ethnopharmacology* 2009, **121:**49-53.
52. Karunamoorthi K, Ilango K, Endale A: **Ethnobotanical survey of knowledge and usage custom of traditional insect/mosquito repellent plants among the Ethiopian Oromo ethnic group.** *Journal of Ethnopharmacology* 2009, **125:**224-229.
53. Sluydts V, Durnez L, Heng S, Gryseels C, Canier L, Kim S, Van Roey K, Kerkhof K, Khim N, Mao S, et al: **Efficacy of topical mosquito repellent (picaridin) plus long-lasting insecticidal nets versus long-lasting insecticidal nets alone for control of malaria: a cluster randomised controlled trial.** *The Lancet Infectious Diseases* 2016, **16:**1169-1177.
54. Naz M, Rehman N, Nazam Ansari M, Kamal M, Ganaie MA, Awaad AS, Alqasoumi SI: **Comparative study of subchronic toxicities of mosquito repellents (coils, mats and liquids) on vital organs in Swiss albino mice.** *Saudi Pharmaceutical Journal* 2019, **27:**348-353.
55. Kaliyaperumal K, Askual G, Samuel Fekadu H: **Mosquito repellent activity of essential oil of Ethiopian ethnomedicinal plant against Afro-tropical malarial vector Anopheles arabiensis.** *Journal of King Saud University - Science* 2014, **26:**305-310.
56. Chin AZ, Avoi R, Atil A, Awang Lukman K, Syed Abdul Rahim SS, Ibrahim MY, Ahmed K, Jeffree MS: **Risk factor of plasmodium knowlesi infection in Sabah Borneo Malaysia, 2020: A population-based case-control study.** *PLoS One* 2021, **16:**e0257104.
57. Hogarh JN, Antwi-Agyei P, Obiri-Danso K: **Application of mosquito repellent coils and associated self-reported health issues in Ghana.** *Malaria Journal* 2016, **15:**61.
58. Furnival-Adams J, Olanga EA, Napier M, Garner P: **House modifications for preventing malaria.** *Cochrane Database Syst Rev* 2021, **1:**Cd013398.
59. Fox T, Furnival-Adams J, Chaplin M, Napier M, Olanga EA: **House modifications for preventing malaria.** *Cochrane Database Syst Rev* 2022, **10:**Cd013398.
60. Jumbam DT, Stevenson JC, Matoba J, Grieco JP, Ahern LN, Hamainza B, Sikaala CH, Chanda-Kapata P, Cardol EI, Munachoonga P, Achee NL: **Knowledge, attitudes and practices assessment of malaria interventions in rural Zambia.** *BMC Public Health* 2020, **20:**216.
61. Ondiba IM, Oyieke FA, Ong'amo GO, Olumula MM, Nyamongo IK, Estambale BBA: **Malaria vector abundance is associated with house structures in Baringo County, Kenya.** *PLoS One* 2018, **13:**e0198970.
62. Jatta E, Jawara M, Bradley J, Jeffries D, Kandeh B, Knudsen JB, Wilson AL, Pinder M, D'Alessandro U, Lindsay SW: **How house design affects malaria mosquito density,**

temperature, and relative humidity: an experimental study in rural Gambia. *Lancet Planet Health* 2018, **2:**e498-e508.
63. Tusting LS, Ippolito MM, Willey BA, Kleinschmidt I, Dorsey G, Gosling RD, Lindsay SW: **The evidence for improving housing to reduce malaria: a systematic review and meta-analysis.** *Malar J* 2015, **14:**209.
64. Tusting LS, Ippolito MM, Willey BA, Kleinschmidt I, Dorsey G, Gosling RD, Lindsay SW: **The evidence for improving housing to reduce malaria: a systematic review and meta-analysis.** *Malaria Journal* 2015, **14:**209.
65. Bempah S, Curtis A, Awandare G, Ajayakumar J: **Appreciating the complexity of localized malaria risk in Ghana: Spatial data challenges and solutions.** *Health & Place* 2020, **64:**102382.

