<u>Original</u>

Predictors of food insecurity in the selected areas of SINDH Pakistan

Rubina Hakeem*, Farzana Asar

Rana Liaqat Ali Khan Government College of Home Economics Karachi Pakistan

ABSTRACT *Background and Purpose*: Food insecurity is associated with a variety of nutrition problems. Families vulnerable to food insecurity need to be efficiently identified to assure cost effectiveness of the interventions. In Pakistan exploration of community and family level determinants of food insecurity is relatively rare. This paper   estimated the variation in food insecurity and identified predictors of food insecurity in the selected areas of Sindh province of Pakistan. *Methods*: Data was collected from six districts of Sindh namely Karachi, Hyderabad, Mirpurkhas, Thatta, Thar, Tando Ala Yar. Household food insecurity was assessed by Household Food Insecurity Access Scale (HFIAS). Several socio-demographic variables that have potential influence Food and nutrition security were measured and used to generate "Economic Score" i.e. Economic potential for assuring Food and nutrition security", "Care Score" i.e. Care potential for assuring Food and nutrition security". Overall Nutrition Care Potential" Score was estimated by summing up the score attained on "Economic score" and "Care score". Both uni-variate and Multivariate analysis were done to identify the predictive power of individual demographic variables and composite predictive tools. *Results*: A total of 573 households were surveyed. Severe food insecurity rates were the highest in Thar: 58.8%, followed by Tando Alayar: 51.9%, Hyderabad: 37.5%, Thatta: 35.8%, Mirpurkhas: 33.3%, and lowest in Karachi: 14.5%. Family's "nutrition care potential" score had a significant negative correlation with food security status of the family (r= .559; P <0.001). Association between economic score and Food Security Access Score was stronger (r=.600 P<0.001) as compared to association between care score and Food Security Access Score (r=.456 P<0.001). Strength of these associations varied between different districts and families apparently having similar "care potential" were more like to be food insecure in districts with a lower proportion of urban population. *Conclusion:* Supporting young girls formal education and decreasing the inter district disparity in access to food and relevant resources and opportunities needs to be addressed. Role of place of residence and mother's education has emerged as a very important determinant of food insecurity in study and can help in screening to identify the most vulnerable groups and plan effective interventions.
Key words: food insecurity, Sindh**,** malnutrition, stunting, wasting, overweight, double burden

INTRODUCTION
In Pakistan, malnutrition rates have been rising (1) and a variety of factors could be responsible for this situation (2). Food insecurity is associated with a variety of nutrition problems (3-7). Reduction in food insecurity is not assured by increments in national income or food production and could not be assure unless the vulnerable groups are identified and both immediate and long term actions are taken to reduce the inter and intra community disparities (8). While immediate action may provide temporary relief sustainable progress in reducing food insecurity is not possible without exploring and modifying the underlying factors. Assessing and reducing Food insecurity is a major challenge that requires understanding the dynamics of food insecurity from a variety of perspectives. In Pakistan, while there are a few observations reported that highlight the role of agriculture and economy in reducing food insecurity, exploration of community and family level determinants of food insecurity are relatively rare. Within Pakistan there are inter-province differences in the rates of Malnutrition and food insecurity and has been higher in Sindh as compared to Punjab and NWFP (1). The 2011

National Nutrition Survey (NNS) in Pakistan showed that Sindh province continues to have some of the worst undernutrition rates in South Asia (9). Though reviews have tried to explore the reasons of high rates of malnutrition and food insecurity in Sindh, community and family level disparities in modifiable factors have not been reported. This paper estimates the   variation in food insecurity and explores the association between socio-demographic factors and food insecurity in the selected areas of Sindh province of Pakistan.

METHODS
Data was collected from six districts of Sindh namely Karachi, Hyderabad, Mirpurkhas, Thatta, Thar, Tando Ala Yar. Districts were selected on the basis of representativeness of the district and logistic feasibility of data collectors who were female students of Nutrition department of RLAK college of Home economics Karachi. From each location only family living in small houses (80sq yards or lower) and having a 2-5 year old child were selected as the population to represents lower middle to low income population.

