
Assessment of informal settlement and associated factors as a public health issue in Bahir Dar city, North West Ethiopia; a community based case control study

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Abstract: Background: Informal settlements are housing units that are constructed without compliance of current planning and building regulations. This kind of settlement has become a common practice in recent years in Bahir Dar. Inhabitants who live in these unplanned housing units are often exposed to health risks associated with environmental problems. The objective of this study was to assess the existence of illnesses by infectious diseases associated to informal settlements and exploring associated risk factors in Bahir Dar city. Methods: unmatched case-control quantitative study complemented with qualitative exploration was conducted in Bahir Dar city, from 1 June-31 September 2011. A total of 555 households (185 informal and 370 formal households) were selected by systematic random sampling technique proportional to the number of households in respective sub cities. Pre tested semi structured questionnaire and observation checklist were used to collect the data. Data were coded, entered and cleaned using epidemiological information version 3.3.2, and analyzed by SPSS version 15. Results: As a result, existence of illness by infectious diseases among informally established housing units was found to be 39.5% compared to 10.8% among formally established housing units. The likelihood of establishing informal houses is associated with socio-economic and demographic factors such as respondents' age [AOR= 2.78, 95%CI: 1.34-5.68], education [AOR=9.28, 95%CI: 3.24-26.57], occupation [AOR=2.47, 95%CI: 1.08-5.66], and average monthly income [AOR= 2.58, 95%CI: 1.57-4.23]. Conclusion: The prevalence of illness among informally established housing units were more than formally established housing units. Diarrheal diseases, malaria, typhoid and typhus were the most infectious diseases found to be prevalent in informally established housing units, so that expansions of income generating activities and taking corrective measures to minimize the adverse effects of environmental problems on health status of the people are recommended.

Keywords: Informal Settlement, Public Health Issue, Bahir Dar City

1. Introduction

Informal settlements are defined as residential housing units built on planned and unplanned areas without formal approval from the concerned body [1]. In most cities of the world, slums, by definition, are informal and illegal settlements [2].

The underlying reasons why informal settlements exist are poverty, population growth, urbanization, land scarcity and environmental hazards. In informal settlements, most of the houses have been built by the families who occupy them. Infrastructure and services are lacking, and the house materials are of a temporary nature [3].

Informal settlements are associated with developing countries and characterized by severe overcrowding; deficient access to water and sanitation facilities. This lack of proper drainage and waste removal results pollution of water, air and soil. The existence of overcrowding can contribute to stress, violence and other social problems. The houses of the inhabitants are constructed with simple materials such as plastic sheets and other low quality materials without adequate ventilation. These lacks of facilities play a major role in spread of diseases [4].

Bahir Dar is one of the cities of Ethiopia where significant number of informally established housing units are observed. The number of informally established housing units was

3504 in 1994. This figure rose to 4823 in 1999/2000 with an increase of 38 percent. In 2005, the number of illegal and/or informal houses was 5000 in the city and its vicinity [5].

There is limited information about the spectrum and burden of disease morbidity in informal settlements of the world. This lack of such information hinders fair distribution of health care resources and provision of appropriate disease prevention services. The formal health sectors address dwellers of informal settlement only when they end up with the complications of their chronic illness. They treat these complications at a tremendous cost to their health care resources. Therefore, concerted effort is urgently needed to assess health burden and determinants of disease morbidity among residents of informal settlement at the community level [2].

Therefore, the aim of this study is to assess situation of informal settlement and exploring associated risk factors in Bahir Dar city, North West Ethiopia. The authors hypothesized that people who live in informal settlements are affected by various factors than those who live in formal settlements.

The causes and adverse effects of informal settlement are rarely researched in the area of public health. In order to fill this gap this research is conducted. The findings of this study will provide information to concerned bodies that have an

intention to be engaged in urban planning, health resource allocation, infrastructural development and placement.

