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Attitudes of mothers attending public hospitals in Addis Ababa, Ethiopia, to neonatal sunlight exposure: a cross-sectional study

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ABSTRACT

Background Sunlight exposure helps the body produce vitamin D, prevents rickets and is used for neonatal jaundice treatment. Good neonatal sunlight exposure is exposing the neonate to sunlight in the morning, 8:00 to 10:00, for 30 to 60 min. However, little is known about the practice of neonatal sunlight exposure among mothers in Ethiopia. This study aimed to assess the practices and factors associated with neonatal sunlight exposure among mothers attending public hospitals in Addis Ababa, Ethiopia.

Methods An institution-based cross-sectional study was conducted among 420 mothers attending public hospitals in Addis Ababa. Study participants were selected using a systematic random sampling method. The collected data were entered into Epi-data V.4.6 and exported to SPSS V.26 for analysis. Descriptive and logistic regression analyses were conducted.

Results The practice of neonatal sunlight exposure among mothers was 27.1%. Neonatal age of 16–28 days (adjusted OR (aOR) 1.99, 95% CI 1.15 to 3.44), family members of 4–6 (aOR 1.86, 95% CI 1.08 to 3.21) and ≥7 (aOR 4.43, 95% CI 1.54 to 12.78), living in compound/villa houses (aOR 2.59, 95% CI 1.26 to 5.33), complete antenatal care (ANC) follow-up (aOR 2.79, 95% CI 1.49 to 5.22), delivery at term (aOR 2.54, 95% CI 1.06 to 6.07), poor knowledge of sunlight exposure (aOR 0.40, 95% CI 0.23 to 0.71) and no fear of sunlight exposure (aOR 1.83, 95% CI 1.08 to 3.12) were factors associated with the practice of neonatal sunlight exposure.

Conclusion This study revealed that 27.1% of mothers had good sunlight exposure. Advanced neonatal age, larger family, living in compound/villa houses, complete ANC visits and term delivery were associated with good practices, whereas poor knowledge and fear of sunlight exposure were associated with poor practices. Therefore, interventions focusing on these findings are required to improve the practice of neonatal sunlight exposure.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Sunlight exposure has many health benefits for newborns and infants.
⇒ Adequate exposure of the neonate to sunshine requires exposure of the neonate to sunlight in the morning, 8:00–10:00, for 30–60 min.
⇒ Inadequate exposure of neonates to sunshine leads to vitamin D deficiency and jaundice, which are common health problems worldwide.

WHAT THIS STUDY ADDS

⇒ Advanced neonatal age, higher family size, living in compound/villa houses, complete antenatal care (ANC) visits and term delivery were associated with good practice of neonatal sunlight exposure.
⇒ Poor knowledge of and fear for sunlight exposure are associated with poor neonatal sunlight exposure.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE, OR POLICY

⇒ Interventions focused on mothers' knowledge of sunlight exposure (fear of sunlight, neonatal age and ANC follow-up) are required to improve the practice of neonatal sunlight exposure.

INTRODUCTION

Sunlight exposure has many health benefits for newborns and infants. It helps the body produce vitamin D, preventing rickets in children, and is used to treat neonatal jaundice during the neonatal period.[1–3] Vitamin D everyday requirements can be obtained by 30 to 60 min of exposure to sunlight in the morning.[4] Vitamin D plays a vital role in bone metabolism through regulation of calcium and phosphate homeostasis.[1] Exposure of neonatal skin to sunlight in the morning is significant to producing nocturnal melatonin sooner, which helps them sleep better.[5] Morning sunlight exposure supports the neonatal physiological system to break down indirect bilirubin.[3]

Timely and proper practice of neonatal sunlight exposure by mothers has many health benefits for neonates. The inadequate practice of exposure of neonates to sunshine by mothers leads to vitamin D deficiency, and jaundice is a common health problem

Table 1 Sociodemographic characteristics of the study participants (n=420)

Variables	Category	Frequency (n)	Percent (%)
Age of mothers	≤24 years	93	22.1
	25–29 years	151	36.0
	30–34 years	102	24.3
	≥35 years	74	17.6
Neonatal (postnatal) age	<15 days	174	41.4
	≥15 days	246	58.6
Marital status of mothers	Unmarried	22	5.2
	Married	398	94.8
Mothers' educational status	No education	41	9.8
	Primary education	112	26.7
	Secondary and above	267	63.6
Occupation status of mothers	Housewife	225	53.6
	Government employee	89	21.2
	Private employee	75	17.9
	Merchant	31	7.4
Family size	1–3	184	43.8
	4–6	210	50.0
	≥7	26	6.2
Residence	Rural	22	5.2
	Urban	398	94.8
Type of housing	Condominium/apartments	86	20.5
	Compound house (villa)	334	79.5
Household monthly income in ETB	≤1800	90	21.4
	1801–3800	102	24.3
	3801–7500	122	29.0
	≥7501	106	25.2
Husband's educational status	No formal education	29	6.9
	Primary education	87	20.7
	Secondary and above	304	72.4