To whom correspondence should be addressed:
rubina.hakeem@gmail.com

Sample size calculation was done on the basis of rates of wasting in under-five children. Data was collected from 573 households. Direct observation were made about hygiene conditions, anthropometric measurements were taken from 2 to 5 year old children and information about diet, food security, nutrition knowledge, demography etc was collected from mothers. Data collectors were trained by the principal investigator, measuring tools were calibrated and pre-testing of the questionnaire was done on 60 low income families of Karachi.

The questionnaire had queries about Demographic Information, Household Assets, Food security status, Anthropometry, Breastfeeding practices, Household hygiene index, Child care nutritional knowledge, Child feeding practices, 24-hour dietary recall of mother and index child, Recipes of dishes enlisted in 24 hours dietary recall of mother and index child, Details of utensils and portion sizes consumed by mother & index child. The data collection started from 9th march 2016 to 21st march 2016. Data was entered on SPSS (Statistical Software for Social Sciences) Software version 20.

Household food insecurity was assessed by Household Food Insecurity Access Scale (HFIAS) (10). Questions were translated in Urdu and validated for use in local population by pretesting. Interpretation of the answers was done as suggested by the developer of the tool.

The HFIAS is composed of a set of nine questions that have been used in several countries and appear to distinguish food insecure from food secure households across different cultural contexts.

Each of the following questions is asked with a recall period of four weeks (30 days).
1. Did you worry that your household would not have enough food?
2. Were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?
3. Did you or any household member have to eat a limited variety of foods due to a lack of resources?
4. Did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?
5. Did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?
6. Did you or any household member have to eat fewer meals in a day because there was not enough food?
7. Was there ever no food to eat of any kind in your household because of a lack of resources to get food?
8. Did you or any household member go to sleep at night hungry because there was not enough food?
9. Did you or any household member go a whole day and night without eating anything because there was not enough food?

For each questions respondent can answer NO, rarely (once or twice), sometimes (three to ten times) or often (more than ten times) in the past four weeks.
Based on the responses households are categorized into four levels of household food insecurity (access): food secure, and mild, moderately and severely food insecure. Households are categorized increasingly food insecure as

they respond affirmatively to more severe conditions and/or experience those conditions more frequently. i.e.
1. If answer to question 1 in No or rarely and answers to all other questions are NO household is categorized as FOOD SECURE.
2. If answer to Q 5 to 9 is NO and answer to Q 1 is 2/3, answer to Q2 is 1/2/3, or answer to Q 3 or 4 is 1 household is categorized is MILDLY FOOD INSECURE.
3. If answers to Q3 or Q4 is 2/3, OR answer to Q5 or Q 6 is 1or 2 and answers to Q7 8 and 9 is NO household is categorized is MODERATELY FOOD INSECURE
4. If answers to Q5 or Q6 is 3, OR answer to Q7, 8 and 9 is 1/2/3 the household is categorized is SEVERELY FOOD INSECURE

The Household Food Insecurity Access Scale (HFIAS) holds promise as an easier and more user-friendly approach for measuring the access component of household food security. HFIAS is found to be useful in approximating adequacy of urban households' diets (11).

Several socio economic and care variables likely to influence the food security status were studied. In order to facilitate assessment of variation and exploration of associate with food insecurity, relevant socioeconomic indicators were given a numeric score. "Urbanization level of the district" Urbanization level of the district was assessed on the basis of proportion of rural population in each district (12) . 'Family's economic burden' was assessed on the basis of number of children (age <18) in the family. "Fathers economic performance score" was assigned on the basis of average income of the type of profession or business mentioned in which he was engaged, zero was given if not working at all. "Mothers economic performance" was assessed on the basis of average income of the type of profession or business mentioned in which he was engaged zero was given if not working at all. "Family Housing Score" was assigned on the basis of housing structure, utilities, ownership and size. "Family Assets score" was assigned on the basis of equipment, furniture, communication devices and vehicles owned and used by the family. "Economic Score" was estimated by summing ups the score attained on economic parameters i.e. family's economics burden, economic performance housing and assets.

"Father's education score" was determined on the basis of years of formal education. "Mother's education" was determined on the basis of years of formal education. "Family Hygiene Score" was determined by observing the characteristics of the household by a checklist based on the parameters used in "household hygiene index" developed by Webb et al (13). Knowledge score was determined by answers to a knowledge questionnaire developed on the basis of parameters used in "Maternal Child care knowledge questionnaire" developed by Saaka et al (14).. "Care Score" was estimated by summing ups the score attained on care parameters i.e. parents' education, maternal childcare nutrition knowledge and hygiene score.