2. Methods and Materials

Unmatched case control, quantitative supplemented by qualitative study design was employed in Bahir Dar city, North West Ethiopia from 1 June - 31 September, 2011. Bahir Dar is the capital of Amhara National Regional State far from 567 km away from Addis Ababa and for administrative purpose classified in to 9 urban Sub city and 4 satellite kebelles. The source population includes all 28,676 registered houses in Bahir Dar City. Systematic random sampling technique proportional to number of households in respective sub cities were used to select the study population from the source population. The sample size include 555 housing units of which 185 were informally established and 370 were formally established housing units who full fill the inclusion criteria. Housing units that are headed by children below eighteen years of age, mentally sick people, respondents with hearing impairments or people who live in houses constructed for less than six months were excluded from the study. The sampling procedure is presented as follows

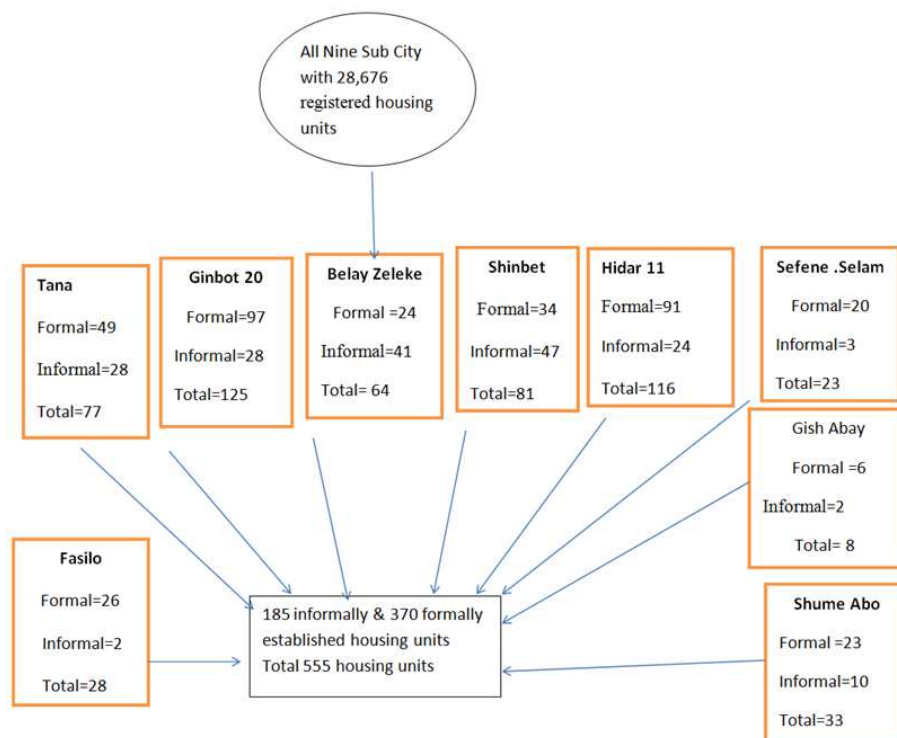


Fig. 1. Schematic presentation of sampling procedure

Data were collected using semi structured Amharic (the local language) questionnaire through face to face interview. Direct observation of physical and social environments of both settlements by using observation checklist were conducted to collect qualitative data. One day training has been given for eight data collectors and two supervisors on

the objective of the study, techniques how to approach respondents, techniques of face to face interview and how to keep confidentiality.

2.1. Operational Definition

Formal Settlement:- Housing units constructed in

planned area in compliance with building code of the municipality.

Informal Settlement: -Housing units constructed in planned/unplanned area without compliance with building code of the municipality.

Sufficient living area/Absence of overcrowding:- Fewer than 3 persons live per room or a minimum of four square meter [6].

Ventilation:- is the existence of at least one window per room for the circulation of the air in the room

Improved sanitation facilities: Availability, accessibility and affordability of safe solid or liquid waste disposal facilities such as connection to public sewers, septic systems, pour-flush latrines, simple pit latrines and ventilated improved pit latrines [7].

Improved access to water: defined as availability, accessibility and affordability of at least 20 liters of water per person per day from water sources include piped in to dwelling piped in to compound, tube or borehole, public, protected dug wells, protected springs, and rainwater collections [7,8].

2.2. Data Quality, Management and Analysis

Pre- test was done in a similar setting out of the study area. Internal consistency of the questionnaire were measured by reliability analysis by calculating chronbach's alpha. Data was checked for accuracy, completeness and consistency of responses manually by supervisors and principal investigators every day. Data were coded, entered and cleaned using epidemiological information (EPINFO) version 3.3.2, and exported to statistical package for social sciences (SPSS) version 15 for analysis. Descriptive statistics was used to summarize the data. The degree of association between dependent and predictor variables was assessed using crude odds ratio (COR). Adjusted odds ratio (AOR) for each independent variable was calculated using backward stepwise binary logistic regression analysis model to control potential confounding variables. Qualitative data was summarized manually and discussed along with quantitative finding to validate quantitative data. P value less than 0.05 was considered statistically significant.