ETB, Ethiopian Birr.

in many developing countries, especially in sub-Saharan African countries such as Ethiopia.[6 7]

Ultraviolet (UV) radiation weakens the immune system. Skin dendritic cells are damaged by UV-B rays, which also cause regulatory T cells to generate the immunosuppressive cytokine IL-10.[8] Pyrimidine dimerisation and DNA strand breaks are induced by UV light. Additional effects of UV radiation include externalisation of nuclear antigens on cell surfaces and production of neoantigens, which can exacerbate autoimmune illnesses such as lupus. Another problem associated with chronic UV radiation exposure is photoaging. Numerous epidemiological research showed that sunlight exposure is one of the primary risk factors for the development of melanoma and non-melanoma skin cancer.[9 10] This risk is greatest in the white population, indicating that melanin has a protective effect.[11] It has also been discovered that exposure to UV rays during childhood increases the risk of developing skin cancer compared with exposure later in life.[12]

In Middle East Asia, such as the northern parts of China, Mongolia and Afghanistan, mothers' practice of sunlight exposure for neonates is poor. As a result, most neonates develop vitamin D deficiency and rickets.[6 13] In Ethiopia, shortage of exposure to sunlight and inadequate vitamin D consumption are the main causes of rickets among children. According to a study conducted in Addis Ababa, Ethiopia, 41% of children under 3 years of age had vitamin D deficiency rickets, and the incidence was higher among infants.[14] A study conducted in Jimma, Ethiopia, showed that 10.5% of children under 5 years of age had rickets, with the main identified causes being lack of exposure to sunlight and inadequate intake of vitamin D, and the highest rate (11%) occurred in infants.[15–17]

Although daily sunlight exposure remains the cheapest, safest and most effective method of prevention of rickets, significant numbers of children are not properly exposed to sunlight. According to recent studies in Ethiopia among mothers, 55.4% in Debre Markos town, 52% in the South Gondar zone and 34.3% in Debre Berhan town had poor practice of exposing neonates to sunlight.[18–20] Numerous factors may be associated with the practice of neonatal sunlight exposure among mothers. These factors include sociodemographic factors such as age, marital status, educational status, occupation of mother, neonatal age, family size, place of residence, type of housing, educational status of the husband, household monthly income,[18–24] maternal and neonatal-related factors such as antenatal care (ANC) follow-up, place of delivery, gestational age, birth weight, mother's knowledge[13 16 17 21 23 25] and fear of sunlight exposure.[16 18 19 21 26] However, little is known about the practice of neonatal sunlight exposure among mothers in Ethiopia. Thus, this study aimed to assess the practices and factors associated with neonatal sunlight exposure among mothers visiting public hospitals in Addis Ababa, Ethiopia, 2020.

METHODS

Study area, design and population

This institutional-based cross-sectional study was conducted from 18 March to 30 April 2020, in three public hospitals in Addis Ababa town, Ethiopia: Gandhi Memorial Hospital (GMH), Tikur Anbessa Specialized Hospital (TASH) and Yekatit 12 Hospital (Y12H). All mothers with neonates and those attending follow-up and immunisation clinics were included, except those who had neonates above 1 month of age and were unable to communicate during the study period.

Sample size determination and sampling procedure

The single population proportion formula was used to calculate the sample size based on the following assumptions: the prevalence of mothers' practice of neonatal sunlight exposure was 45.7%, as done in South Gondar zone, Ethiopia,[19] 95% confidence level and 5% margin of error. The final sample size, including the non-response rate, included 420 mothers. Three hospitals were selected using the lottery method. According to recent monthly data from the three hospitals, a total of 1621 mothers with neonates attended follow-up and immunisation clinics, and this was taken as a sampling frame. The total sample size for each hospital was allocated proportionally based on the sampling frame (GMH, N=650; TASH, N=536; Y12H, N=435). Therefore, 168 mothers from GMH, 139 mothers from TASH and 113 mothers from Y12H were selected using systematic random sampling at k=3 intervals.

Study variables

The study variable was sunlight exposure practice, and the independent variables included sociodemographic factors such as age, marital status, educational status, occupation of the mother, neonatal age, family size (number of individuals in the family), place of residence, type of housing, household income, maternal and neonatal-related factors such as ANC follow-up, place of delivery, gestational age, birth weight, mothers' knowledge and fear of sunlight exposure.

Data collection tool and procedure

Data were collected using the Amharic version of an adapted questionnaire with face-to-face interviews. The questionnaire was first written in English, translated into Amharic versions, and re-translated into English by language experts to ensure consistency. The data collection tool was adapted after an extensive review of the literature on this area.[16 18 19 21 22 27] The sociodemographic and maternal and neonatal factors of the mothers were documented using 14 items. Mothers' knowledge of sunlight exposure was measured using seven items. Participants who scored above the median value on the mother's knowledge of the sunlight exposure tool were categorised as having good knowledge. Neonatal sunlight exposure was measured using 10 self-reported items. Participants who responded correctly to all practice questions on the practice questionnaire were considered as having good practice and those who had scored less than or equal to 9 were considered as having poor practice.