"Overall Nutrition Care Potential" Score was estimated by summing up the score attained on "Economic Score" and "Care Score".

Association between dependent variable (food insecurity) and independent variables ("Overall

Nutrition Care Potential" Score and its components) was estimated by comparison of means, exploring correlations between variables and comparing proportion of food insecure families within various tertiles of independent variables.

Multivariate analysis (linear regression) was done to exclude the impact of covariates and identify true significant predictors of food insecurity.

Data analysis was done SPSS version 21

RESULTS
Demographic characterstics:

A total of 573 households were surveyed. Mothers age ranged from 15 to 50 years (mean =28.6) and children age ranged from 2 to 5 years (mean = 3.4).

Food security

Overall Mean Food Insecurity Access Score was 7.12±8.469, n=573) being the highest in Thar (14.91±10.115, n=35), followed by Thatta (9.38±9.498, n=110), Tando Alayar (8.80±7.884, n=54), Mirpurkhas (8.44±9.358, n=124), Hyderabad (6.28±6.169, n=107), and the lowest in Karachi (2.32±4.741, n=143).
Rates of severe food insecurity differed according to

district and urban-rural status within the district Collectively in the areas surveyed, overall rates of severe food insecurity were 34.2% (Urban: 22.1%, Rural:47.5%, P<0.001). Significant (P<0.001) between districts differences were noted. Severe food insecurity rates were the highest in Thar: 68.6% (Urban:54.5%, Rural:75.0%), followed by Tando Alayar: 51.9% (Urban:35.0%, Rural:61.8%), Thatta: 40.0% (Urban:25.0%, Rural:50.0%), Hyderabad: 39.3% (Urban:33.9%, Rural:45.1%), Mirpurkhas: 35.5% (Urban:11.1%, Rural:57.9%) and lowest in Karachi: 14.7% (Urban:20.8%, Rural:0.0%).

Association between Food insecurity and socio-economic status

Family's nutrition care potential score had a significant negative correlation with food security status of the family (r= .559; P <0.001). Means score attained by families on all the indicators excluding the mothers' economic performance, were significantly higher for the families having a lower level of food insecurity (table 1). Bivariate correlations also indicated significant negative association between food insecurity and all the economic and care indicators except mothers' 'job level' (Table 2).

Table 1 Socio-demographic characteristics of subjects

	Food Insecurity Levels										Sign. P Value
	Not Food Insecure		Mildly Food Insecure		Moderately Food Insecure		Severely Food Insecure		Total		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Index Childs Age	3.37	1.10	3.61	1.15	3.48	1.19	3.58	1.13	3.49	1.13	0.212
Father's Age	33.2	6.0	33.2	6.3	34.6	7.7	36.6	8.6	34.6	7.4	<0.001
Mother's Age	28.0	5.4	27.4	5.4	28.1	6.2	29.4	7.3	28.4	6.3	0.063
Urbanisation level of the district	4.64	1.48	3.96	1.49	3.75	1.45	3.48	1.57	4.03	1.59	<0.001
Family's economic burden (Number of kids)	2.70	1.42	2.89	1.53	3.24	1.83	3.90	2.11	3.21	1.83	<0.001
Fathers economic performance	4.90	2.03	4.97	1.94	3.51	1.86	2.96	1.73	4.10	2.11	<0.001
Mothers economic performance	0.41	1.39	0.36	1.21	0.43	1.22	0.42	1.11	0.41	1.25	0.988
Family Housing Score	11.64	2.86	12.33	3.40	9.77	2.71	7.41	3.39	10.02	3.68	<0.001
Family Asset score	5.54	2.32	5.83	2.41	3.67	2.21	2.37	2.11	4.23	2.69	<0.001
Father's education	8.29	4.99	8.54	4.39	4.77	4.12	3.72	4.20	6.25	5.02	<0.001
Mother's education	6.65	4.78	6.20	4.61	3.26	3.30	2.13	2.64	4.56	4.44	<0.001
Hygiene Score	8.39	3.45	8.93	3.26	7.14	3.56	5.94	3.42	7.45	3.62	<0.001
Knowledge score	11.97	2.33	11.37	2.41	11.52	2.16	11.34	2.34	11.62	2.33	<0.035
Economic Score	30.00	6.58	30.14	6.47	23.52	5.79	18.59	7.14	25.23	8.46	<0.001
Care Score	34.75	11.72	34.83	11.42	26.52	8.05	23.08	8.65	29.63	11.58	<0.001
Nutrition care potential Score	64.75	16.85	64.97	16.26	50.04	11.77	41.68	13.92	54.86	18.52	<0.001

