Journal of Health, Population and Nutrition

REVIEW

Open Access

Health status of particularly vulnerable tribal groups (PVTGs) of Odisha: a narrative review

Nibedita Bhoi[1] and Subhendu Kumar Acharya[1*]

Abstract

There are 75 identified Particularly Vulnerable Tribal Groups (PVTGs) in India of which the highest numbers i.e., 13 PVTGs reside in Odisha. Particularly Vulnerable Tribal Groups (PVTGs) are indigenous communities distinguished by their unique cultural practices, traditional lifestyles, and geographical isolation. Their health status is often precarious due to strong traditional health practices, limited access to healthcare, inadequate nutrition, and exposure to community-acquired diseases. This review aims to explore the health status of all 13 PVTGs in Odisha, analyzing 67 studies from various sources/databases between 2000 and 2023. These studies include peer-reviewed published papers, grey literature, and brief reports. The findings showed that nutritional status among PVTGs varies widely while low BMI and undernutrition exist at different rates in different tribes. Deficiency diseases like goitre and anemia, infectious ailments such as tuberculosis and leprosy, and non-communicable diseases like hypertension and diabetes were reported with significant prevalence. Additionally, hemoglobinopathies, oral health issues, eye problems, undernutrition, poor mental health, and various other health challenges affect these tribes. Furthermore, behavioral issues like high tobacco consumption, alcoholism and menstrual health and hygiene disparities are other major challenges. Health disparities in diverse PVTGs arise from socioeconomic factors, cultural norms, and healthcare access. PVTGs face unique hurdles like major geographic isolation and traditional cultural influences which significantly shape their health choices. Addressing their poor health status demands cultural understanding, community engagement, and interventions targeting root inequalities for inclusive healthcare and improved well-being.

Significance

• There are 75 Particularly Vulnerable Tribal Groups (PVTGs) in India and Odisha has the highest, 13 number of PVTGs.
• PVTGs, the extremely vulnerable section within the tribal groups facing significant challenges, are characterized by pre-agricultural lifestyles, reliance on hunting and gathering, minimal/stagnant population growth, geographical isolation, and lower literacy rates.
• The study reports the various health issues faced by PVTGs including undernutrition, infectious and vector-borne diseases, hepatitis, hemoglobinopathies, low immunization rates, poor maternal and menstrual health, poor oral and eye health, and increasing mental health issues.

*Correspondence:
Subhendu Kumar Acharya
a.subhendu@gmail.com

Full list of author information is available at the end of the article

• Present findings highlight limited research on PVTGs' health with the increasing health burden catalyzed by systemic and structural factors.
• It discusses the various influencing factors by recommendations from multiple reports on effective strategies, interventions, and future actions.

Keywords Tribal health, Primitive tribal group (PTG), Indigenous community, Tribes of odisha, Health disparities, Indian tribes

Background

An estimated 476 million indigenous people live worldwide making up 6% of the world population [1]. They are known by various names such as tribes, native people, aborigines, first nations, Adivasi, Janajatis, and Hill tribes [2, 3]. India, with a tribal population of 104 million (8.6% of the country's population) is home to the second-largest tribal population in the world after China (Fig. 1) [2]. Within India's vulnerable tribal section, a subsection is recognized as 'Particularly Vulnerable Tribal Groups' (PVTGs) encountering heightened vulnerabilities [4]. As per the latest data provided by the Ministry of Tribal Affairs, Govt. of India on PM-JANMAN Scheme- 2024, PVTGs population stands at 44,71,005 individuals among the total Indian tribal population [5].

The categorization of PVTGs was first discussed in the Report of the Dhebar Commission in 1973, which identified disparities in development rates within Scheduled Tribes [6, 7]. Such tribes were defined as Primitive Tribal Groups (PTGs) by specific characteristics, including pre-agricultural lifestyles, reliance on hunting and gathering with subsistence economic practices, socio-cultural homogeneity, stagnant or declining population growth, geographical isolation, lower literacy level, a slower pace of societal change compared to other tribal groups; these findings were also justified in the Xaxa commission report in 2014 [6, 8]. In 2006, the Government of India redefined "Primitive Tribal Group (PTGs)" as "Particularly Vulnerable Tribal Groups (PVTGs) to better encompass the vulnerability and unique needs of these communities by removing the word 'primitive' as it was derogatory and was a stigma [6, 8, 9]. Initially, there were 52 groups in India identified as PVTGs; as per Census-2011, there are 75 PVTGs out of the 705 Scheduled Tribes (Fig. 2) in India, representing less than 0.6% of the total households. [10–11] Odisha hosts the highest number of PVTGs in India, with 13 officially acknowledged communities, recognized during the 5th to 8th Five-Year Plans (Fig. 2) [10–12] (See Table 1).

Tribal and indigenous populations globally suffer from various vulnerabilities and disparities on all fronts of their lives. Indigenous populations though constitute 6% of the world population, constitute about 19% of the world's extremely poor; their life expectancy has been observed 20 years less than the nonindigenous population [1]. Similarly in the Indian context, as per the Fifth Round of the National Family and Health Survey (NFHS 5; 2020-21) report, Indian tribes constitute only 8.6% of the national population and constitute more than 70% of the lowest two wealth/income quartiles of the country. This status of Indian tribes indicates the existence of extreme poverty, inequality, and social disparity among them in comparison to others. The Xaxa Commission report, 2014 highlighted that the tribal groups suffered from major socio-economic disadvantages, limited access to healthcare infrastructure, geographical isolation due to remote living practices, lack of awareness, and unique cultural norms and beliefs [8]. The historical large-scale inequalities suffered by these indigenous people also extend to their health status with a significant burden of diseases and disability; the health outcomes are poorer among them than the rest sections of the society [13]. The burden of undernutrition, maternal and infant mortality, infectious diseases, vector-borne diseases, and hemoglobinopathies like major types of health hazards are significantly high among them. Along with this, issues associated with poor behavioral habits namely, alcoholism and substance use are huge social and health problems among Indigenous people across India. Gender disparity, disadvantaged youth, and unsupported old age are less explored but other major concerns in indigenous health. The large-scale disparity among tribal and non-tribal populations indicates the existence of a substantial structural inequality leading to major suffering for these underprivileged communities. In this scenario, evidence around PVTG health and associated causative factors are highly sporadic in India. National-level large sample surveys are least representative of PVTG groups in their samples due to their small population size and remote living nature. On the other hand, the National Technical Report on Tribal Health, 2018 reported a visible population decline in several of the PVTGs in the country [14] It further highlights that there is a huge information gap and poor documentation on the health and population of the PVTGs. It is therefore crucial to constantly evaluate the health status of these underprivileged groups to ensure their timely welfare and upliftment.

In the above background, the state of the health among PVTGs in Odisha carries high significance as the state houses the highest number (64) of tribes as well as PVTG communities (13) in the country; one-fourth of the population residing in the state carry tribal identities and