Figure legends

Figure 1. Study areas

Tables legends

Table 1. Univariate and bivariate analysis of baseline socio-demographic characteristics of participants (n=92)

Table 2. Factors associated with malaria prevalence in the low endemic area (n=92)


UNIVERSITAS
SRIWIJAYA
ILMU ALAT PENGABDIAN

Dr.rer.med.Hamzah Hasyim <hamzah@fkm.unsri.ac.id>

Re: Revision Quality Check: “Risk Factors of Malaria Transmission Among Mining Workers at Muara Enim, South Sumatra, Indonesia”

1 message

Ayesha Siddiqka <ayesha.siddiqka@springernature.com> 22 October 2022 at 12:26
Reply-To: Ayesha Siddiqka <ayesha.siddiqka@springernature.com>
To: hamzah@fkm.unsri.ac.id

Dear Dr. Hasyim,

Many thanks for letting me know.

We have received your manuscript and the same has been processed further.

With best regards,
Ayesha
--

Ayesha Siddiqka (Ms.)
JEO Assistant
Journals Editorial Office (JEO)

On Sat, 22 Oct at 12:49 AM , Hamzah <hamzah@fkm.unsri.ac.id> wrote:

[External - Use Caution]

Dear
Ayesha Siddiqka (Ms.)
JEO Assistant
Journals Editorial Office (JEO)

Thank you for the reminder; we have updated the file per your recommendation.
The supplied 300 dpi image of Figure 1 with number labels has been incorporated into the manuscript. We have submitted the manuscript in word.doc including a cover letter for the editor of Malaria Journal and a response to reviewers in PDF; please double-check. If you have any questions, please feel free to contact me.

Respectfully,

Hamzah Hasyim

On Fri, 21 Oct 2022 at 11:50, Ayesha Siddiqka <ayesha.siddiqka@springernature.com> wrote:

> Dear Dr. Hasyim,
>
> Thank you for submitting your revision to Malaria Journal. However, in order to further process your paper, we will require the following to be included:
>
> • Fig. 1 caption(s) is/are either missing in the manuscript or given in non-editable format. Could you please check?
>
> * A cover letter describing your response to our editorial requests.
>
> * A point-by-point response to any issues raised by our referees, uploaded as ‘response to reviewers’.
>
> * Source files for your submission: word.doc or LaTeX
>
> If you intend to submit a TeX/LaTeX version of your paper, please zip the package and upload it under ‘Supplementary Information’ and submit a PDF conversion of your paper as the ‘Manuscript File’.
>
> At this stage, please also ensure that you have replaced your initial-submission image files with production quality figures. These should be supplied at 300 dpi resolution for .jpeg and .tiff or as .eps files. Figures should not include Figure number labels in the image: (https://www.nature.com/srep/author-instructions/submission-guidelines#figures-publication).
>
> Your paper has been placed back in the menu of the submitting author: you may access it via the following link: (please use the same email address as the one you registered with)

https://submission.springernature.com/submission/704fae14-8f97-4b1a-95e2-081424943303

(Press/Click on the above link to be automatically sent to the web page.)

Please make the requested amendments only, before selecting the “Submit manuscript” button on the “Review” page.

If you have any questions, please feel free to contact us.
Thank you very much.

With best regards,
Ayesha
--

Ayesha Siddiqka (Ms.)
JEO Assistant
Journals Editorial Office (JEO)

Dr.rer.med.Hamzah Hasyim <hamzah@fkm.unsri.ac.id>

0a263113-fb5d-4ace-aaa5-d7d45ef847e6 - Risk Factors of Malaria Transmission Among Mining Workers at Muara Enim, South Sumatra, Indonesia

1 message

Ayesha Siddiqka <ayesha.siddiqka@springernature.com> 27 October 2022 at 12:58
Reply-To: Ayesha Siddiqka <ayesha.siddiqka@springernature.com>
To: hamzah@fkm.unsri.ac.id
Cc: witacitradewiadi@gmail.com, risvaprina@gmail.com, rostikaflora@gmail.com, novrikasari@fkm.unsri.ac.id, icheandriyaniliberty@fk.unsri.ac.id, 10012682125016@student.unsri.ac.id, zemenut1979@gmail.com, sitiherlinda@unsri.ac.id, fadhilah.em94@gmail.com

Dear Dr. Hasyim,

I would like to let you know that the revision is sent inadvertently.