The questionnaire was administered to experts to check content validity and accuracy. Data were collected by four trained nurses from other health facility units. Moreover, the completeness of the questionnaire and quality of data collection were checked daily by supervisors, and detailed feedback was provided to the data collectors.

Data processing and analysis

The data were checked, coded and entered into Epi-Data V.4.6 and exported to SPSS V.26 software for analysis. Descriptive data were reported as frequencies and percentages. A bivariate logistic regression analysis model was used to identify factors associated with neonatal sunlight exposure. Variables with a p value <0.25 in the bivariate logistic regression were entered into a multivariable logistic regression analysis. A multivariate logistic regression model was used to identify the association between the independent variables and neonatal sunlight exposure. In the multivariable logistic regression analysis, the statistical significance of associations between independent variables and the practice of neonatal sunlight exposure was determined using ORs with a 95% CI and p values <0.05.

Patient and public involvement

Patients and the public were not involved in the design, conduct, reporting, or dissemination plan of this study.

RESULTS

Sociodemographic characteristics of participants

A total of 420 mothers participated in the study, with a 100% response rate. The mean age of the participants

Table 2 Maternal and neonatal-related factors of the study participants (n=420)

Variables	Category	Frequency (n)	Per cent (%)
Antenatal care visit	Yes	410	97.6
	No	10	2.4
No of antenatal care visits (n=410)	1–3	163	39.8
	≥4	247	60.2
Place of delivery	Home	7	1.7
	Health centre	104	24.8
	Hospital	306	72.9
	Other	3	0.7
Gestational age	<37 weeks	107	25.5
	37–42 weeks	287	68.3
	≥42 weeks	16	3.8
	Unknown	10	2.4
Birth weight	<2.5 kg	115	27.4
	≥2.5 kg	301	71.7
	Unknown	4	1.0

was 28.8±5.61 years. Most participants were married (n=398, 94.8%) and residing in urban areas (n=398, 94.8%). More than half of them, 225 (53.6%) were housewives, and 267 (63.6%) had secondary or above educational status. Half of the participants, 210 (50%), had family members of 4–6 and 334 (79.5%) were living in a compound/villa house. The majority of husbands of participants, 304 (72.4%), had secondary or higher educational status (table 1).

Maternal and neonatal-related factors of participants

Most of the participants, 410 (97.6%), had ANC follow-up, and three-fourths of the participants, 306 (72.9%), delivered their neonates in hospitals. More than two-thirds of neonates, 287 (68.3%), were at term (37–42 weeks) gestational ages, and the majority of neonates, 301 (71.7%), had a birth weight of ≥2.5 kg at the time of delivery (table 2).

Participants' knowledge, fear and practice of neonatal sunlight exposure

Most participants (388 (92.4%)) had information about neonatal sunlight exposure. The majority of the participants, 258 (66.5%), heard about the sunlight exposure of neonates from midwives/nurses. Most participants (380 (97.9%)) knew the benefits of neonatal sunlight exposure. The majority of the participants identified vitamin D (n=235, 67.1%). Of the participants, 365 (94.1%) reported good time to expose neonates in the morning. More than half of the participants (245 (58.3%)) feared exposing their neonates to sunlight. Of the total participants, 181 (43.1%) had good knowledge and 114 (27.1%) practised good neonatal sunlight exposure (table 3).

Factors associated with the participants' practice of neonatal sunlight exposure

In univariate logistic regression, neonatal age, educational status, occupation and marital status of the mother, family size, type of housing, educational status of the husband, ANC follow-up, gestational age, birth weight, mother's knowledge and fear of sunlight exposure were significantly associated with practice. However, in the multiple logistic regression analysis, neonatal age, family size, type of housing, ANC follow-up, gestational age, mothers' knowledge and fear of sunlight exposure had a statistically significant association with practice.

Mothers who had neonates aged 16–28 days (adjusted OR (aOR) 1.99, 95% CI 1.15 to 3.44) were two times more likely to have good practice than mothers who had neonates aged <15 days. Mothers who had a family of 4–6 members (aOR 1.86, 95% CI 1.08 to 3.21) and greater than or equal to 7 (aOR 4.43, 95% CI 11.54 to 12.78) were 1.86 and 4.43 times more likely to have good practices, respectively, compared with those who had family members of 1–3. Mothers who lived in compound/villa houses (aOR 2.59, 95% CI 1.26 to 5.33) were 2.6 times more likely to have good practices than those who lived in condominiums/apartment houses.