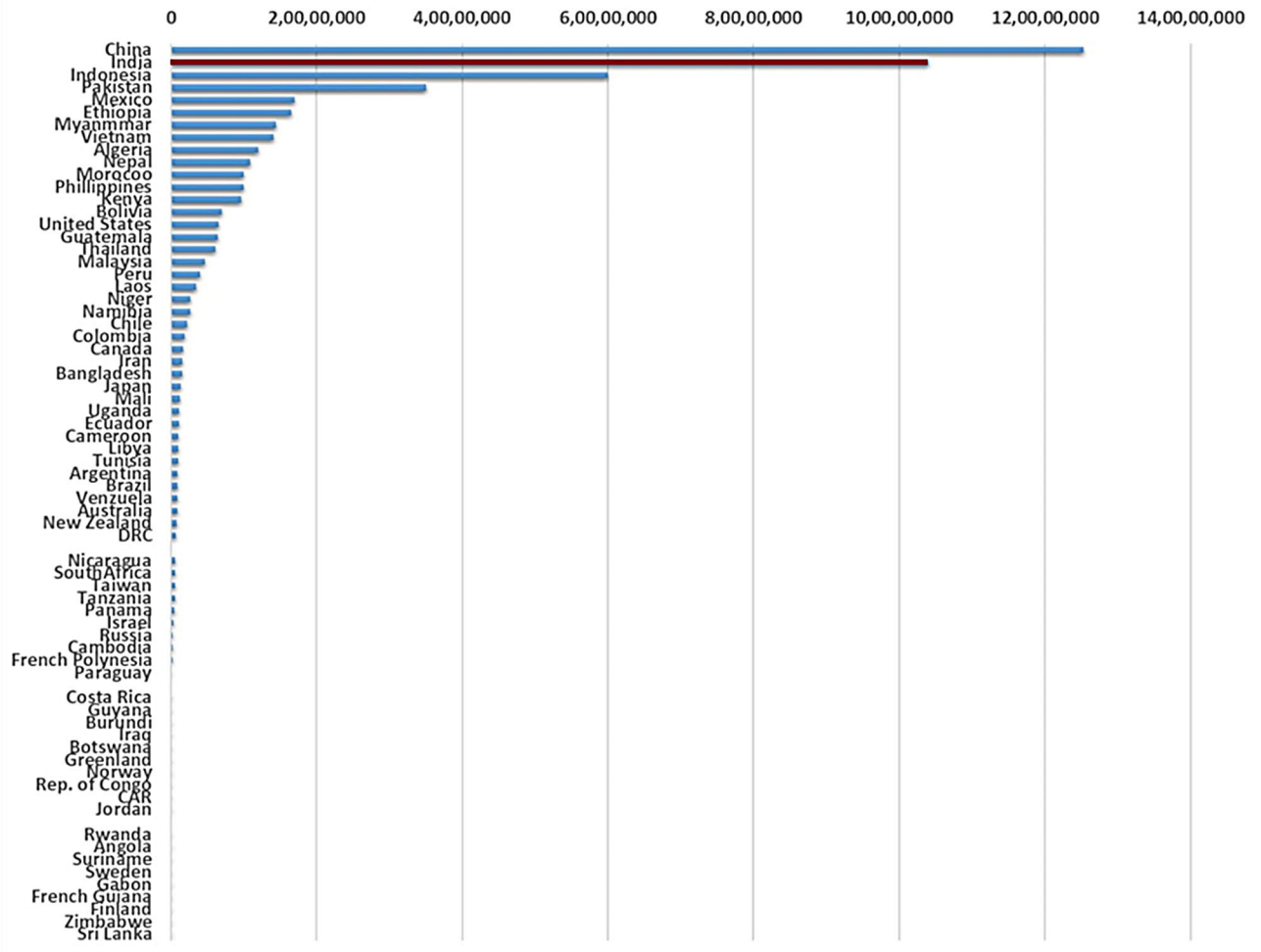

Fig. 1 Status of Population of Indigenous communities in various countries around the world. (Source: The Indigenous World 2024 (38th Edition), (IWGIA), 2024)

are at the risk of facing substantial disparities in various aspects, including health [15]. Understanding their health status is therefore crucial to help explain the scope for their well-being within the broader national context.

Objectives of the review

This review aims to provide a comprehensive analysis of the health status of PVTGs in Odisha, drawn from a meticulous assessment of published and unpublished research studies, offering an in-depth exploration of the health landscape of these communities.

Methods

The study populations and their characteristics

Odisha's 13 PVTGs live in 12 districts, mostly remote and fringe areas in challenging terrains (Table 2). They face major issues in accessing basic amenities like access to electricity, sanitation, clean drinking water, housing, etc. Over 90% of them lived in overcrowded, inadequate housing facilities lacking amenities [16]. A 2018 survey revealed high rates of malnutrition, diseases, illiteracy, and poverty among these PVTGs in the state [16]. The survey also indicated their literacy rate at as low as 37.4%, significantly lower than the state's average (73%) (Table 3); the average monthly per capita income is Rs. 2,100, placing most PVTGs below the poverty line.

In Table 3, we briefly analysed the details of their occupational patterns, tangible/intangible cultural characters, and other social aspects based on our ethnographic fieldwork. The 13 PVTGs reside largely in 12 districts in Odisha with a concentration in selected blocks. The population of the PVTGs varies between 593 for Birhors to 534,751 for Souras [4]. The literacy level among PVTGs, and particularly among females is significantly lower than the other tribal, non-tribal communities, along with national and state literacy rates [4]. Their occupational practices are mainly associated with sources from nature mostly depending on the local forest. There has been limited transition at the technological level through adaptation to modernity.

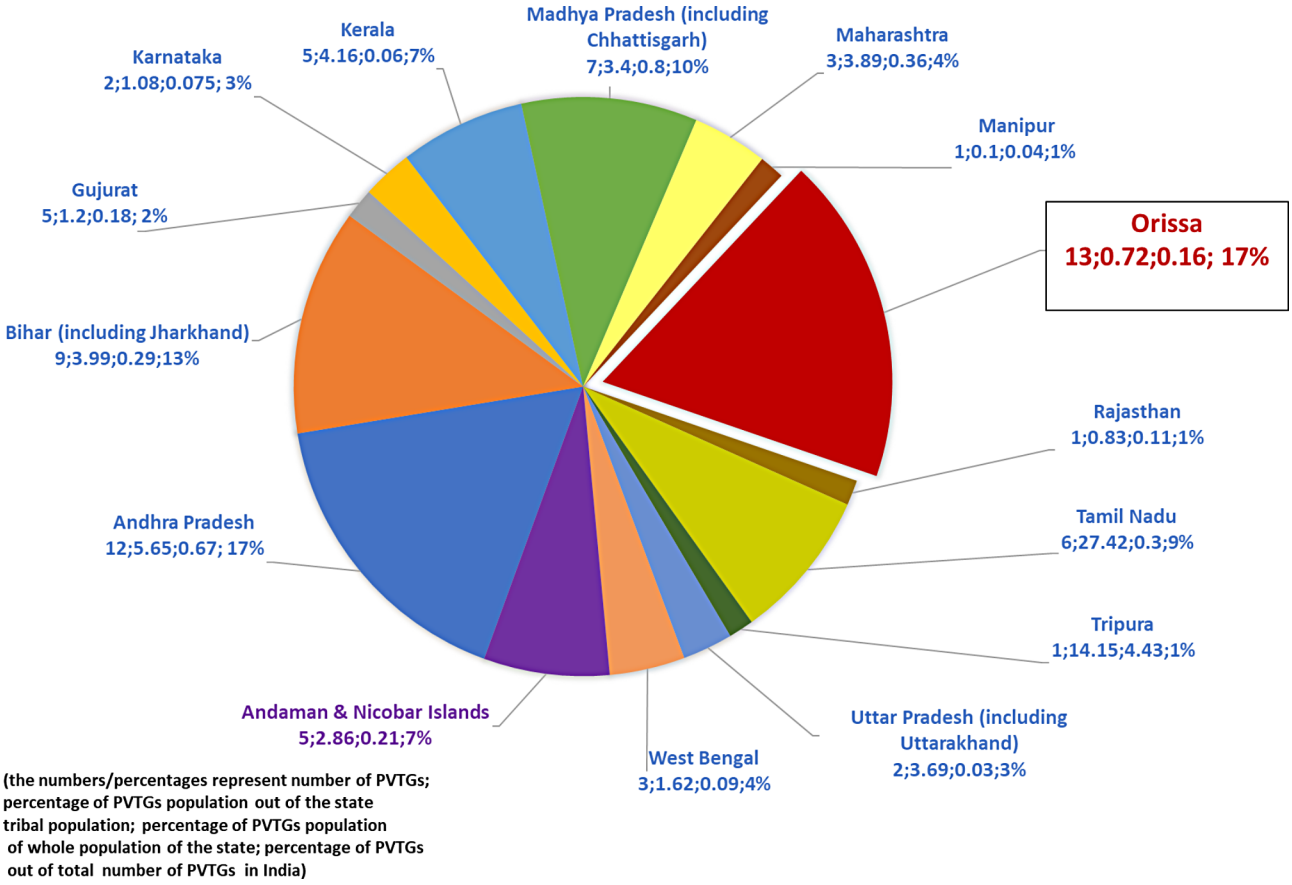

Fig. 2 State-wise demographic details of the PVTG population in India. (Source: Census of India, 2011)

Table 1 Year of recognition/inclusion of PVTGs of Odisha

Five year plan(Year)	PVTGs
5th (1974–78)	Bonda
6th (1980–85)	Juang
	Dongriya Kondh
	Paudi Bhuyan
	Lanjia Saora
	Saora
	Kutia Kondh
	Birhor
7th (1985–90)	Didayi
	Hill Kharia
	Mankirdia
	Birhor
	Lodha
8th (1992–97)	Chutkia Bhunjia

Table 2 Geophysical zone-wise distribution of PVTGs of Odisha and their living settings

Geophysical zone/ Physical Zone	PVTGs	Living settings
Northern Plateau	Birhor	Plain
	Mankidia	Plain
	Hill Kharia	Hill
	Juang	Plain
	Lodha	Plain
	Paudi Bhuyan	Hill
	Bonda	Both Hill and plain
Eastern Ghat	Didayi	Plain
	Chuktia Bhunjia	Plain
	Dongria Kondh	Hill
	Kutia Kondh	Hill
	Lanjia Saora	Hill
	Saora	Hill

There are community-specific sociocultural practices like age hypogyny (a female marrying a younger boy) among Bondas, clan/lineage endogamy (marrying within clan/lineage) among Birhors, practices of animism/animalism (magico-religious belief and worshiping practices) among Didayi, Youth Dormitory System(a community place where young people live together and learn their culture and community skills) among Juang, the practice of Sacred Groove (Groove of trees with religious importance) among Hil Kharias, strong and long historical cultural association with Lord Jagannath of Hindu religious tradition among Souras. The spoken languages among the 13 PVTGs belong to Mundari, Astro-Asiatic, Dravidian, and Indo-Aryan language families[17].

In the background of above state of development, sociocultural practices, and economic status, the present review tries a comprehensive assessment of available evidence focusing on studies on the health of Particularly Vulnerable Tribal Groups (PVTGs) in various domains including, genetic diseases, oral health, various deficiency diseases, eye health, menstrual health and hygiene, nutrition, the burden of communicable diseases and non-communicable diseases etc.