Table 1. Socio demographic characteristics of housing units, 1 June - 31 September 2011, Bahir Dar City, NW Ethiopia.

Variables	Cases n=185(%)	Controls n=357(%)	Total n=555(%)	Chi-square	P-Value
Sex					
Male	121 (65.4)	275 (74.3)	396 (71.4)	4.8	0.02*
Female	64 (34.6)	95 (25.7)	159 (28.6)		
Age					
<30	32 (17.3)	45 (12.2)	77 (13.9)		
30-39	48 (25.9)	67 (18.1)	115 (20.7)	12.82	0.012*
40-49	43 (23.2)	107 (28.9)	150 (27)		
50-59	24 (13)	81 (21.9)	105 (18.9)		
60+	38 (20.5)	70 (18.9)	108 (19.5)		
Place of Birth					
Bahir Dar	60 (32.4)	138 (37.3)	198 (35.7)		
Out of Bahir Dar	125 (67.6)	232 (62.7)	357 (64.3)	1.27	0.25
Educational status					
Illiterate	55 (29.7)	50 (13.5)	105 (18.9)		
Read and Write	31 (16.8)	45 (12.2)	76 (13.7)		
Grade 1-6	43 (23.2)	41 (11.1)	84 (15.4)	66.68	0.00**
Grade 7-8	11 (5.9)	46 (12.4)	57 (10.3)		
Grade 9-12	36 (19.5)	92 (24.9)	128(23.1)		
Certificate and above	9 (4.9)	96 (25.9)	105 (18.9)		
Occupational status					
Government Employee	22 (11.9)	101 (27.3)	123 (22.2)		
House wife	17 (9.2)	42 (11.4)	59 (10.6)		
Merchant	26 (14.1)	84 (22.7)	110 (19.80)	82.29	0.00**
Daily Laborer	66 (35.7)	27 (7.3)	93 (16.8)		
Farmer	8 (4.3)	6 (1.6)	14 (2.5)		
Others	46 (24.9)	110 (29.7)	156 (28.1)		
Religion					
Christians	173 (93.5)	323 (87.3)	496 (89.4)		
Muslims	12 (6.5)	47 (12.7)	59 (10.6)	5.2	0.02*
Ethnicity					
Amhara	182 (98.4)	347 (93.8)	529 (95.3)		
Others	3 (1.6)	23 (6.2)	26 (4.7)	5.83	0.01*
Income					
Less than 600 Birr	124(67)	123(33.2)	247 (44.5)	56..99	0.004*
Greater than 600 Birr	61(33)	247(66.8)	308 (55.5)		

P<0.05 significant* p<0.001 highly significant**

2.3. Ethical Consideration

Ethical clearance obtained from University of Gondar. Permission was also obtained from Bahir Dar City Administration to communicate affiliated sub cities. Informed oral consent was obtained from the study participants after explaining the purpose and objective of the study. Participants were told that they had the right to withdraw from the study at any time during the interview. To ensure confidentiality and privacy of participants names or codes that led to identify the respondent for the third party were not recorded throughout the study.

3. Result

3.1. Socio Demographic Characteristics of Respondents

A total of selected 555 heads of housing units were interviewed. Among these study subjects, 370(controls) were formally established households where as 185 study subjects (cases) were informally established housing units. About 65.4% of cases and 74.3% of controls were headed by males. A place of birth for 67.6% of cases is out of Bahir Dar compared to 62.7% of controls. Regarding educational status about 29.7% of cases were illiterate compared to 13.5 controls. About 4.9% of cases and 25.9 % controls have received certificate and above. Pertaining to their occupational status, 14.1% of cases and 22.7% were merchants, while 11.9% case and 27.3% controls were government employees. About 93% of cases and 87.3 % of controls were Christians in their religious back ground. The majority, 98.4 cases and 93.8 controls belong to Amhara

ethnic groups. The average monthly income of cases greater than Birr 600 is 33 % compared to 66.8 % control groups table [table 1]