Mothers who had complete ANC follow-up (≥4 times) (aOR 2.79, 95% CI 1.49 to 5.22) were 2.79 times more likely to have good practice compared with those who had incomplete ANC follow-up. Mothers who delivered at term (aOR 2.54, 95% CI 1.06 to 6.07) were 2.54 times more likely to have good practice compared with those who delivered before term. Mothers who had good knowledge of sunlight exposure were 40% more likely to have good practices compared with their counterparts (aOR 0.40, 95% CI 0.23 to 0.71). Mothers who did not

Table 3 Knowledge, fear and practice of neonatal sunlight exposure of the study participants (n=420)

Variables	Category	Frequency (n)	Per cent (%)
Had information about sunlight exposure	Yes	388	92.4
	No	32	7.6
Source of information about sunlight exposure (n=388)	Physician	173	44.6
	Midwife/nurse	258	66.5
	Television/radio	17	4.4
	Neighbours/elder people	105	27.1
Is sunlight exposure beneficial? (n=388)	Yes	380	97.9
	No	8	2.1
The benefit of sunlight exposure (n=380)	Strengthens bone	252	66.3
	Strengthens teeth	6	1.6
	Keeps child warm	73	11.3
	Produces vitamin D	235	67.1
	Strengthens body	160	42.1
Is sunlight exposure harmful? (n=388)	Yes	190	49.0
	No	198	51.0
The harmful effect of sunlight exposure (n=190)	Skin cancer	37	19.5
	Sterility	80	42.1
	Blindness	104	54.7
A good time to expose neonates (n=388)	Morning	365	94.1
	Afternoon	13	3.4
	Evening	66	17.0
Mothers fear sunlight exposure	Yes*	245	58.3
	No	175	41.7
Knowledge	Good knowledge	181	43.1
	Poor knowledge	239	56.9
Practice	Good practice	114	27.1
	Poor practice	306	72.9

*Sickness, evil eye, cold.

have fear of sunlight exposure (aOR 1.83, 95% CI 1.08 to 3.12) were 1.83 times more likely to have good practice than those who had fear of sunlight exposure in their neonates (table 4).

DISCUSSION

This study explored the practices and factors associated with neonatal sunlight exposure among mothers attending governmental hospitals in Addis Ababa, Ethiopia, and found that 27.1% of mothers practised good neonatal sunlight exposure. The findings of this study were lower than those of studies conducted in Ethiopia in the South Gondar zone (54.3%),[19] Debre Markos town (44.6%),[18] Debre Berhan town (34.3%)[20] and Aleta Wondo town (32.6%).[21] The possible reason might be due to differences in housing type, family size and mothers' fear of sunlight exposure. In this study, the majority of mothers were living in condominiums/apartments, had low family sizes and had a fear of sunlight exposure to their neonates. In addition, a possible reason might be the cut-off point of the tool used to measure mothers' practice of neonatal sunlight exposure. The other studies used the median value as the cut-off point, and the participants who responded correctly above the median value were classified as having good practice, but in this study, participants who responded correctly to all practice questions were classified as having good practice.

This study found that neonatal age, family size, type of housing, ANC follow-up, gestational age, mothers' knowledge and fear of sunlight exposure were associated with mothers' practice. This study revealed that mothers who had neonates of advanced age (16–28 days) had good practices compared with those who had neonates of an earlier age (≤15 days). This finding was different from those of studies conducted in Debre Markos town, Aleta Wondo town and the South Gondar zone.[18 19 21] This discrepancy might be due to differences in cultural beliefs, in which mothers fear exposure to neonates aged

Table 4 Factors associated with the practice of neonatal sunlight exposure of the study participants (n=420)

Variables	Category	Practice		cOR (95% CI)	aOR (95% CI)
		Good	Poor		
Neonatal age	0–15 days	39	135	1	1
	16–28 days	75	171	1.73 (1.11 to 2.71)	1.99 (1.15 to 3.44)*
Educational status of the mother	No formal education	7	34	1	1
	Primary education	19	93	0.99 (0.38 to 2.57)	0.61 (0.20 to 1.86)
	Secondary and above	88	179	2.39 (1.02 to 5.60)	1.07 (0.36 to 3.19)
Occupation of mother	Housewife	45	180	1	1
	Government employee	36	53	2.72 (1.59 to 4.64)	1.49 (0.74 to 3.02)
	Private employee	30	45	2.67 (1.51 to 4.69)	0.93 (0.45 to 1.93)
	Merchant	3	28	0.43 (0.13 to 1.47)	0.34 (0.08 to 1.44)
Marital status of the mother	Unmarried	2	20	1	1
	Married	112	286	3.92 (0.90 to 17.03)	1.80 (0.35 to 9.20)
Family size	1–3	35	149	1	1
	4–6	65	145	1.91 (1.19 to 3.05)	1.86 (1.08 to 3.21)*
	≥7	14	12	4.97 (2.11 to 11.67)	4.43 (1.54 to 12.78)*
Type of housing	Condominium/apartment	14	72	1	1
	Compound/villa	100	234	2.19 (1.18 to 4.08)	2.59 (1.26 to 5.33)*
Educational status of husband	No formal education	4	25	1	1
	Primary education	13	77	1.06 (0.32 to 3.53)	0.63 (0.16 to 2.42)
	Secondary and above	97	204	2.97 (1.01 to 8.78)	1.64 (0.45 to 5.99)
ANC follow-ups	1–3 times	21	142	1	1
	≥4 times	93	154	4.08 (2.41 to 6.91)	2.79 (1.49 to 5.22)*
Gestational age	<37 weeks	13	98	1	1
	37–42 weeks	96	197	3.31 (1.83 to 6.01)	2.54 (1.06 to 6.07)*
	≥42 weeks	5	11	3.09 (0.94 to 10.14)	3.24 (0.72 to 14.55)
Birth weight	<2.5 kg	19	96	1	1
	≥2.5 kg	95	206	1.93 (1.11 to 3.35)	1.42 (0.59 to 3.39)
Knowledge	Good	38	143	1	1
	Poor	76	163	0.57 (0.36 to 0.89)	0.40 (0.22 to 0.70)*
Fear of sunlight exposure	Yes	54	188	1	1
	No	60	118	1.77 (1.15 to 2.73)	1.83 (1.08 to 3.12)*