Inclusion and exclusion criteria

This review considers all the primary studies focusing on reported health and disease conditions of PVTGs of Odisha, India covering all age groups of both the genders. The present review included only the primary studies conducted between the years 2000 to 2023. We also included the unpublished dissertations/thesis, reporting only primary findings. The medium for all the included studies was English language only. We included journals that are available in online modes. We hand-searched and added articles published by the local tribal research institute and university journals.

Search strategy

A comprehensive literature search was undertaken from various sources, including online databases such as PubMed, EMBASE, Web of Science, Scopus, the Cochrane Library, Google Scholar, and Google Search, UGC-Shodhganga. We also searched for the references in the studies initially included. We hand-searched and added articles from local journals like "Adivasi," published (in offline mode) by Scheduled Castes and Scheduled Tribes Research and Training Institute (SCSTRTI), Bhubaneswar, Odisha, and "Man in Society," published by the P.G Department of Anthropology at Utkal University, Bhubaneswar, Odisha. We also explored the websites of Government of India like the Ministry of Tribal Affairs, SCSTRTI, and the Indian Council of Medical Research (ICMR). We searched for student dissertations and Ph.D thesis in UGC-Sodhaganga. Additionally, we undertook library review in the Libraries of ICMR-RMRC Bhubaneswar, Parija Library at Utkal University, Odisha, and the Department Library of P.G Department of Anthropology, Utkal University, Bhubaneswar. To cover the health status of the recent past, we have included research articles published between 2000 and 2023 presenting the recent findings. This review of the literature was performed by using appropriate MeSH terms (Supplementary File 1). Key search terms were determined as per the review questions and the inclusion criteria.

In the first step, the titles and abstracts were screened and duplicate articles were removed from the study. The relevant literature was selected based on the defined inclusion criteria. The authors extracted the data manually from the selected full-text articles and entered them into a Microsoft Excel Spreadsheet. The data included the title of the articles, Authors' names, publishing years, areas of the studies, names of the PVTGs studied, etc. In the final step, the health status of PVTGs was collected and categorized into different themes followed by a summarization of the results. The retrieved data were identified with the major concepts and themes linked to the specific health status. The objectives and results of the included studies were analyzed to identify research gaps and scopes for future research. In total, we reviewed and analyzed 67 research studies specifically focusing on PVTGs in Odisha.

Results

All the included studies focused on the 13 Particularly Vulnerable Tribal Groups (PVTGs) residing across 12 districts of Odisha (Table 3). The present study identified eleven themes based on available literature namely, nutritional status, infectious and vector-borne diseases, non-communicable diseases, inherited genetic disorders, maternal and child health, oral health, eye health, alcohol and tobacco consumption, mental health, menstrual health, and hygiene.

Nutritional status of PVTGs

The selected studies highlighted the trends in nutritional status and associated health conditions among PVTGs in Odisha, namely, Kutia Kandha, Mankidia, Bonda, Lodha, and Dongria Kondh. Low Body Mass Index (BMI) and malnutrition were the major nutritional problems among these groups, with varying degrees of severity.

The prevalence of low BMI ranged from 29.5% [18] to 79.08% [19]. A study in 2022 on Kutia Kandha reported low BMI among 77.02% of individuals aged 0 to 20 years and 52.43% of individuals above 20 years [20]. Similarly, in a study reported in the year 2023, undernourishment was noted as 29.5% among Paudi Bhuyans in the above 6 years of age group [18] and 43.1% in the age group below 6 years of age [21]. A 2015 study on the Mankidia tribe showed the prevalence of undernutrition as 54.23% [22] while another study in 2022 among Bonda communities exhibited varied rates with 79.08% among Upper Bonda and 41.83% in Lower Bonda settings [19].

Early adolescents among Dongria Kandhas showed an increased prevalence of inadequate energy intake, while late adolescents exhibited significantly high protein inadequacy affecting 62.36% of the age group as observed in the year 2017 [23]. Another study in 2015 among Mankidias showed high chronic energy deficiency (CED), reaching 48.4% in males and 59.5% in females including those in the normal range for BMI [22]. The Juang tribe displayed high anthropometric failure rates with 22.73%

Table 3 Brief socio-demographic profile, geographic population concentrations, traditional characteristics, and availability of health facilities among PVTGs of Odisha

Name of the tribe	Population [4]	Literacy rate (%) [4]			District of population concentration	Major blocks	No. of PHCs	Language family for the spoken language [17]	Major occupation	Recent and continuing change in the Techno-economic stage	Striking tangible/intangible cultural characters
		Male	Female	Total							
Bonda	12,231	39.79	25.74	33.00	Malkangiri	Khairput	4	Astro-Asiatic/ Mundari	Weaving handloom clothes, carpet, making bead necklaces, broomstick, Archery	Shifting cultivators to settled agriculturists	Women wear heavy necklaces of colored beads and brass. Age hypogyny practice among women
Birhor	596	35.63	38.92	37.24	Jajpur	Sukinda	4	Astro-Asiatic/ Mundari	Rope and basket making, leaf plate stitching	Hunter-gathers to settled agriculturists.	Endogamous. Birhors keep their domestic animals and birds in the same hut.
Chuktia Bhunija	3086	27.45	19.52	23.53	Nuapada	Nuapada Sunabeda	4	Dravidian	Bead neckless making	Settled agriculturalists to industrial laborers along with continuing the same traditional agricultural practices	A typical sacred kitchen practice prohibits all including married daughters from access.
Dongria Khondh	9659	7.14	5.71	6.35	Rayagada	Bissam cuttack	4	Dravidian	Wood work, wall painting, animal harn based-comb making, forest collection	Shifting cultivators to settled agriculturists.	Known for the Niyamgiri movement
Didayi	8890	9.24	4.76	6.87	Malkangiri	Khairiput Kudumulguma	7	Astro-Asiatic/ Mundari	Bamboo basketry, weaving handloom clothes, archery, broomstick making	Shifting cultivators to settled agriculturists.	Practice animism and animalism.
Juang	47,095	35.00	25.00	30.00	Keonjhar	Banspal Harichandanpur Ghatgaon Telkoi	16	Astro-Asiatic/ Mundari	Wood making, comb making	Shifting cultivators to settled agriculturists.	Practice Bachelor dormitory system
Kutia Khondh	39,761	6.39	3.52	4.98	Kandhamal Kalahandi	Tumudibandha Lanjigarh	5	Dravidian	Basketry, broomstick and mat making	Shifting cultivators to gathers/ settled agriculturists.	Strong social organisation, endogamous community
Lodha	9785	31.06	23.56	27.20	Mayurbhanj	Baripada Badasahi Kaptipada Shyama Khunta Khunta	17	Indo Aryan	Rope making, bamboo craft	Gathers/ Settled cultivators to settled agriculturists.	Mother Earth is the chief deity, strong beliefs in ghosts
Lanjia Saora	40,913	36.34	25.14	30.68	Rayagada	Gunupur	2	Astro-Asiatic/ Mundari	Wall painting, wood carving, stone terracing, cashew plantation	Gathers/Shifting cultivators to settled agriculturists.	The name 'Langia' comes from the practice of a loin hanging cloth in front like a tail (Langia-tail bearing), famous for wall painting called 'Idital', skilled in water management

Table 3 (continued)

Name of the tribe	Population [4]	Literacy rate (%) [4]		District of population concentration	Major blocks	No. of PHCs	Language family for the spoken language [17]	Major occupation	Recent and continuing change in the Techno-economic stage	Striking tangible/intangible cultural characters
Hill Kharia/Kharia	2800	44.51	39.26	41.75 Mayurbhanj	Bisoi Jashipur karanjia thakurmunda	9	Astro-Asiatic/ Mundari	Forest collection, broomstick making, leaf plate making	Hunter gathers to settled agriculturalists.	Practice sacred groove
Mankidia	2222			Mayurbhanj	Bisoi Jashipur Karanjia Thakurmunda	9	Astro-Asiatic/ Mundari	Basket, roap and sling making, monkey catching, leaf plate making	Hunter gathers to settled agriculturists.	Strong belief in ghost, hunt and eat monkey from which the name is derived i.e. one who eat 'mankad' (monkey) in local Odia language.
Paudi Bhuyan	61,303	34.84	31.35	33.18 Angul, Keonjhar Sundergarh	Pallahara Banspal Lahunipada	12	Indo Aryan	Broomstick, mat, leaf plate making, basket.	Shifting cultivators to settled agriculturists.	Unique cultural practices and rituals at different phases of cultivation; use cow for tilling.
Saora	534,751	40.03	30.27	36.13 Gajapati Ganjam	Mohana R.Udayagiri Patrapur	12	Astro-Asiatic/ Mundari	Wall painting, wood carving, carpet weaving, mulberry cultivation	Shifting cultivators to settled agriculturists.	Strong belief in ghost, historical connection with the cult of Lord Jagannath
Total population	773,092									

in preschool, 62.35% in school-going children, and 63.95% among adolescents [24, 25].