Kindly submit the manuscript online without any changes so that the editor could process accordingly.

Thank you very much.

With best regards,
Ayesha
--

Ayesha Siddiqka (Ms.)
JEO Assistant
Journals Editorial Office (JEO)

Dr.rer.med.Hamzah Hasyim <hamzah@fkm.unsri.ac.id>

Re: Re: Malaria Journal: Decision on your manuscript

1 message

Ayesha Siddiqka <ayesha.siddiqka@springernature.com> 26 November 2022 at 21:59
Reply-To: Ayesha Siddiqka <ayesha.siddiqka@springernature.com>
To: hamzah@fkm.unsri.ac.id

Dear Dr. Hasyim,

I have now forwarded this to the relevant department in this regard and will notify you once a response is received.

Thank you very much.

With best regards,
Ayesha
--

Ayesha Siddiqka (Ms.)
JEO Assistant
Journals Editorial Office (JEO)

Dr.rer.med.Hamzah Hasyim <hamzah@fkm.unsri.ac.id>

Re: Fwd: Re: Malaria Journal: Decision on your manuscript - Ticket ID [#7424773]

1 message

Open Research Support <orsupport@springernature.com> 27 November 2022 at 23:16
Reply-To: Open Research Support <orsupport@springernature.com>
To: hamzah@fkm.unsri.ac.id
Cc: ayesha.siddiqka@springernature.com

Dear Dr. Hasyim,

Thank you for contacting Springer Nature.

Just to add, please be advised that for fully open access journals; you will be notified that payment is due upon editorial acceptance of your article.

If you have any questions, please do not hesitate to contact us quoting your Ticket ID [#7424773].

With kind regards,
--
Allen Angelo Perfecto
Global Open Research Support Specialist
Author Service

Springer Nature Group
www.springernature.com
--

Dr.rer.med.Hamzah Hasyim <hamzah@fkm.unsri.ac.id>

Re: Re Submission: 0a263113-fb5d-4ace-aaa5-d7d45ef847e6

1 message

Ayesha Siddiqka <ayesha.siddiqka@springernature.com> 3 December 2022 at 21:10
Reply-To: Ayesha Siddiqka <ayesha.siddiqka@springernature.com>
To: hamzah@fkm.unsri.ac.id

Dear Dr. Hasyim,

I am yet to receive a response from the editor and will notify you once a response is received.

Thank you very much.

With best regards,
Ayesha
--

Ayesha Siddiqka (Ms.)
JEO Assistant
Journals Editorial Office (JEO)