3.2. Housing Conditions

Overcrowding is prevalent among 54.1% of cases and 20.3% controls. About 42.7 cases and 48.1 controls live in unventilated rooms. With regard to year of construction, 57.3% of informal houses and 30.8% formally established households were constructed before the year 1991. All informal houses were constructed with non-durable materials, where as 61.1% of formally established houses were built with non-durable materials. About 61.1% of cases and 10% of controls had no kitchen. About 109(96.5%) of cases and 94.1% of controls prepare their food in open spaces in the absence of kitchen. As far as latrine facilities were concerned, 18.9% cases and 1.4 controls have no any kind of household latrine facilities. With regard to type of latrine facilities, 78.4 cases% and 45.7% controls had no improved latrine facilities.

3.3. Waste Management Practice

About 77.3% of cases and 57.8% of controls practice improper liquid waste management whereas 50.8% of cases and 12.7% of controls had improper dry waste management practice. Prevalence of illness with infectious diseases is investigated among 39.5% of cases and 10.8% of controls were exposed to infectious diseases mainly diarrheal diseases, malaria, typhoid, typhus other infectious diseases [table2]

Table 2. Distribution of housing units with their waste management practice, prevalence of conflict, level of satisfaction and prevalence of illness, 1 June - 31 September 2011, Bahir Dar City, NW Ethiopia.

Variables	Cases n=185(%)	Controls n=357(%)	Total n=555(%)	Chi-square	P-value
Improper Liquid waste Management					
Yes	143(77.3)	214(57.8)	357(64.3)	20.35	0.000**
No	42(22.7)	156(42.2)	198(35.7)		
Improper dry waste Management					
Yes	94(50.8)	47(12.7)	141(25.4)	94.51	0.00**
No	91(49.2)	323(87.3)	414(74.6)		
Prevalence of Conflict					
Yes	20(10.8)	(1.4)	25(4.5)	25.66	0.00**
No	165(89.2)	365(98.6)	530(95.5)		
Level of satisfaction in their shelter					
Yes	141(76.2)	3(0.8)	144(25.9)	364.90	
No	44(23.8)	367(99.2)	411(74.1)		0.00**
Prevalence of Illness					
Yes	73(39.5)	40(10.8)	113(20.4)	62.43	
No	112(60.5)	330(89.2)	442(79.6)		0.00**

P<0.05 significant P<0.001 highly significant**

3.4. Determinants of Settlement

Respondent's educational status showed significant difference with form of settlement. Respondents who are illiterate, able to read and write, 1-6 and 9-12 grades were nine, five and half, eight and three and half times more likely

to establish informal houses than whose educational status are certificate and above, respectively [AOR=9.28, 95%CI: 3.24-26.57], [AOR=5.58, 95%CI: 1.95-15.96], [AOR=8.02, 95%CI: 2.96-21.68] and [AOR=3.47, 95%CI: 1.41-8.54]. Regarding to occupational status, daily laborers are two and

half times more likely to establish informal settlements than government employs [AOR=2.47, 95% CI: 1.08-5.66]. People whose age less than 30 years and found between 30-39 age categories were two and three times more likely to establish informal houses respectively than people with other age categories [AOR =2.42, 95%CI: 1.10-5.32] and [AOR=2.78, 95%CI: 1.35-5.67].

Respondents who had less income were two and half times more likely to have chance of establishing informal houses than respondents who had more income [AOR= 2.58,

95% CI: 1.57 - 4.23]. Regarding occupational status, daily laborers and house wives were more likely to establish informal houses than government employs respectively [AOR=2.47, 95%CI: 1.08-5.66] and [AOR=0.29, 95%CI: 0.11-0.78].

Sex, religion and ethnicity showed statistically significant difference in the crude analysis [COR=1.53, 95%CI: 1.05-2.24], [COR=0.48, 95%CI: 0.25-0.92] and [COR=0.25, 95%CI: 0.07-0.84] respectively but, these associations did not retain their significance when adjusted for confounders.

Table 3. Factors associated with forms of settlement, 1 June - 31 September, 2011, Bahir Dar City, NW Ethiopia.