*p<0.05.
aOR, adjusted OR; cOR, crude OR.

less than 15 days for different reasons, such as evil eye, cold and other cultural reasons. Therefore, mothers who have a neonatal age of ≤15 days require special care when designing interventions aimed at increasing their practice of neonatal sunlight exposure.

This study shows that mothers who had higher family sizes had better practices than those who had lower family sizes. This finding is consistent with other studies conducted in Ethiopia.[18 19] The scientific explanation might be due to mothers who had low family sizes, especially primipara mothers' lack of experience in the practice of neonatal sunlight exposure. Thus, mothers with smaller family sizes may require educational provision during follow-up to improve their practice of neonatal sunlight exposure.

Our study shows that mothers who lived in compound/villa houses had better practices compared with those who lived in condominiums/apartment houses. This might be related to the fact that condominiums/apartment houses are very crowded with many populations and do not have lifts and fences, and mothers might fear evil eye and fall accidents. This study showed that mothers who had complete ANC follow-up (≥4 times) had good practice compared with mothers who had lower ANC follow-up. This might be because when ANC visits are regular and complete, the mother has adequate

knowledge and practices of neonatal sunlight exposure. Therefore, encouraging mothers to have regular and complete ANC follow-ups is important to improve their practices of neonatal sunlight exposure.

This study also shows that mothers who delivered at term had good practice compared with mothers who delivered before term. The scientific explanation for this might be that sunlight exposure to premature and low-birthweight neonates is controversial, and most preterm babies stay at the hospital for the treatment of different preterm complications. In this study, knowledge was another modifiable factor associated with the mothers' practice of neonatal sunlight exposure. Mothers who had poor knowledge about neonatal sunlight exposure had poorer practice than those who had good knowledge. This finding was similar to those of other studies conducted in Ethiopia.[16 21] This might be related to the fact that mothers who know well and practise neonatal sunlight exposure may perform more practice than mothers who do not know. Future studies are required to identify the effects of knowledge on neonatal sunlight exposure among mothers.

In this study, we found that mothers who did not fear exposing their neonates practised better than those who had feared. This finding is consistent with other studies conducted in Ethiopia.[16 18 19] The mothers' fear of sunlight exposure to the neonates might be related to their poor knowledge about sunlight exposure, as the majority of the participants in this study had poor knowledge about sunlight exposure. Knowledge is very important for the practice of neonatal sunlight exposure, as it decreases the fear of neonatal exposure to sunlight. Therefore, emphasis should be placed on those mothers when preparing educational interventions during follow-up to improve the practice of neonatal sunlight exposure by increasing knowledge about neonatal sunlight exposure.

CONCLUSION

This study revealed that 27.1% of mothers had good sunlight exposure. Advanced neonatal age, having a higher family size, living in compound/villa houses, having complete ANC visits and having term delivery were associated with good sunlight exposure practice, whereas poor knowledge and fear of sunlight exposure were associated with poor sunlight exposure practice. Therefore, interventions focusing on these findings are required to improve the practice of neonatal sunlight exposure.

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Contributors YA conceptualised and designed the study; collected, analysed and interpreted the data; and drafted the manuscript. GT, DG and MK were involved in data analysis, drafting of the manuscript and advising the entire research paper. They were also involved in the interpretation of the data and contributed to manuscript preparation. All authors have read and approved the final manuscript.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and ethical clearance was obtained from the Institutional Review Board of Addis Ababa University, College of Health Sciences, School of Nursing and Midwifery with reference number 011/20/SNM. Participants gave informed consent to participate in the study before taking part.