Table 2: Association of various sociodemographic factors with Food Insecurity

Determinants of Food Insecurity	Correlation	Significance (P Values)	N
Urbanisation level of the district	R= - .313**	P<.000	559
Family's economic burden (family size)	R= - .264**	P<.000	559
Fathers economic performance	R= - .417**	P<.000	480
Mothers economic performance	R= .006	P<.890	550
Family Housing Score	R= - .508**	P<.000	559
Family Asset score	R= - .528**	P<.000	559
Father's education	R= - .418**	P<.000	545
Mother's education	R= - .460**	P<.000	549
Hygiene Score	R= - .303**	P<.000	559
Knowledge score	R= - .111**	P<.008	559
Economic status score	R= - .600**	P<.000	559
Care potential score	R= - .456**	P<.000	559

Using the same variables, multiple regression analysis was also conducted. This analysis estimates proportion of variability in the outcome variable that can be predicted from the independent variables jointly and by any one factor exclusive (i.e while controlling for the confounding effects of other independent variable). R-squared measures the proportion of the variation in the dependent variable (Y) explained by the independent variables (X) for a linear regression model. Adjusted R-squared adjusts the statistic based on the number of independent variables in the model. The model had R square of .397 that means it explained 39.7% of variation in food insecurity (i.e about 40% of difference in food insecurity was due to these factors). It also shows that if we know about the values of these independent variables we can predict the level of food insecurity to a certain degree and we can modify relevant situations equivalent decrease in food insecurity is feasible.

Unstandardized coefficients are 'raw' coefficients produced by regression analysis when the analysis is performed on original, unstandardized variables. An unstandardized coefficient represents the amount of change in a dependent variable Y due to a change of 1 unit of independent variable X. Standardized coefficients, which are normalized unit-less coefficients, an unstandardized coefficient has units and a 'real life' scale. The t statistic is the coefficient divided by its standard error. The standard error is an estimate of the standard deviation of the coefficient, the amount it varies across cases. It can be thought of as a measure of the precision with which the regression coefficient is measured. Every t-value has a p-value to go with it. A p-value is the probability that the results from your sample data occurred by chance nsd indictes level of significance of the observation.

Based on regression analysis, five of the economic indicators, and one of the care potential indicators (mother's lower level of formal education) emerged as the significant predictors of food insecurity. It indicates that these factors can have an important influence on level of food insecurity if other factors wer kept constant. (Table 3).

Apparent impact of economic status or care potential on food insecurity was different in different districts (figures 1 and 2). Environmental protections against food insecurity needs to be strengthened.

Table 3: Predictors of Food Insecurity*

Independent Variables	Beta	t	Sig.
e1_Urban District	-.160	-4.123	.000
e2_Smaller Family	-.132	-3.493	.001
e3_Father's job level	-.145	-3.075	.002
e4_Mother's job.level	.003	.088	.930
e5_Housing Score	-.222	-4.048	.000
e6_Asset Score	-.164	-2.744	.006
c1_Father's Education	-.001	-.016	.987
c2_Mother's Education	**-.136**	-2.415	**.016**
c3_Household Hygeine Score	.007	.151	.880
c4_Mother's Nutrition Knwoledge Score	-.014	-.360	.719