Lodha adolescent girls exhibited higher rates of stunting and underweight than boys [26]. Illiteracy and poverty significantly contributed to undernutrition among the Juangs [27]. Dongria Kondhs faced protein and calorie inadequacies alongside iodine deficiency disorders among children, posing serious health concerns as per the studies conducted in the year 2022 [28, 29].

Deficiency-associated anomalies like goitre and anemia were also reported in the selected studies. A study conducted in the year 2009 among the elderly population indicated that the prevalence of goitre was at 3% in Paudi Bhuyan, and 5.3% among the Kutia Kandha tribe [30].

Regarding anemia, a study among Paudi Bhuyan in the year 2023 reported that 16.6% had mild anemia, 9.8% had moderate anemia, and 5.88% had severe anemia [31]. On the other hand, a study on Kutia Kandha in 2017 showed a higher prevalence (70.54%) of moderate anemia along with 21.09% having severe anemia [20].

A study (2017) on Dongria Kondh adolescent girls reported the prevalence of 21.1% mild anemia, 71.9% moderate anemia, and 7% severe anemia among individuals with normal BMI [23]. Along with this, inadequate energy intake affected 62.36% of Dongria Kondh adolescent girls in early adolescence, while 80.60% faced inadequate protein intake in late adolescence [23]. These findings underscore the extensive presence of deficiency diseases, particularly anemia, among these tribal populations.

Status of infectious and vector-borne disease among PVTGs

The burdens of infectious and vector-borne diseases are other major concerns among PVTGs due to the evolving scenarios like increasing migration and community-acquired infections, deforestation, increasing mining, etc. Tuberculosis prevalence rates among various PVTG populations are significantly high. As per the study on the elderly population in the year 2009, it affected 6% of the Paudi Bhuyan tribe, 18% of the Dongria Kandha tribe, and 2.6% of the Kutia Kandha tribe [30]. However, other studies undertaken in different geographic locations reported lower rates: 2.48% in the Kutia Kandha, in the year 2017 [23] and 3% in the Mankidia, in the year 2009 [22].

Additionally, cases of leprosy were reported among the elderly PVTGs in the year 2009. Specifically, 2% of the elderly in the Dongria Kandha, 3.5% in the Kutia Kandha, and 2% in the Paudi Bhuyan were reported with leprosy [30].

According to a study in the year 2022, the prevalence of malaria among PVTGs stood at 8.1%. The highest prevalence was noted in the Kutia Kandha tribe at 25%,

followed by the Dongria Kandha tribe at 13.8%, Paudi Bhuyan at 11%, Bonda at 7.8%, Hill Kharia at 6.3%, Chuktia Bhunjia at 5.1%, Saora at 4.5%, and Didayi at 2.45% [32]. Similarly, another study conducted in 2004, reported that malaria prevalence in the Khadia tribe at 11.11% and in the Saora tribe at 15.81% [33]. These findings emphasize the urgent need to address malaria within these vulnerable tribal communities.

Hepatitis

The prevalence of HCV infection varies among tribal groups, ranging from 0 to 13.4%, notably increasing with age. HBV infection among Particularly Vulnerable Tribal Groups (PVTGs) is also a high concern with prevalence rates as high as 14.18% as per the study conducted in the year 2023 [34]. A study conducted on the prevalence of hepatitis C virus among tribes in the year 2019 reported that tribes like Juanga and Mankidia with substantially high HCV rates; this burden was also high among children aged 6 to 15 years as well as among children under 5 years, reaching upto 1.9–3.8% [35]. Kandhamal recorded the highest HBV prevalence at 4.7% as per a recent study in 2023 [34] Clinical observations highlighted hepatitis-related symptoms but relatively low clinical hepatic condition. HCV-positive cases predominantly showed genotype 1b, while HBV cases exhibited symptoms of hepatitis without hepatic failure [35, 36].

Non-communicable diseases among PVTGs

Non-communicable diseases have emerged as a major public health concern for both the nontribal and indigenous groups. Nonetheless, there is a dearth of research focused on vulnerable tribes. Among Juangs, a study in 2020, showed age-related raised blood pressure trends. A raised average heart rate was witnessed (81.82 bpm), which was notably higher in males (75.40 bpm) than females (73.95 bpm), and such raised average heart rate was observed mostly in the late adulthood (41–50 years age group) [37]. Similarly, the mean arterial pressure (MAP) was observed at an average of 92.56 mmHg slightly higher among males. Hypertension prevalence was reported at 9.26% (males, 6.17%; females, 3.09%) [37].

Another study in 2009 reported varying prevalence rates of hypertension among the elderly population of the PVTGs with 68% in Lanjia Saora, 33% in Paudi Bhuyan, 18% in Dongria, and 9.8% in Kutia Kandha [30]. The overall prevalence of hypertension ranged from 2.20% in Kutia Kandha (2017) [20] to 27.6% in Paudi Bhuyan(2023) [31], 43.3% in Saora(2017) [38], and 8.80% in the Bonda tribe(2022) [39]. Hypotension was observed at 0.44% in Kutia Kandha(2017) [20] and 23.30% in Saora(2017) [38].

Additionally, diabetes was observed of emerging as a notable concern among PVTGs. A study in the year 2023 reported 31.25% individuals with of prediabetes sugar levels and another significant burden of high sugar levels among the Paudi Bhuyans [31].

Asthma cases were found among elderly PVTGs, involving 20% of Dongria Kandha and 3% of Paudi Bhuyan individuals in a study conducted in 2009 [30].

Inherited genetic disorders among PVTGs

Hereditary genetic disorders have been a persistent health concern among endogamous communities like PVTGs due to their assortative mating practices. These disorders involve anomalies with abnormal hemoglobin like Sickle Cell anemia, Thalassemia, etc. along with other issues like glucose-6-phosphate dehydrogenase (G-6-PD). Blood disorders, specifically hemoglobinopathies, and various blood group incompatibilities have a notable presence among tribal communities in Odisha. [32– 46] These communities, often residing in remote and malaria-endemic areas. A study by Dixit et al.,2022 reported that the overall prevalence of sickle cell among Particularly Vulnerable Tribal Groups (PVTGs) in Odisha is 3.3% ([32]. However, variations exist among tribes with Bonda at 2.26%, Didayi at 7.1%, Dongia Kandha at 2.0%, Juang at 3.6%, Langia Saora at 5.4%, and Paudi Bhuyan at 3.8% of prevalence ([32]. Multiple studies conducted in different years have shown a wide range of prevalence. For example, studies among PVTGs have reported prevalence ranging from 5.3% (year 2003) to 7.7%(year 2006) among Kharia ([44, 46], 3.3%(year 2022) to 16.4%(year 2006) among Kutia Kandha ([32, 46], and 5%(year 2022) to 7.3%(year 2004) among Saoras ([32, 33]. Beta-thalassemia prevalence in Odisha's studied PVTGs is 0.3% (2022), varying from 1.6% (year 2014) to 11.20%(year 2003) ([32, 41, 42]. Coexistence of Alpha-thalassemia and sickle cell anemia are found in varying percentages across tribes ([32]. The prevalence of G6PD deficiency in Odisha's studied PVTGs is 3.1% (2022), with variations in prevalence in tribes; in Kharia it ranges from10.4%(2022) to 24.9%(2007) and in Paudi Bhuyan it ranges from 1.3%(2022) to 13.72%(2006) ([32, 40, 43].

Status of maternal and child health among PVTGs

In Odisha, PVTGs endure significant challenges in maternal and child health with significant burdens of morbidity and mortality rates which are higher than other tribes and nontribal communities ([47] Studies in 2020 revealed that among the Juang tribe, over two-thirds of women didn't receive crucial antenatal check-ups; a study on Hill Kharia in 2013 reported that 35.2% lacked essential iron and folic acid supplements during pregnancy ([27, 48]. Moreover, a notable percentage of women across various tribes refrained from family planning, ranging from 44.6%(2013) to as high as 82.9%(2022), highlighting the widespread nature of the issue ([27, 49, 50]. Our primary field findings among PVTGs explain

that cultural factors like stigma among women and fear of loss of vigor to do hard work among men are primary factors associated with avoidance of permanent sterilization. Males also wanted to avoid childlessness as there is a high prevalence of child death rate among these remote living communities. Among children, low rates of infant breastfeeding (18.6%) and high levels of unvaccinated children (33.8%) add to the concerning health scenario among these tribal groups ([27].

Oral health issues among PVTGs

The importance of maintaining good oral hygiene transcends aesthetics; it profoundly impacts overall health and well-being. Neglecting oral care can result in severe issues like cavities and gum diseases, along with serious outcomes like heart diseases, strokes, diabetes, and pregnancy complications ([51, 52]. Globally, approximately 3.5 billion people grapple with oral diseases, and these challenges disproportionately affect disadvantaged populations (WHO) ([53].