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REFERENCES

1 Reed K. 7 health benefits of direct sunlight to newborn babies. positive health wellness, 2017. Available: https://www.positivehealthwellness.com/diet-nutrition/7-health-benefits-direct-sunlight-newborn-babies/
2 Cranney A, Horsley T, O'Donnell S, *et al*. Effectiveness and safety of vitamin D in relation to bone health. *Evid Rep Technol Assess* 2007;1:1–235.
3 Salih FM. Can sunlight replace phototherapy units in the treatment of neonatal jaundice? An in vitro study. *Photodermatol Photoimmunol Photomed* 2001;17:272–7.
4 Teotia M, Teotia SP, Singh KP. Endemic chronic fluoride toxicity and dietary calcium deficiency interaction syndromes of metabolic bone disease and deformities in India: year 2000. *Indian J Pediatr* 1998;65:371–81.
5 Mead MN. Benefits of sunlight: a bright spot for human health. *Environ Health Perspect* 2008;116:A160–7.
6 Bakeit Z, Abdel Megeid F. Study of risk factors of rickets in children. *World Appl Sci J* 2012;17:1386–93.
7 Aladag N, Filiz TM, Topsever P, *et al*. Parents' knowledge and behaviour concerning sunning their babies; a cross-sectional, descriptive study. *BMC Pediatr* 2006;6:1–6.
8 Dupont E, Craciun L. UV-Induced immunosuppressive and anti-inflammatory actions: mechanisms and clinical applications. *Immunotherapy* 2009;1:205–10.
9 Barbhaiya M, Costenbader KH. Ultraviolet radiation and systemic lupus erythematosus. *Lupus* 2014;23:588–95.
10 Vilá LM, Mayor AM, Valentín AH. Association of sunlight exposure and photoprotection measures with clinical outcome in systemic lupus erythematosus. *P R Health Sci J* 2014;18:89–94.
11 Duarte-García A, Fang H, To CH, *et al*. Seasonal variation in the activity of systemic lupus erythematosus. *J Rheumatol* 2012;39:1392–8.
12 Hasan T, Pertovaara M, Yli-Kerttula U, *et al*. Seasonal variation of disease activity of systemic lupus erythematosus in Finland: a 1 year follow up study. *Ann Rheum Dis* 2004;63:1498–500.
13 John M. Vitamin D and calcium deficiency rickets in infants and children: a global. *Indian Journal of Medical Research* 2008;8:245–9.

14 Aust-Kettis A, Björnesjö K, Mannheimer E. Rickets in Ethiopia. The occurrence and clinical picture of the disease in the experiences of a pediatric clinic in Addis Ababa. *Ethiopian Medical Journal* 1965;3:109–21.
15 Eshetu M. Analysis of pediatric admissions to Jimma Hospital pediatrics ward: a three-year retrospective study. *Ethiopian Journal of Health Sciences* 1994;4:1–11.
16 Getaneh T, Assefa A, Taddese Z. Rickets and the knowledge and practice of exposure to sunlight in Jimma town. *The Ethiopian Journal of Health Development* 1998;12.
17 Kenenisa C, Ewnetu H, Sime H. Retrospective analysis of the prevalence of rickets and associated factors among children admitted to pediatric ward in Jimma university specialized Hospital. *J Pediatr Neonatal Care* 2014;1:00044.
18 Abate A, Murugan R, Gualu T. Assessment of practice and factors affecting sunlight exposure of infants among mothers attending governmental health facilities in Debre Markos town, East Gojjam, Ethiopia, 2015. *AJNS* 2016;5:30–6.
19 Gedamu H, Tafere Y. Assessment of knowledge, attitude, and practice of sunlight exposure of infants among mothers attending in governmental health facilities in Farta district, South Gondar zone, North West Ethiopia, 2018. *Int J Reprod Med* 2019;2019:1–7.
20 Teklehaimanot WZ, Kitawu LD, Tesfaye T, *et al*. Assessment of practice and factors associated with sunlight exposure of infants among mothers in Debre Berhan Town, North Shewa Zone, Amhara Region, Ethiopia. *Pediatric Health Med Ther* 2021;12:507–17.
21 Bedaso A, Gebrie M, Deribe B, *et al*. Knowledge and practice on adequate sunlight exposure of infants among mothers attending EPI unit of Aleta Wondo Health Center, SNNPR, Ethiopia. *BMC Res Notes* 2019;12:1–7.
22 Christie FTE, Mason L, Knowledge ML. Knowledge, attitude and practice regarding vitamin D deficiency among female students in Saudi Arabia: a qualitative exploration. *Int J Rheum Dis* 2011;14:e22–9.
23 Duquia RP, Menezes AMB, Almeida HLde, HLd A, *et al*. Prevalence of sun exposure and its associated factors in southern Brazil: a population-based study. *An Bras Dermatol* 2013;88:554–61.
24 Bezabih AS, Eshetu D, Yohanis N, *et al*. Knowledge and practice of infants exposure to sunlight among lactating mothers attending at Yirgalem Hospital, Sidama Regional State. *Clin Med Insights Pediatr* 2021;15:11795565211041348.
25 LH V, van der Pols JC, Whiteman DC. Knowledge and attitudes about vitamin D and impact on sun protection practices among urban office workers in Brisbane, Australia. *Cancer Epidemiology & Prevention Biomarkers* 2010;19:1784–9.
26 Belachew T, Gebremariam A, Legesse W. Micronutrient deficiency; 2005.
27 Harinarayan CV, Holick MF, Prasad UV, *et al*. Vitamin D status and sun exposure in India. *Dermatoendocrinol* 2013;5:130–41.