Multivariate regression analysis: Dependent Variable: Food Insecurity Levels; R2 = 0.392; adjusted R2 = 0.379; F = 29.308, P <0.001
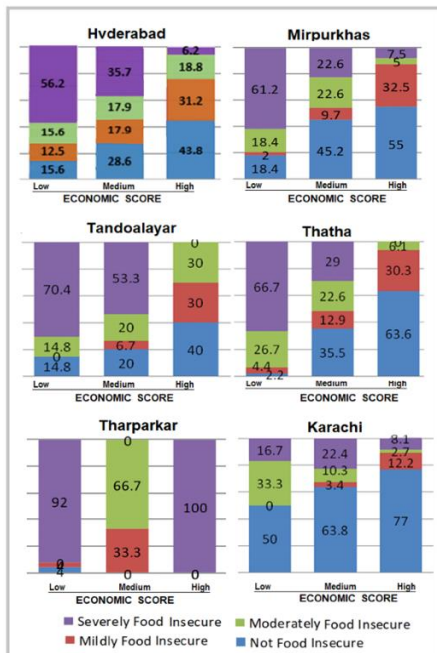

Figure 1: Proportion of Food insecure in subgroups of families having varying Economic in various districts of SINDH
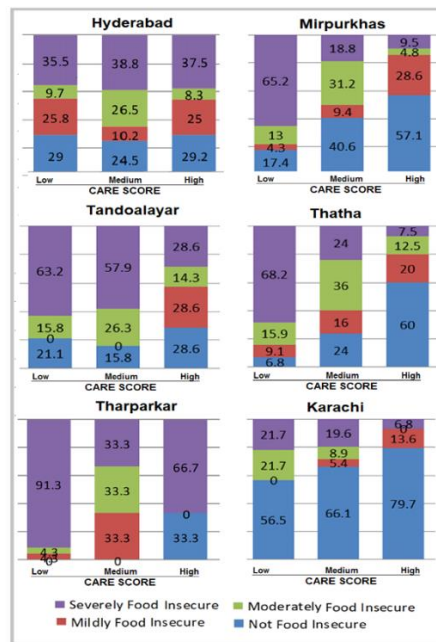

Figure 2: Proportion of Food insecure in subgroups of families having varying Care Score in various districts of SINDH

DISCUSSION

In Ethopia, Using the HFIAS, 17.7 % of households were food secure. The percentage of households that were mildly, moderately and severely food insecure was 6.8 %, 27.7 % and 47.8 %, respectively (15). In an urban resettlement colony of South Delhi, India HFIAS identified a total of 77.2% households as food-insecure, with 49.2% households being mildly food-insecure, 18.8% of the households being moderately food-insecure, and 9.2% of the households being severely food-insecure (16).

In another research that included 100 households form Pakistan as part of a multinational study, proportion of severely food insecure was 17.4 % (17). In our study 34.2% households were severely food insecure. Considering the fact that food insecurity is higher in Sindh as compared to other provinces, and that in this study only lower middle income group was included this difference in rates of sever food insecurity were as per expectations.

In Psaky et al, the mean FAIS score was 8.3-and in our study it was FAIS 7.12. The discrepancy is trends is explained by difference in proportion of moderately food insecure household's i.e. 48% in Psaki et al and 14 8% in this study. If we combine two uppermost categories of food insecurity the proportion of moderately or severe food insecurity is 60.2% in our sample and 65% in Psaky et al that corresponds to the difference in means. This observation indicates the limitations of using this tool in different settings and on the basis of mean FIAS score. As categorisation of families in different food insecurity categories is not based on total score but on the combination of answers to specific questions, differences in answers to even one or two questions can put a family in an extremely different category, comparison among different subsets of populations need to consider both mean score and all categories.

Food insecurity in Sindh has been a cause of concern however assessment of role of family and community is rarely reported. This paper has tried to explore the degree of variability in food security in the low income households of the selected areas of Sindh and the role of economic as well other nutrition-care potential indicators with the level of food insecurity. As expected and as identified in other studies all the economic indicators and most of the other nutrition care potential indicators were negatively associated with food insecurity.

There have been mixed observations about the role of mother's education in predicting food insecurity. In our study mothers formal education had a negative association with food insecurity even after controlling for other factors.

Role of place of residence has emerged as a very important determinant of food insecurity in study. Living in more urbanised districts increased the chances of being food secure even at a lower level of economic status or education. These observation calls of exploration of the reason for this trend and development of strategies to decrease inter district disparity in access to food and relevant resources and opportunities.