In Odisha's Kandhamal district, a study focusing on the Kutia Kandha in 2023, revealed concerning status of oral health in the community. The mean DMFT (Decayed Missing Filled Teeth) score for permanent teeth was 4.06±3.5 which was high in a community setting. The study indicated that the daily consumption of rice along with the high frequency of non-vegetarian food items was a possible major reason for the high DMFT index score. Additionally, 56% of the participants displayed 4–5 mm attachment loss, and 35.6% had 6–8 mm attachment loss. About 16% experienced bleeding gums, 42.6% had pockets of 4–6 mm, and 32.5% exhibited pockets exceeding 6 mm. Alarmingly, only 7.6% practiced proper oral hygiene using adequate toothbrushes or toothpaste, indicating a lack of awareness ([54]. However, no mention of traditional practices around oral hygiene was reported in the selected study. This study also highlighted the high consumption of smokeless tobacco use as a major reason for poor oral health in the community, as a significant section of the studied participants were reported with oral pockets due to the particular use of smokeless tobacco.

Similarly, among the Juang tribe, a study undertaken in 2019 identified dental fluorosis affecting 2% of the population, with varying severity: 1% had very mild, 0.9% had moderate, and 0.1% had severe dental fluorosis. Access to general and oral health services remained limited within this community ([55]. These findings underscore the need for comprehensive oral health education and improved access to oral care services among the affected tribal communities to effectively address prevalent oral health issues.

Issues in eye health among PVTGs

Issues around eye health were observed in reports from PVTGs in Odisha. A study among Dongria Kandha in 2023, revealed significant eye health challenges among them. Refractive errors affected 7.5% of individuals mostly females (63%) than males (37%). Among those aged in the 50–59 years age group, 28.3% had refractive errors ranging from +3.00 to -3.00 Diopters (D) ([56].

In another study in the same year (2019) on visual impairment among Dongria Kandhas,12.4% were reported with visual impairment, 9.9% with early moderate visual impairment (MVI), and 2.5% with severe visual impairment (SVI) or blindness. Cataract was the primary cause of early MVI (50%) and SVI/blindness (76%), increasing with age. Uncorrected refractive errors affected 7.5% of individuals, mainly adults and females. Presbyopia was present in 41.5%. Senile cataracts affected 7.6% constituting mostly females and occurring bilaterally. Vitamin A deficiency signs, like conjunctival xerosis, affected 20% of children, with other disorders such as strabismus and cataracts. Moreover, issues like high (>20%) Vitamin A deficiency were observed among Dongria children. A considerable portion of the community-mostly females was reported underweight. Hypertension was also highly prevalent and alcohol consumption was widespread including females and those under 18 years old which were potential contributing factors to poor eye health in the community ([57].

Prevalence of alcohol and tobacco consumption among PVTGs

Alcohol and tobacco use present significant public health concerns among Odisha's Particularly Vulnerable Tribal Groups (PVTGs).

Additionally, particular PVTGs like the Juang, Bonda, Kutia Kandha, and Paudi Bhuyan tribes exhibited elevated rates of alcohol and tobacco consumption. For example, alcohol consumption ranged from approximately 60–70% among the Juang as per the studies done in the year 2020 ([58–60] while the Bonda tribe's consumption was reported to be 66.7% in the year 2022 ([61]. Kutia Kandha was reported with an alcohol consumption rate of 58.95% ([21], and Paudi Bhuyan had a rate of 32.33% ([62] as per the study conducted in the year 2017 and 2023 respectively.

Similarly, tobacco use was prevalent across these tribes, with the consumption rates varying from 57.14% among the Juang (2020) ([59] 61.2% among the Bonda (2022) ([61] 71.63% among Kutia Kandha(2017) ([20] and 57.33% among the Paudi Bhuyan tribe(2023) ([62]. These statistics underscore the urgent necessity for targeted public health initiatives tailored to address alcohol and tobacco-related challenges within these vulnerable tribal communities.

Mental health status among PVTGs

Mental health is a universal concern that can affect any community, regardless of its location or background. A study on the Juang tribe in Odisha in 2021 revealed that 35.20% of participants experienced moderate depression, with 8.00% reporting severe depression. The research highlights specific components of depression, such as changes in sleeping patterns, appetite, and feelings of tiredness and fatigue, which were significantly associated with age in both males and females. Moreover, emotional aspects like 'loss of interest in sex,' 'past failures,' 'worthlessness,' 'punishment feelings,' and 'suicidal thoughts' displayed concerning trends with the increase in age among females. This study underscores the importance of addressing mental health universally and tailoring interventions to specific age and gender-related factors ([63].

Status of menstrual health and hygiene among PVTGs

The selected studies also highlighted the unique issues around menstrual health and hygiene in Odisha's PVTG tribal communities, like the Juang and Dongria Kondh tribes. The findings around menstrual health practices revealed specific challenges. For example, a study among Juang women in 2023 reported that 85% relied on old clothes as menstrual absorbents due to reasons like limited access (36%), lack of awareness (31%), and high cost (15%), hindering the adaption of sanitary napkins ([64]. Furthermore, during menstruation, around 85% of Juang women were restricted from religious activities, and nearly 94% avoided social gatherings. A significant portion (71%) of Juang women experienced menstrual problems in the past six months, with only one-third seeking treatment for these issues. Another study among adolescent girls of Dongria Kondh in 2022 reported that the average age at menarche was 12.06 years, with 79.1% reporting regular menstruation and 53.1% experiencing dysmenorrhea ([65]. While 39.1% used sanitary napkins, 60.9% still relied on old clothes as absorbents. These findings underscore the urgent need for culturally sensitive solutions in these tribal communities to address menstrual health disparities.

Discussion

The health status of PVTGs in Odisha reflects a wide spectrum of challenges. As per the findings of the studies, undernutrition was observed to be the major concern among all tribes ([18–26, 67] manifesting in anemia, micronutrient deficiency, low BMI, stunted growth, and overall thinness in both children and adults. Similarly, the rapid transition to modern lifestyle and evolving dietary habits have led to a rise in overweight and obesity ([68, 69]. PVTGs in Odisha also grapple with a rising burden of NCDs such as hypertension, diabetes, and asthma across various age groups ([30, 31, 70–75]. Hereditary blood disorders are prevalent among various tribes, particularly PVTGs in Odisha, highlighting the need for community-specific interventions ([44]. Infectious and vector-borne diseases like tuberculosis, leprosy, and malaria continue to remain significant health concerns among PVTGs in Odisha. Furthermore, hepatitis infections, specifically HCV and HBV, were reported to be prevalent among some of the PVTGs such as Juanga and Mankidia, primarily due to cultural practices like sharing razors, tattooing, and receiving multiple injections which need details investigations by including other PVTGs ([34, 35]. Evidence around oral health indicates the presence of pre-cancerous lesions, high rates of cavities, gum diseases, and poor oral hygiene practices among the tribes of Odisha attributed to limited awareness and access to oral care ([66].

On the behavioral health front, alcohol and tobacco use rates among PVTGs in Odisha are significantly higher than those of the nontribal population ([58–62]. Similarly, mental health is also becoming an emerging concern among tribal and vulnerable populations ([63, 76].

Studies examining menstrual health practices among Juang and Dongria Kondh communities revealed challenges such as limited access to hygiene products and significant social taboos around menstruation causing discrimination; it emphases the need for heightened awareness and improved solutions ([64, 65]. Furthermore, maternal and child health services witness low utilization rates, particularly in antenatal check-ups, vaccinations, and home deliveries. ((27, 48, 49, 50, 51, 77–78).

Based on our recent fieldwork and ethnographic findings among PVTGs like Juang, Mankidia, and Bonda, it may be mentioned that PVTGs are very recently but rapidly adapting to modernization and coming across the mainstream societies ([79, 80]. Their indigenous culture is interacting with mainstream social and cultural practices in a complex manner. There is significant change around their collective and individual consciousness and identity which further influences their overall health and treatment-seeking behaviour ([79]. Though the studies included in the present study did not report such modernization and lifestyle-associated health risk factors, further studies in these aspects will bring important perspectives.

Comparing the health risk status of PVTG groups from Odisha and other states, similar risk patterns were observed in several contexts. The prevalence of undernutrition among the Kamar tribe was found to be 48% (2002) ([81]. Tthere was a 54.7%(2020) prevalence of undernutrition among Preschool children of Hill Korwa of Chhattisgarh ([82], with 60%(2009) among Jenu Karba ([83] of Karnataka, 39.72%(2023) among Birhors of West

Bengal ([84], 45.7%(2014) among Raji tribe of Uttarakhand ([85] and 35.9%(2007) among Baharias of Madhya Pradesh ([86]. Similarly, regarding the NCD burden among PVTGs in other states, a high prevalence was observed among Birhors (13.04%), Lodha (5.21%), and Toto (16.07%) in West Bengal in the year 2021 ([87]. For infectious diseases, several clusters of HBV infections have also been identified in regions including Ladakh (12.7%), Arunachal Pradesh (21.2%), along with tribes like Nicobarese (23.3%), Shompen (37.8%), and Jarawa (65%) in the Andaman and Nicobar Islands in the year 2004 ([33]. Issues around oral health have also been reported in 2018 among Bharias, a PVTG of Madhya Pradesh where the prevalence of periodontal disease has also been found at a high rate ([88].