Attitudes of mothers attending public hospitals in Addis Ababa, Ethiopia, to neonatal sunlight exposure: a cross-sectional study.

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Sample size calculation for mothers attending public hospitals, Addis Ababa, Ethiopia, 2020.

The sample size was calculated using the single population proportion formula considering the following assumptions; the prevalence of mothers' practice of neonatal sunlight exposure is 45.7% as done in South Gondar Zone, North West Ethiopia among mothers, 95% confidence level, and 5% margin of error.

Sample size (n)= $\frac{Z^{\alpha}/_{2}^{2}p(1-p)}{d^2}$

$$n = \frac{1.96^2 \times 0.457 \times 0.543}{0.05^2}$$

n =**381**

Where **Z** = critical value for normal distribution at 95% confidence level which equals to 1.96 (z value at α =0.05)

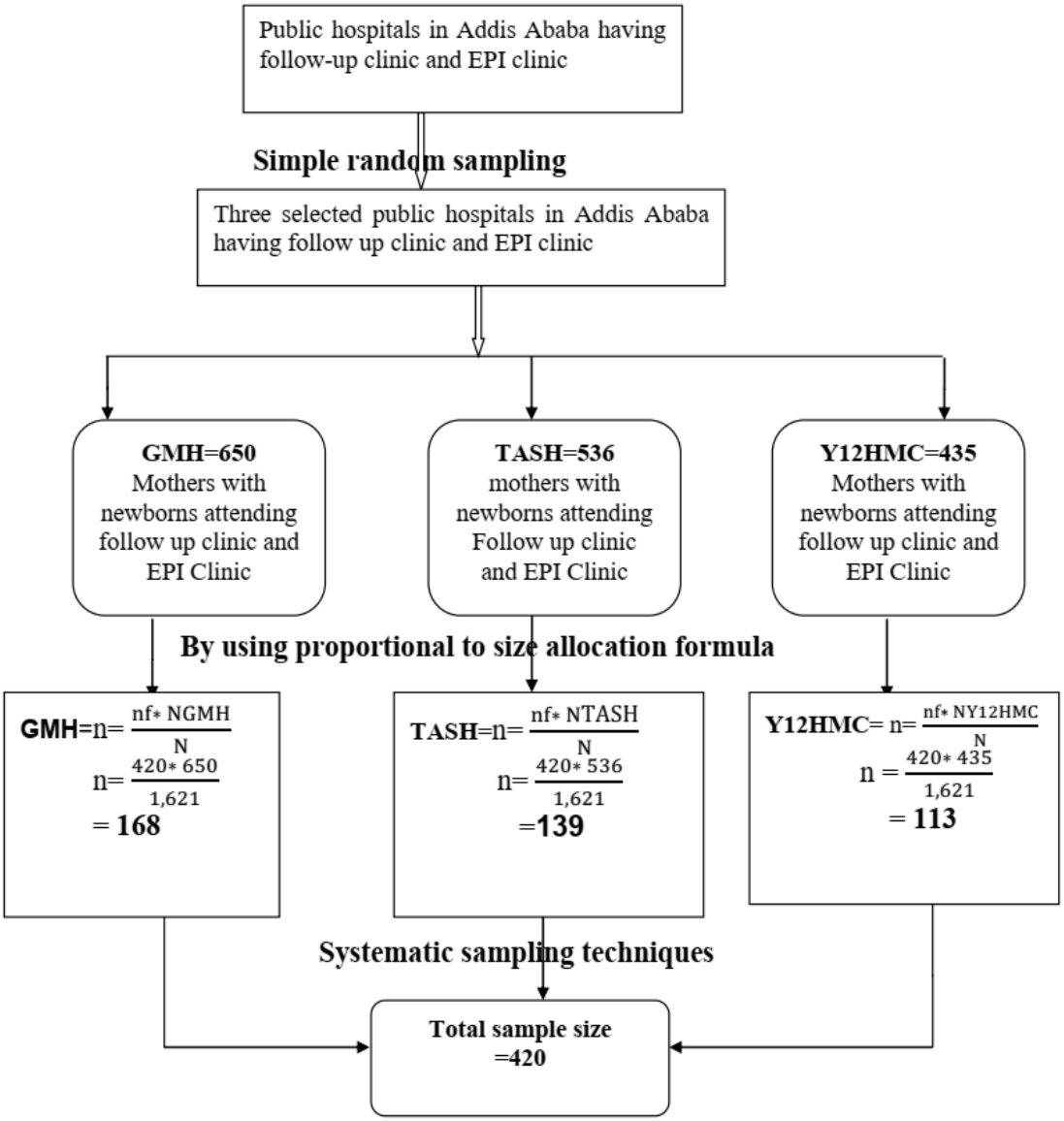
n= Sample

p= prevalence of mothers' practice of neonatal sunlight exposure.

d= Margin of error=5%=0.05

Adding 10% of the non-respondent rate, the final sample size was **420**.