Variable	Settlement form		COR (95%CI)	AOR (95%CI)
	Informal (n= 185)	Formal (n= 370)		
Education status:				
Illiterate	55	50	11.73 (5.36 - 25.68)*	9.28(3.24 - 26.57)*
Read and write	31	45	7.35 (3.23 - 16.72)*	5.58 (1.95 - 15.96)*
Grade 1-6	43	41	11.19 (4.50 - 25.05)*	8.02 (2.96 - 21.68)*
Grade 7-8	11	46	2.55 (0.99 - 6.59)	2.09 (0.68 - 6.38)
Grade 9-12	36	92	4.17 (1.91 - 9.15)*	3.47 (1.41 - 8.54)*
Certificate and above	9	96	1.0	1.00
Age				
<30	32	45	1.31 (0.72 - 2.39)	2.42 (1.10 - 5.32)*
30-39	48	67	1.32 (0.77 - 2.27)	2.77 (1.35 - 5.68)*
40-49	43	107	0.74 (0.44 - 1.26)	1.52 (0.78 - 2.96)
50-59	24	81	0.55 (0.30 - 0.99)*	0.69 (0.34 - 1.42)
60+	38	70	1.0	1.0
Sex				
Male	121	275	1.0	1.0
Female	64	95	1.53(1.05 - 2.24)*	0.81 (0.46 - 1.43)
Religion				
Christian	173	323	1.0	1.0
Muslim	12	47	0.48 (0.25 - 0.92)*	2.17 (0.99 - 4.54)
Occupation				
Government Employee	22	101	1.0	1.0
Merchant	26	84	1.42(0.75 - 2.67)	0.64 (0.29 - 1.41)
House Wife	17	42	1.86 (0.89 - 3.85)	0.29 (0.11 - 0.78)*
Daily laborer	66	27	11.22(5.90 - 21.34)*	2.47(1.08 - 5.66)*
Farmer	8	6	6.12 (1.93 - 19.42)*	1.62 (0.42 - 6.22)
Others	46	110	1.92(1.08 - 3.41)*	0.75 (0.36- 1.58)
Monthly income				
Less income	124	61	4.08 (2.80 - 5.94)*	2.58 (1.57 - 4.23)*
More income	123	146	1.0	1.0
Ethnicity				
Amhara	182	347	1.0	1.0
Others	3	23	0.25 (0.07 - 0.84)*	0.83 (0.22 - 3.09)

* Indicates Significant Association

4. Observation Results

As expected, informally established housing units have much poorer housing conditions than formally established housing units whether we consider construction material, residential crowding, ventilation of the dwelling, practice of waste disposal or access to water and household sanitation facilities.

All the informal houses were built from simple Bamboo, woods and mud. They are overcrowded with lack of ventilation and lack of hygiene compared formally established houses. Informally established housing units lacked basic services such as access to safe water, paved

walkways, drains, sanitation and other essential infrastructures compared to formally established houses.

Liquid and solid waste management were not safe in both forms of settlements. However, it was worst in informally established housing units. Informally built houses dispose kitchen and laundry grey water in roads and in front of the main gates. People practice open defecation. There are housing units without latrine facilities. Even existing latrines were poorly structured, unclean and lifeless. Accordingly, it was not uncommon to see human feces near their houses. Children were observed with barefooted and poorly dressed with unclean clothes on this unsafe living environment. They are places where alcoholic people, drug addicts and commercial sex workers were found. Sometimes the

situation goes to the other extreme, where people abandon their homes, tempted by the prospect of unconsciousness through alcohol or drug abuse. Once people develop such problems the prospects of finding work may diminish. Accordingly, they fall deeper into poverty and the cycle continues.

Sexual abuses and gender based violence were frequently observed. Frequent border conflicts are also observed due to lack of boundary demarcations by municipality.

5. Discussion

The proportion of government employees among cases was 11.9 % compared to 27.3 controls. This could be attributed to the fact that people in informal settlement are associated to low income groups. Accordingly, 67% of cases belong under low income category compared to 32.3% of controls. The implication of this is reflected in the daily standard of living as many are unable to meet their basic needs which make life more unbearable for them.

The study conducted in sub Saharan Africa showed that 40% of the urban housing is built from improper materials [3]. In this study, 74.1% of the housing units were built with low quality and non-durable materials. When we compare informal and formal housing units, all informally established houses were built with non-durable materials such as woods and mud, bamboo and plastics without or with poor structural quality which is by far less than a study done in Jamaica which shows that about 63% of informal established houses were constructed mainly from a combination of concrete and board [9]. Even the situation of houses in Bahir Dar is under poor condition compared to sub Saharan housing condition.