Regarding hemoglobinopathies like sickle cell anemia, and thalassemia, there is a significant prevalence among PVTGs in Jharkhand, Andaman and Nicobar Islands, Odisha, Gujarat, Maharashtra, and Tamil Nadu ([89]. Furthermore, regarding G6PD deficiency, the prevalence rates vary from 1.5 to 16.0% among the PVTGs of India ([90]. Detecting genetic conditions early and providing preventive measures are crucial for the successful management of such inherited disorders. Similarly, exploring health patterns requires understanding cultural norms followed by appropriate intervention, as was found required in the case of Dudh Kharia and Delki Kharia ([43].

In the context of the above findings, several important perspectives emerge towards improving the health scenario among PVTGs. The majority of the studies reported in the present review are recent which provides a tremendous scope for understanding recent trends in PVTG health and necessary interventions. With traditional medicine and cultural practices remaining highly prevalent due to age-old beliefs and inadequate availability of healthcare services, intervention from social and biocultural perspectives will help identify solutions to such risky behaviors ([91]. Government initiatives like Odisha's PVTG Empowerment and Livelihoods Improvement Programme (OPELIP), and PVTG-specific Integrated Tribal Development Agencies (ITDA) have pivotal roles in empowering local communities, while the PVTG Nutritional Improvement Programme (OPNIP) focuses on targeted nutritional interventions ([92]. Emphasizing cultural food practices and actively involving tribal communities in nutritional planning can significantly enhance these initiatives. Addressing prevalent myths and misconceptions can significantly improve program execution. Realizing the roles of indigenous practitioners in healthcare implementation is essential for improving healthcare outcomes and addressing traditional beliefs that hinder access to modern healthcare services.

Beyond health, our review reported witch-hunts as a major social problem among PVTGs of Odisha; it in most cases happens as a direct outcome of apprehension and suspect behind poor health and disease conditions in the community or neighbourhood. The blind beliefs are often accompanied by misinformation and misconceptions regarding individual, familial, communal, or village health, contributing to broader problems i.e., witch-hunting, particularly targeting women. According to the National Crime Records Bureau (NCRB) report, between 2001 and 2014, 2,290 women were subjected to persecution in India under accusations of practicing witchcraft ([93]. In terms of national statistics, Odisha holds the second position for incidents related to witch-hunting, after Jharkhand, with a significant occurrence in predominantly inhabited by PVTG communities like Mayurbhanj, Keonjhar, Ganjam, Sundargarh, Gajapati, Rayagada, Malkangiri, and Koraput ([93]. Addressing and dispelling such misconceptions is highly important. Improved healthcare, effective health communication, increased awareness, proper implementation of various programs, and community engagement are key to better health of the PVTGs and larger community well-being.

The Xaxa Commission Report of 2014 and Expert Committee on Tribal Health Report – 2018 offer vital recommendations for addressing the health and socio-economic challenges faced by Particularly Vulnerable Tribal Groups (PVTGs) in India; ([3, 8, 94] They emphasize the need for culturally sensitive healthcare interventions, improved access to services, and holistic development strategies. These recommendations align with the principles of equity and inclusivity as emphasized in the National Health Policy (2017) ([95]. 'Prioritizing tribal areas for Universal Health Insurance/Assurance' emphasizes community-based primary care to remote tribal populations managed by Aarogya Mitra, local tribal youth, and ASHA workers, supported by Gram Sabhas by ensuring effective healthcare delivery. Extending the benefit of financial protection through government medical insurance schemes will ensure their access to essential secondary and tertiary health care without facing financial hardship.

Community engagement is important to improve the health outcomes of Particularly Vulnerable Tribal Groups (PVTGs), which is now being adopted as the major frontier by the state and central government of India. Community involvement, collaboration with community members, co-designing, and planning the intervention with community dialogue are important strategies for understanding the root causes of tribal health issues. This will also help in designing culturally relevant healthcare approaches by successfully implementing health programs in these vulnerable groups. It is essential to move from the top-down approach of healthcare

communication and intervention- imposing the mainstream ideas on these marginalized populations, to a to bottom-up approach.

Gap analysis

The burden of diseases among PVTG communities in Odisha is substantially high. There is a visible gap in the comprehensive evaluation of health status among the selected communities. The availability of evidence around the health status of Particularly Vulnerable Tribal Groups (PVTGs) in Odisha is highly sporadic and disproportionately distributed. When examining evidence regarding the nutritional status of PVTGs, such as the Birhor, Kharias, and Chuktia Bhunjia among others, there is a significant dearth of research. Similarly, studies focusing on maternal and child health among PVTGs are scarce, with a very limited number of investigations available. Moreover, studies addressing infectious and vector-borne diseases lack substantial evidence concerning prevalent skin infections, a major concern within PVTG communities. Research on the prevalence of non-communicable diseases is notably limited. Several of the studies exploring inherited genetic disorders primarily focusing on hemoglobinopathies and G6PD deficiency, were very small in sample size leading to no detection and disproportionate risk evaluation. Additionally, research on the eye and oral health status of PVTGs in Odisha is sparse and requires extensive evaluation, by including all PVTG communities adequately. While many studies suggest alcoholism and tobacco use are the major contributing factors to the poor health status of PVTGs, there is a glaring absence of published data specifically addressing alcohol and tobacco consumption among all PVTGs. So, we believe, a concerted effort in the above context can bring substantial improvement in the health status of PVTGs of Odisha.

Conclusion

The present review in the context of the health status of PVTGs in Odisha and the landscape of research on PVTG health, highlights that the state of health among PVTGs requires serious attention. The communities are suffering the undernutrition and infectious diseases along with the NCDs at the same time. So, a multipronged approach is required to address such a scenario with intensive efforts. The status of social determinants like poverty, illiteracy, healthcare access, housing, livelihood, etc. defining health and well-being need to be assessed to ensure evidence-based interventions. Strengthening the public health system, ensuring the availability of health personnel and other facilities, community intervention around knowledge and practices in health and treatment-seeking behavior, and addressing traditional beliefs hold the key to the betterment of these remote living communities. Regular assessment of programs, working on community signals with early intervention, universal screening of diseases like hemoglobinopathies, TB, and Leprosy, availing safe drinking water, access to Public Distribution System (PDS), etc. will ensure the sustainability of the healthcare and well-being among the communities. Prioritizing and promoting focused implementation research along with the rapid assessment of various health issues at a larger scale will bring effective input for policy and program implementation.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s41043-024-00671-8.

Supplementary Material 1

Acknowledgements

We are thankful to ICMR-Regional Medical Research Centre, Bhubaneswar for their support and access to the institute library. We also thank the Department of Anthropology, Utkal University, Parija Library, Utkal University and SCSTRTI, Bhubaneswar for providing their support. We express our gratitude to Miss Susangita Jena and Miss Arpita Panda for their technical support during the preparation of the manuscript.

Author contributions

S.K.A. conceptualized the paper. The methodology was defined by S.K.A. N.B. and S.K.A. conducted the literature search. Data extraction and synthesis were done by N.B. The original draft preparation was done by N.B and SKA. Figures 1 and 2, and Tables 1, 2 and 3 were prepared by S.K.A. Review and editing were done by S.K.A.

Funding

This research paper received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethical approval

This research review paper does not require ethical approval.

Patient and public involvement

No patients were involved.

Competing interests

The authors declare no competing interests.

Author details

[1]Indian Council of Medical Research-Regional Medical Research Centre, Bhubaneshwar, Odisha, India

Received: 24 June 2024 / Accepted: 19 October 2024
Published online: 30 October 2024

References

1. Indigenous Peoples. 2024. World Bank. Accessed January on 2,2024.
2. India - IWGIA - International Work Group for Indigenous Affairs. 2023. IWGIA - International Work Group for Indigenous Affairs. 2023. Accessed on January 2, 2024.