Schematic presentation of the sampling procedure for mothers attending public hospitals, Addis Ababa, Ethiopia, 2020.



English Version Questionnaires

Part I- Questions related to Socio-demographic information

Instruction: Socio-demographic characteristics of the study participants in public hospitals, Addis Ababa, Ethiopia, 2020.

No.	Questions	Coding categories	Skip to
101	Mother's age	_____years	
102	Neonatal/postnatal/ age	_____days	
103	Marital status	1. Single 2. Married 3. Divorced 4. Widowed 5. Others _____	
104	Mother's educational status	1. No formal learning 2. Grade 1 -8 3. Grade 9^{th} -12 4. College Diploma 5. University Degree and Above	
105	Occupation	1. Student 2. Housewife 3. Government employee 4. Private employee 5. Daily laborer 6. Merchant 7. Others_____	
106	Residency	1. Urban 2. Rural	
107	Type of housing designs	1. Compound House (villa) 2. Condominium/ Apartments 3. Other specify _____	
108	Family size	_____	
109	Monthly income	_____Ethiopian birr	
110	Husband's educational status	1. No formal learning 2. Grade 1 -8 3. Grade 9^{th} -12 4. College Diploma 5. University Degree and Above	

Part II: Maternal and neonatal factors related to the mother's practice of sunlight exposure of their neonates in public hospitals, Addis Ababa, Ethiopia, 2020.

No.	Questions	Coding categories	Skip to
201	ANC visit	1. Yes 2. No	
202	Number of visits	_____number	
203	Place of delivery	1. Home 2. Health center 3. Hospital 4. Others _____	
204	Gestational Age	_____in wks.	
205	Birth weight	_____in kg	

Part III- Knowledge of mothers on sunlight exposure of their neonates in public hospitals, Addis Ababa, 2020.

No.	Questions	Coding categories	Skip to
301	Do you know about sunlight exposure	1. Yes 2. No →	401
302	Source of information about sunlight exposure (Circle more than one)	1. Physician 2. Midwife/nurse 3. Television/radio 4. Neighbors/elder people 5. Others_____	
303	Does sunlight exposure beneficial?	1. Yes 2. No →	305
304	The benefit of sunlight exposure (Circle more than one)	1. Strengthen bone 2. Strengthen teeth 3. Keep the child warm 4. Produce vitamin D 5. Strengthen the body 6. Others_____	
305	Does sunlight exposure harmful	1. Yes 2. No	
306	The harmful effect of sunlight exposure (Circle more than one)	1. Skin cancer 2. Sterility 3. Blindness 4. Others_____	

307	Good time to expose newborns on sunlight (Circle more than one)	1. Morning 2. Afternoon 3. Evening	

Part IV- Other factors affecting the practice of mothers on sunlight exposure of their neonate among public hospitals, Addis Ababa, Ethiopia, 2020.

No	Questions	Code categories	Skip to
501	Do you have a fear to expose your baby to sunlight?	1. Yes 2. No	
502	Mother's fear of sunlight exposure (Circle more than one)	1. Sickness 2. Evil eye 3. Cold 4. Other specify_____	

Part V- Practices of mothers on sunlight exposure of their neonates in public hospitals, Addis Ababa, Ethiopia, 2020.

No.	Questions	Coding categories
401	Do you expose your neonate on sunlight?	1. Yes 2. No
402	Age of the newborns to start sunlight exposure	_____
403	How frequently do you expose?	1. Daily 2. Sometimes
404	Where do you expose your neonate on sunlight	1. Outdoor 2. Indoor
405	At what time of the day do you expose your baby outdoors? (Circle more than one)	1. Morning 8-10 AM 2. Mid-day 11 AM-1 PM 3. Afternoon 2-4 PM
406	Condition of clothing during exposure	1. Unclothed 2. With diapers and eye protection only 3. Partly covered 4. Completely covered
407	For how many minutes do you expose your neonate on sunlight?	_____
408	Do you apply lubricants to your neonate body during sunlight exposure?	1. Yes 2. No

409	If you apply, when do you apply? (Circle more than one)	1. Before exposure 2. During exposure 3. After exposure
410	What things do you apply?	1. Baby Vaseline 2. Baby lotion 3. Butter 4. Other_____