About 57.3% of informal houses had been built over 20 years ago compared to 30.8% of formally established houses. According to personal observation, most of the buildings were accessible by roads but, the main problem is that majority of the roads are not properly constructed and the conditions are extremely poor. The roads were characterized by poor drainage, lack of street lighting, absence of pedestrian walkway as well as on street parking.

The study revealed that 61.1% informal houses and 10% of formal houses had no any kind of kitchen. Even existing kitchen facilities were found in poor condition. About 18.9% of informal hadn't any kind of toilet facilities which is less compared to a study done in Jamaica which shows that only 3% of informally established housing units had no any kind of toilet facilities [9]. Majority of informal houses had no access to improved sanitation which is consistent with the study done in Zanzibar town in 2003 which indicates sanitation is the major problem in informal settlement areas due to the lack of established collection points, piles of garbage are scattered in and around residential areas which leads to environmental and health problems [10]. About 77.3% of informal houses have improper liquid waste management practice which is similar with a study done in Zanzibar in 2006 as there is no centralized sewage system,

liquid waste which includes water from washing, laundry, kitchen, bath and other domestic uses is haphazardly discharged onsite. This disposal practice pollutes the groundwater and marine environments and is a major cause of water born diseases [1].

With regard to dry waste management, 50.8% of informal houses and 12.7% formal houses dispose inappropriate way.

Majority of the respondents (95.7%) of informal houses and all formal houses had access to improved drinking water this finding is better than a study done in Jamaica which indicates that 85% of informal houses had improved drinking water [9].

Waste management deficiencies resulting in lack of drainage and uncontrolled solid and liquid waste disposal in the poor settlements lead to severe environmental health risks. The study conducted in selected six areas of Abidjan showed that the prevalence of disease mainly, malaria diarrhea and skin diseases in informal settlement had reported to be 48 % [11]. Another study conducted in Dareselam, the capital of Tanzania found that cholera incidence was most closely associated with informal housing, population density, and the income level of informal residents [12].

A cross-sectional study was conducted in Yaoundé, the capital of Cameroon to measure diarrheal prevalence and identify factors associated with it. Lack of access to improved sanitation, existence of poor hygiene, overcrowding and uncomfortable housing found to be the risk factors for the prevalence of diarrhea. Accordingly, 16% of the diarrhea prevalence was identified compared to 14.4% overall prevalence rate [13]. Concerning the prevalence of infectious disease in this study about 39.5% of informal houses and 10.8% of formally established houses were exposed to disease mainly malaria, typhoid, typhus and TB. This finding is lower than the findings of Abidjan and higher than the findings of Yaoundé study [11, 13].

6. Conclusion and Recommendation

This study was conducted on formally and informally established housing units to assess the situation of informal settlement in Bahir Dar City and reach at plausible conclusions. Accordingly, the conclusions were stipulated below: Informal settlement is associated with socio-economic and demographic factors such as respondents' age, educational status, occupation and average monthly income.

The prevalence of illness among informally established housing units were more than formally established housing units. Diarrheal diseases, malaria, typhoid and typhus were the most infectious diseases found to be prevalent in informally established housing units.

Based on the above findings and conclusions the investigators recommend the following points:-

- Keble small and Micro enterprises should work in expansions of income generation activities to create employment opportunities and generate more income.

This can improve socioeconomic conditions of the people including access to shelter.

- The adverse effect of informal settlement on health status of the people should get the attention of health sector and remedial measures should be taken to minimize their negative impact.

6.1. Strengthening and Limitations of the Study

6.1.1. Strengthening

- ✓ This study gives the increasing urbanization and population is an important step to generate information that could be useful to health policy makers and to planners.
- ✓ There are no enough similar studies on urban informal settlement has been conducted in the country.
- ✓ The study design being case - control enabled to generate more information on the associated factors.

6.1.2. Limitations

- ✓ Lack of similar studies hindered further comparison of the results
- ✓ Some respondents may not give exact information assuming that the result of the study may affect them

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Computing Interests

The authors declared that they have no any computing interests

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