3. Report Of The Expert Committee On Tribal Health-Tribal Health in India. Bridging the gap and a Roadmap for the Future. 2018. Ministry of Health and Family Welfare Government of India and Ministry of Tribal Affairs, Government of India. Accessed on January 2, 2024.
4. Registrar G, Government of India. & Census Commissioner, India. Census of India. Ministry of Home Affairs, ; 2011. https://censusindia.gov.in/2011-common/censusdata2011.html. Accessed on January 2,2024.
5. Ministry of Tribal Affairs. Government of India. Union Minister of State for Tribal affairs, Shri Durgadas Uikey in Lokshabha (*Lok Sabha US Q488/654) on* implementation of PM-JANMAN. 2024. Accessed on September 09, 2024.
6. Dhebar UN. India. Scheduled Areas and Scheduled Tribes Commission. 1960-61. Report of the Scheduled Areas and Scheduled Tribes Commission. Accessed on January 2,2024.
7. Scheduled Areas and Scheduled Tribes Commission. 2004.Report of the Scheduled Areas and Scheduled Tribes Commission. Accessed on January 2,2024.
8. Xaxa Commission. Report of the High Level Committee on Socio-Economic, Health and Educational Status of Tribal Communities of India. 2014. Ministry of Tribal Affairs, Government of India. Accessed on January 10,2024.
9. Network TK. Reports. 2024. Ministry of Tribal Affairs. https://knowledge.tribal.gov.in/reports/, Accessed on January 10,2024.
10. Eswarappa K. The complexity of the tribal question in India: the case of the particularly vulnerable tribal groups. J Asian Afr Stud. 2024;59(3):858–75.
11. Mohanty SC, Ota AB. Particularly Vulnerable Tribal Groups (PTGs) of Odisha. 2015.
12. Sahay VS, Gupta U. Tribal Administration in India: Issues and Challenges. Administration in India.:15–29.
13. The Health of Indigenous Peoples; Inter-Agency Support Group On Indigenous Peoples' Issues. 2014. United Nations Children's Fund.
14. Report TH. India. First Comprehensive Report on Tribal Health in India. 2018. National Technical Report on Tribal Health.
15. Ota AB, Mohanty BN, Mohanty SC. Particularly vulnerable tribal groups of Odisha. 2021.
16. Base Line Survey of all Particularly Vulnerable Tribal. Groups (PVTGs) in the Micro Project Area & its surroundings and reported places outside the Micro Project areas. 2018-19. Scheduled Castes & Scheduled Tribes Research and Training Institute (SCSTRTI).
17. Linguistic Survey of India-Orissa. Office of the registrar general and census commissioner. Ministry of home affairs, Government of India; 2002.
18. Sahoo SP. M.Sc Dissertation. P.G Department of Anthropology, Vani Vihar, Bhubaneswar; 2023 (Unpublished).
19. Narreen NMS, Dissertation. An Anthropological Study of Health Status Among the Bondo Children (0–6) of Malkangiri District, Odisha. 2022 (Unpublished).
20. Baliarsingh S. PhD Thesis. A Comparative Study on Nutritional Status of Kutia Kandha and Panos of Belghar Panchayat of Kandhamal. 2017(Unpublished).
21. Naik M. MSc Dissertation. An Anthropological Study of Health Status Among Paudi Bhuyan Children (0–6) Years of Banspal Block of Keonjhar District, Odisha. 2023(Unpublished).
22. Goswami M. Anthropometric Characteristics and Chronic Energy Deficiency of the Mankidias-A PTG of Northern Odisha, India. Stud Tribes Tribals. 2015;13(1):88–93.
23. Nanda S, Dhar RN. A study on nutritional status of adolescent girls of Dongria Kondh tribe. Int J Community Med Public Health. 2017;4(5):1573–6.
24. Kuiti BK, Acharya S, Satapathy KC, Barik DK, Patra PK. Assessment of Nutritional Status among children and adolescents of Juang Tribe in Keonjhar District of Odisha, India. Orient Anthropol. 2022;22(2):336–47.
25. Kuiti BK, Acharya S, Satapathy KC, Barik DK, Patra PK. Composite Index of Anthropometric Failure (CIAF) among Juang Children and adolescents of Keonjhar District in Odisha, India. Man Environ Soc. 2022;3(1):133–54.
26. Dash NC, Baral S, Mahanta T. Healthcare management and nutritional status of the Lodha tribe of Odisha. Adivasi. 2017;58(12):1–8.
27. Kanrar P, Goswami M. Sociodemographic profile, reproductive health and nutritional status among the Juangs—a particularly vulnerable tribal group of Odisha, India. Orient Anthropol. 2020;20(1):135–49.
28. Bulliyya G. Ethnographic and health profile of the Dongria Kondhs: a primitive tribal group of Niyamgiri hills in Eastern Ghats of Orissa. Afro Asian J Anthropol Social Policy. 2010;1(1):11–25.
29. Bulliyya G, Mallick G, Sethy PG, Kar SK. Prevalence of Iodine Deficiency disorders among Dongria Kondh Primitive Tribal Community in Niyamgiri Mountain area of Rayagada District, Orissa. Orissa 2004-05.
30. Kerketta AS, Bulliyya G, Babu BV, Mohapatra SS, Nayak RN. Health status of the elderly population among four primitive tribes of Orissa, India: a clinico-epidemiological study. Zeitschrift für Gerontologie Und Geriatrie. 2009;42:53–9.
31. Mahapatra S. M.Sc. dissertation. The status of non-communicable diseases among the Paudi Bhuyan tribe of Keonjhar district. 2023(Unpublished).
32. Dixit S, Das A, Rana R, Khuntia HK, Ota AB, Pati S, Bal M, Ranjit M. A community-based study on haemoglobinopathies and G6PD deficiency among particularly vulnerable tribal groups in hard-to-reach malaria endemic areas of Odisha, India: implications on malaria control. Malar J. 2022;21(1):340.
33. Balgir RS, Dash BP, Murmu B. Blood groups, Hemoglobinopathy, and G-6-PD Deficiency investigations among Fifteen Major scheduled tribes of Orissa, India. Anthropologist. 2004;6(1):69–75.
34. Bhattacharya H, Parai D, Sahoo SK, Swain A, Pattnaik M, Mohapatra I, Choudhary H, Dash GC, Akhtar N, Kshatri JS, Bhattacharya D. Hepatitis B virus infection among the tribal and particularly vulnerable tribal population from an eastern state of India: findings from the serosurvey in seven tribal dominated districts, 2021–2022. Front Microbiol. 2023;14:1039696.
35. Kar SK, Sabat J, Ho LM, Arora R, Dwibedi B. High prevalence of hepatitis C virus infection in primitive tribes of eastern India and associated socio-behavioral risks for transmission: a retrospective analysis. Health Equity. 2019;3(1):567–72.
36. Dwibedi B, Sabat J, Ho LM, Singh SP, Sahu P, Arora R, Kar SK. Molecular epidemiology of hepatitis B virus in primitive tribes of Odisha, eastern India. Pathogens Global Health. 2014;108(8):362–8.
37. Satpathy KC, Patra PK, Chinara M, Barik DK, Bal SR. A study on blood pressure distribution among the Juangs: a particularly vulnerable tribal group (PVTGs) of Odisha. Adivasi. 2020;60(2):34–47.
38. Samal M. MPhil dissertation. An epidemiological study of blood pressure among the tribal communities of Nabarangpur district, Odisha. 2017(Unpublished).
39. Mohanty B. MSc dissertation. Non-communicable disease baseline survey of Bonda community of Khairput block of Malkangiri district, Odisha. 2022(Unpublished).
40. Balgir RS. Genetic burden of red cell enzyme glucose-6-phosphate dehydrogenase deficiency in two major scheduled tribes of Sundargarh district, Northwestern Orissa, India. Curr Sci. 2007;92(6):768–74.
41. Purohit P, Dehury S, Patel S, Patel DK. Prevalence of Deletional Alpha Thalassemia and Sickle Gene in a tribal dominated Malaria Endemic Area of Eastern India. Malar J. 2014;13:124.
42. Balgir RS, Mishra RK, Murmu B. Clinical and Hematological Profile of Hemoglobinopathies in two tribal communities of Sundargarh District in Orissa, India. Int J Hum Genet. 2003;3(4):209–16.
43. Balgir RS. Genetic diversity of hemoglobinopathies, G6PD deficiency, and ABO and Rhesus blood groups in two isolates of a primitive Kharia Tribe in Sundargarh District of Northwestern Orissa, India. Int J Anthropol. 2010;25(3):173–80.
44. Balgir RS. Prevalence of abnormal haemoglobin E gene in the Dhelki Kharia tribal population. Curr Sci. 2003;85(11):1604–8.
45. Balgir RS. Intervention and prevention of hereditary hemolytic disorders in India: a case study of two ethnic communities of Sundargarh district in Orissa. JAPI. 2008;56.
46. Dash BP. Sickle cell haemoglobinopathies in Orissa. Man Soc. 2005-2006;16:91–5.
47. International Institute for Population Sciences (IIPS). ICF. 2015–16. National Family Health Survey (NFHS-4). http://rchiips.org/NFHS/NFHS-4Reports/Odisha.pdf. Accessed on January 2,2024.
48. Pedi GK, Dash NC, Dash J. Reproductive Health Status of the Hill Kharias of Odisha, India. Bhubaneswar, Odisha, India: Journal of Scheduled Castes & Scheduled Tribes Research and Training Institute (SCSTRTI); 2013. p. 12.
49. Pattnaik S. MSc dissertation. An anthropological study of maternal health status among the Paudi Bhuyan tribe of Keonjhar district, Odisha. 2023(Unpublished).
50. Swain PP. MSc dissertation. An anthropological study of maternal health status among the Bondo tribe of Malkangiri district, Odisha. 2022.
51. Yap AU. Oral health equals total health: a brief review. J Dentistry Indonesia. 2017;24(2):59–62.
52. Kirkengen AL, Lygre H. Exploring the relationship between childhood adversity and oral health: an anecdotal approach and integrative view. Med Hypotheses. 2015;85(2):134–40.
53. World Health Organization. 2024. Oral Health. https://www.who.int/health-topics/oral-health#tab=tab_1.Accessed on October 31, 2023.