Conflict of Interest Declaration

Manuscript title: Predictors of food insecurity in the selected areas of SINDH Pakistan

REFERENCE

1) World Food Program. Food insecurity in Pakistan rises to 58%, National Nutritional Survey. WFP 2012 December 20 [cited 18 A.D. Feb 24];Available from: URL: https://www.wfp.org/content/food-insecurity-pakistan-rises-58-national-nutritional-survey

2) Mursil Mehmmod Butt. Food insecurity in Pakistan rises to 58%, National Nutritional Survey. NEWS PAKISTAN WEBSITE 2012 November 1Available from: URL: http://www.newspakistan.pk/2012/01/11/Food-insecurity-in-Pakistan-rises-to-58-National-Nutritional-Survey/

3) Abdurahman AA, Mirzaei K, Dorosty AR, Rahimiforoushani A, Kedir H. Household Food Insecurity May Predict Underweightand Wasting among Children Aged 24-59 Months. Ecol Food Nutr Sep;55(5):456-72. 2016

4) Shahraki SH, Amirkhizi F, Amirkhizi B, Hamedi S. Household Food Insecurity Is Associated with Nutritional Status among Iranian Children. Ecol Food Nutr Sep;55(5):473-90. 2016

5) Weigel MM, Armijos RX, Racines M, Cevallos W. Food Insecurity Is Associated with Undernutrition but Not Overnutrition in Ecuadorian Women from Low-Income Urban Neighborhoods. J Environ Public Health 2016:8149459.

6) Farrell P, Thow AM, Abimbola S, Faruqui N, Negin J. How food insecurity could lead to obesity in LMICs: When not enough is too much: a realist review of how food insecurity could lead to obesity in low- and middle-income countries. Health Promot Int 2017 May 24.

7) Shamah-Levy T, Mundo-Rosas V, Morales-Ruan C, Cuevas-Nasu L, Mendez-Gomez-Humaran I, Perez-Escamilla R. Food insecurity and maternal-child nutritional status in Mexico: cross-sectional analysis of the National Health and Nutrition Survey 2012. BMJ Open Jul 31;7(7):e014371. 2017

8) Nazam Maqbool. Food Security in Pakistan. Mehbool Haq Human Development Center. Report No.: Policy Brief no 2. 2015

9) Di CM, Bhatti Z, Soofi SB, Fortunato L, Ezzati M, Bhutta ZA. Geographical and socioeconomic inequalities in women and children's nutritional status in Pakistan in 2011: an analysis of data from a nationally representative survey. Lancet Glob Health Apr;3(4):e229-e239. 2015

10) Coates J, Swindale A, Bilinsky P. Household Food Insecurity Access Scale (HFIAS) for measurement of food access: indicator guide. Washington, DC: Food

and Nutrition Technical Assistance Project, Academy for Educational Development 34. 2015

11) Becquey E, Martin-Prevel Y, Traissac P, Dembele B, Bambara A, Delpeuch F. The household food insecurity access scale and an index-member dietary diversity score contribute valid and complementary information on household food insecurity in an urban West-African setting. J Nutr Dec;140(12):2233-40. 2010

12) Pakistan Bureau of Statitstics. Districts at a glance-SINDH. www fbs gov pk 2017 August 8 [cited 2016 Feb 2];Available from: URL: http://www.pbs.gov.pk/pco-sindh-tables

13) Webb AL, Stein AD, Ramakrishnan U, Hertzberg VS, Urizar M, Martorell R. A simple index to measure hygiene behaviours. Int J Epidemiol Dec;35(6):1469-77. 2006

14) Saaka M. Relationship between mothers' nutritional knowledge in childcare practices and the growth of children living in impoverished rural communities. J Health Popul Nutr Jun;32(2):237-48. 2014

15) Regassa N, Stoecker BJ. Household food insecurity and hunger among households in Sidama district, southern Ethiopia. Public Health Nutr Jul;15(7):1276-83. 2012

16) Chinnakali P, Upadhyay RP, Shokeen D, Singh K, Kaur M, Singh AK, et al. Prevalence of household-level food insecurity and its determinants in an urban resettlement colony in north India. J Health Popul Nutr Jun;32(2):227-36. 2014

17) Psaki S, Bhutta ZA, Ahmed T, Ahmed S, Bessong P, Islam M, et al. Household food access and child malnutrition: results from the eight-country MAL-ED study. Popul Health Metr Dec 13;10(1):24. 2012