> On Fri, 2 Dec at 8:23 AM , Hamzah <hamzah@fkm.unsri.ac.id> wrote:
> **[External - Use Caution]**
> **Dear**
> **Ayesha Siddiqka (Ms.)**
> JEO Assistant
> Journals Editorial Office (JEO)
>
> Again, thank you for your great support and understanding.
> I hope to get LoA for this current paper soon.
>
> I know this process required much of your time, and I couldn't have done it without you. Thank you for understanding
>
> Respectfully,
>
> Hamzah Hasyim
>
> Lecturer in Faculty of Public Health, Universitas Sriwijaya,
> South Sumatra, Palembang-Prabumulih, KM 32
> Indralaya (Ogan Ilir) 30662
> INDONESIA
> http://fkm.unsri.ac.id/id/
> hamzah@fkm.unsri.ac.id
> Phone number: +6282184773402
>
> Doktor der theoretischen Medizin (Dr. rer. med.)
> An alumnus of the Institute for Occupational, Social and Environmental Medicine,
> Faculty of Medicine of the Goethe University in Frankfurt am Main
> DEUTSCHLAND
> https://www.kgu.de/einrichtungen/einrichtungen-des-fachbereichs/zentrum-der-gesundheitswissenschaften/arbeits-sozial-und-umweltmedizin
> hamzah.hasyim@stud.uni-frankfurt.de
> Phone number: +4915905821418
>
> ID
> Scopus ID 57200911734
> Orcid ID 0000-0002-2780-8902
> Web of Science Researcher ID AAO-1249-2020
> https://publons.com/wos-op/researcher/3629645/hamzah-hasyim/
> https://scholar.google.com/citations?user=0OtyRq0AAAAJ&hl=id
> Sinta ID 5974146
>
> bit.ly/weM38G
> Please consider the environment before printing this e-mail
> Bitte denken Sie an die Umwelt, bevor Sie diese e-Mail ausdrucken

On Thu, 1 Dec 2022 at 00:34, Ayesha Siddiqka <ayesha.siddiqka@springernature.com> wrote:

> Dear Dr. Hasyim,
>
> I have now contacted the senior editor in this regard and will notify you shortly.
>
> Thank you very much.
>
> With best regards,
> Ayesha
> --
>
> **Ayesha Siddiqka (Ms.)**
> JEO Assistant
> Journals Editorial Office (JEO)


UNIVERSITAS
SRIWIJAYA
ILMU ALAT PENGABDIAN

SURAT PERNYATAAN TANGGUNG JAWAB BELANJA

Yang bertanda tangan di bawah ini :

Nama : Dr.rer.med HAMZAH HASYIM S.KM, M.KM
Alamat : Jalan Sukatani Lr. Kantor Lurah No 2232-B

berdasarkan Surat Keputusan Nomor 142/E5/PG.02.00.PT/2022, 10 Mei 2022 dan Perjanjian / Kontrak Nomor 0148/UN9.3.1/PL/2022, 17 Mei 2022 mendapatkan Anggaran Penelitian Analisis Determinan dan Eliminasi Malaria di Wilayah Endemik Sumatera Selatan Sebesar 200,000,000

Dengan ini menyatakan bahwa :

1. Biaya kegiatan Penelitian di bawah ini meliputi :

No	Uraian	Jumlah
01	**Bahan** Pembelian ATK, Bahan Penelitian (Habis Pakai), Bahan-bahan penelitian enumerator dan Tim, HDD Perekaman Data, Banner Penelusuran pustaka online , Prokes Masker dan handsanitizer, Cetak Dokumentasi dan Paket Data	24,543,597
02	**Pengumpulan Data** Rakor, FGD, Kuesioner Uji coba sample, Pelatihan Surveyor, Cetak Instrumen, Honor Narasumber, Paket Meeting, Uang Harian, Transport, Cetak Spanduk, Pustaka Online, Transport, Pengumpulan Data, Penginapan dan konsumsi.	109,475,000
03	**Analisis Data(Termasuk Sewa Peralatan** HR Sekretariat/Administrasi Peneliti Dan HR Pengolah Data, Manajemen Data, Analisis Sampel dan Reference Manager	4,555,083
04	**Pelaporan, Luaran Wajib dan Luaran Tambahan** Biaya Seminar Internasional, Proofreading, BMC Malaria Jurnal, dan RTL	57,676,320
05	**Lain-lain**	3,750,000
	Jumlah	200,000,000

2. Jumlah uang tersebut pada angka 1, benar-benar dikeluarkan untuk pelaksanaan kegiatan Penelitian dimaksud.

Demikian surat pernyataan ini dibuat dengan sebenarnya.

Palembang, 30-11-2022
Ketua,

(Dr.rer.med HAMZAH HASYIM S.KM, M.KM)
NIP/NIK 197312262002121001