54. Dash P, Kumar G. Assessment of oral Health Status among the Kutia Kandha Tribe-A particularly vulnerable Group Residing in Kandhamal District, Odisha. J Health Sci Med Res. 2023: 2023946.
55. Das D, Suresan V, Jnaneswar A, Khurana C, Bhadauria US, Saha D. Oral health status and treatment needs among the Juang tribe-a particularly vulnerable tribal group residing in Northern Odisha, India: a cross-sectional study. Health Soc Care Commun. 2019;27(5):e752–9.
56. Padhy D, Das T, Majhi D, Khanna RC, Avhad K, Ota AB, Rout PP, Rath S. Prevalence of refractive error among Dongarias and use of folding Phoropter (FoFo) as a field device enabling implementation research in this indigenous community. Tribal Odisha Eye Disease Study (TOES) Report# 13. PLoS ONE. 2023;18(5):e0284790.
57. Majhi D, Das T, Padhy D, Marmamula S, Khanna RC, Ota AB, Rout PP, Avhad K, Rath S. Prevalence and causes of visual impairment in Dongaria indigenous (tribal) community. Tribal Odisha eye disease study. Indian J Ophthalmol. 2023;71(7):2850–5.
58. Dash A. MPhil dissertation. A Study on Nutritional Status Among Juang Community, Kodiposa Panchayat, Keonjhar, Odisha. 2020(Unpublished).
59. Akash SU. MSc dissertation. Prevalence of non-communicable diseases and their risk factors among Juang people of Keonjhar district, Odisha: A community-based baseline survey. 2020(Unpublished).
60. Baral R. MPhil dissertation. Geriatric Health of Ageing People Among the Juang Community of Kundhei Village, Keonjhar District, Odisha. 2020(Unpublished).
61. Badanayak S. MSc dissertation. Alcohol and Tobacco Consumption Among the Bonda Tribe of Khairaput Block, Malkangiri District, Odisha. 2022(Unpublished).
62. Bhoi N. MSc dissertation. Alcohol and Tobacco Consumption Among Paudi Bhuyan Tribe of Keonjhar District. 2023(Unpublished).
63. Panda SS, Sahoo S, Kuiti BK, Satapathy KC, Chinara M, Patra PK. Prevalence and pattern of depression among the Juang (PVTG) adults of Odisha. Adivasi. 2021;61(1):16–25.
64. Mudi PK, Pradhan MR, Meher T. Menstrual health and hygiene among Juang women: a particularly vulnerable tribal group in Odisha, India. Reproductive Health. 2023;20(1):55.
65. Das D, Gautam RK. Problems and practices related to menstruation among adolescent girls of Dongria Kondh of Rayagada, Odisha, India. Frontier Anthropol. 2022;11:13–23.
66. Badamali J, Das A, Satapathy KC, Patra PK, Bhuyan R, Acharya SK. Patterns and distribution of tobacco use and its association with oral precancerous lesions among the tribes of Odisha. J Subst Use. 2023:1–1.
67. Kshatriya GK, Acharya SK. Gender disparities in the prevalence of undernutrition and the higher risk among the young women of Indian tribes. PLoS ONE. 2016;11(7):e0158308.
68. Jena Samanta L, Parida J, Badamali J, Pradhan A, Singh PK, Mishra BK, Patra PK, Pati S, Kaur H, Acharya SK. The incidence, prevalence, and contributing factors of overweight and obesity among adolescent population of India: a scoping review protocol. PLoS ONE. 2022;17(9):e0275172.
69. Rai RK, Kumar C, Singh L, Singh PK, Acharya SK, Singh S. Rising burden of overweight and obesity among Indian adults: empirical insights for public health preparedness. J Biosoc Sci. 2021;53(5):709–23.
70. Kshatriya GK, Acharya SK. Prevalence and risks of hypertension among Indian tribes and its status among the lean and underweight individuals. Diabetes Metabolic Syndrome: Clin Res Reviews. 2019;13(2):1105–15.
71. Kuiti BK, Barik DK, Acharya SK, Satapathy KC, Patra PK. Prediction of the Progressive Level of Hypertension with risk score among adults Juang: consequences for Health. Social, Cultural and Health issues of the Juang. Maya Publishing House. 2022;1:191–211.
72. Kuiti BK, Barik DK, Acharya SK, Satapathy KC, Patra PK. Pattern of body composition and Mid-upeer Arm Based Nutritional Status of Adult Juang. Social, Cultural and Health issues of the Juang. Maya Publishing House. 2022;1:148–66.
73. Kuiti BK, Acharya SK, Satapathy KC, Barik DK, Patra PK. Intra-individual co-prevalence of under-nutrition and Central Obesity among adult Juangs of Keonjhar District in Odisha, India. Antrocom J Anthropol. 2022;18(2a):377–86.
74. Kshatriya GK, Kumari A, Acharya SK. Comparing the ability of anthropometric indicators in determining the prevalence of hypertension among Indian tribes. Diabetes & Metabolic Syndrome: Clinical Research & Reviews. 2019;13(1):696–706.
75. Kshatriya GK, Acharya SK. Triple burden of obesity, undernutrition, and cardiovascular disease risk among Indian tribes. PLoS ONE. 2016;11(1):e0147934.
76. Senapati RE, Jena S, Parida J, Panda A, Patra PK, Pati S, Kaur H, Acharya SK. The patterns, trends and major risk factors of suicide among Indian adolescents–a scoping review. BMC Psychiatry. 2024;24(1):35.
77. Samakya S, Pati S, Acharya SK. Neonatal and Infant Illnesses and Health seeking Behavior among Hilly (Porja) Tribal Community: a qualitative observational study. J Neonatology. 2023:09732179231210741.
78. Samakya S, Pati S, Acharya SK. Knowledge, beliefs, and practices around Newborn Resuscitation in Hilly Tribal Homebirth settings: a qualitative observational study. J Neonatology. 2023;37(3):196–204.
79. Acharya SK, Kshatriya GK. Social Change in Contemporary Tribal India: observations from changing Status of Ethnicity and Language Identity among Santals. East Anthropol. 2016;69(2):205–24.
80. Jena S, Parida J, Panda A, Behera SS, Pradhan A, Patra PK, Pati S, Kaur H, Acharya SK. Knowledge, practices and influencing factors defining unhealthy food behavior among adolescents in India: a scoping review. Front Psychol. 2023;14:1161319.
81. Mitra M, Kumar PV, Ghosh R, Bharati P. Growth pattern of the Kamars –A Primitive Tribe of Chhattisgarh, India. Coll Antropol. 2002;26(2):485–99.
82. Das S, Ghritlahre M, Siddiqui A, Meitei KS. Nutritional status of Hill Korwa preschool children of Jashpur: a particularly vulnerable tribal group of Chhattisgarh. BLDE Univ J Health Sci. 2020;5(1):20–5.
83. Jai Prabhakar SC, Gangadhar MR. Nutritional status of Jenukuruba tribal children in Mysore district. Karnataka Anthropol. 2009;11:83–8.
84. Biswas S, Mahata LL, Gope S, Chandra K. Anthropometry based nutritional status among the adult Birhors: A Particularly Vulnerable Tribal Group (PVTG) of Purulia district, West Bengal, India. Antrocom: Online Journal of Anthropology. 2023;19(1).
85. Alam A, Rawat B, Pulamaghatta VN, Sharam J. A study of the Basic and Derived Anthropometric Indices among the healthy adults of Raji Tribe of Uttarakhand, India. Afro Asian J Anthropol Social Policy. 2014;5(1):66–72.
86. Tiwari MK, Sharma KKN, Bharati S, Adak DK, Ghosh R. Bharati P. Growth and nutritional status of the Bharia–A primitive tribe of Madhya Pradesh. Coll Antropol. 2007;31(1):95–101.
87. Kundu RN, Biswas S, Bharati P. Blood pressure and its relationship with obesity among the young adults particularly vulnerable tribal groups of West Bengal, India. Nternational J Stat Sci. 2021;21(1):39–54. ISSN 1683–5603.
88. Shrivastav A, Maurya R, Shukla C, Sahu T, Chauhan N, Azad A, Dubey A. Oral hygiene and periodontal status in the primitive hidden tribe of Patalkot, a tribal area in Central India. J Indian Soc Periodontology. 2018;22(1):55–9.
89. Ganesh B, Rajakumar T, Acharya SK, Kaur H. Sickle cell anemia/sickle cell disease and pregnancy outcomes among ethnic tribes in India: an integrative mini-review. J Maternal-Fetal Neonatal Med. 2022;35(25):4897–904.
90. Indian Council of Medical Research. Tribal Health Research Forum Report: 2010–2013. New Delhi: Indian Council of Medical Research. Accessed on January 2,2024.
91. Ganesh B, Rajakumar T, Acharya SK, Vasumathy S, Sowmya S, Kaur H. Particularly vulnerable tribal groups of Tamil Nadu, India: a sociocultural anthropological review. Indian J Public Health. 2021;65(4):403–9.
92. Odisha PVTG, Empowerment & Livelihoods Improvement Programme: OPELIP. 2020. ST & SC Development Department, Government of Odisha. https://opelip.org/. Accessed on January 10, 2024.
93. Odisha State Commission for Women. Report on Witch Hunting in Odisha. 2021.Odisha State commission for women. Accessed January 10, 2024.
94. Government of India. Ministry of Health and Family Welfare. National Health Policy 2017. Ministry of Health and Family Welfare, Government of India. Accessed on January 10, 2024.
95. Mutatkar RK. Tribal health issues: need of tribal health policy. Indian J Med Res. 2022;156(2):182–5.

Publisher's note