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Accreditation of a hospital: Do Healthcare providers perceive its impact?

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Abstract

Successful accreditation systems have existed for decades in high-and middle-income countries; however, the development of accreditation systems in low-income countries has been slow. This study aimed to assess the perceived impact of accreditation on the quality of care from the health care professionals' perspectives at a private hospital in Alexandria through a cross-section study design. 186 nurses (74.4%) and 43 doctors (86%) were participated. The average perceived score for improvement of Quality Results in the hospital ranged from 2.8-5. The least perceived improvement due to accreditation was for the difficulties met at work with an average score of 3. Perceived benefit of accreditation was the only significant factor associated with quality scores together with the years of experience in working at the hospital. Motivating healthcare providers to implement accreditation standards is important. Further studies to assess quality using patient outcome indicators to make accreditation an effective regulatory instrument are recommended.

Key words

Accreditation, Quality of health services, accreditation standards, impact of accreditation

Introduction

There has been worldwide rapid increase in the development of national and regional accreditation programs for health services in the past ten years. These programs have tended to be initiated by government, rather than the medical profession. ⁽¹⁾ Although there is a widespread implementation of accreditation in many countries together with prevailing beliefs of the association between the accreditation and variables contributing to organizational outcomes, ⁽²⁾ research into the accreditation effectiveness is scarce and existing research lacks in-depth analysis of the relationships between accreditation process and performance. ⁽³⁾

In many countries, accreditation has developed as an effective strategy for continuous improvement of healthcare systems, with benefits to consumers, regulators, managers, professions and other stakeholders. ⁽¹⁾

Accreditation is a formal process by which a recognized body—either governmental or nongovernmental—assesses and recognizes that a healthcare organization meets pre-established performance standards. ⁽⁴⁾ Certification and Licensure are used worldwide to organize, improve and market the services of healthcare providers and organizations ⁽⁵⁾ The key difference between accreditation and other forms of quality regulation is that by focusing on optimal or desirable, rather than minimum standards of care, accreditation has a strong performance improvement orientation, stimulating healthcare organizations to pursue increasingly higher levels of quality beyond the minimum needed for licensing. ⁽⁴⁾

Team and overall organizational performance, leadership, organizational culture, service outcomes are among variables which are assessed during the accreditation process. ⁽⁶⁾

In Eastern Mediterranean Region a number of countries including Jordan, Kuwait, Oman and Saudi Arabia, have established national committees to study requirements for accreditation; others, such as Egypt and Morocco, are piloting national accreditation programs. Moreover, Private hospitals are active in attaining accreditation and ISO certification. ⁽⁷⁾

Egypt, accreditation of health facilities started in primary healthcare sector before hospitals, being an element of the Egyptian Health Sector Reform Program which was officially launched in 1997. In Egypt a program is developed to accredit all levels of health facilities in all sectors. The Egyptian accreditation standards comply with Egyptian laws, regulations, and cultures, but they also meet the basic intent of international standards. ⁽⁸⁾

Material and Methods

Study setting

The study was conducted at a multi-specialty private hospital of 165 beds. This hospital had ISO certificate and successfully passed the first survey of Joint

Commission international accreditation. Total number of nurses working in the study hospital at that time was 250 while the total number of doctors was 50.

Study design

A cross-sectional study design was used.

Sampling design & sample size

All nurses and doctors who attended the 1st survey of accreditation process and who accepted to participate were included in the study. The total number of nurses involved in the study was 186 (93% response rate) while the total number of doctors was 43 (86% response rate).

Data collection techniques and tools

- A self-administrated questionnaire was used for data collection which consisted of 2 sections:

Section 1 Included socio-demographic data (Gender, age, educational, qualifications, occupational category and years of experience, department)

Section 2 Included ten scales and subscales consisting of 62 items that were rated on a five-point likert scale (ranging from one for strongly disagree to five for strongly agree)

The questionnaire used in this study was developed in previous studies^(9,10) and was adopted from Short ell et al⁽¹¹⁾ with exception of two Scale that were adopted from Pomey et al⁽¹²⁾ and Al- Tehewy M⁽¹³⁾ as shown in table 1.

Table 1: Sources and Coronbach's Alpha values for the study scale

Scale	Number of items	Source
1- Quality results.	5	(35)
2- Leadership, commitment and support.	9	(35)
3- Strategic quality planning.	7	(35)
4- Human resources utilization		
A- Education and training	3	(35)
B- Rewards and recognition	3	(35)
5- Quality management.	6	(35)
6- Use of data.	7	(35)
7- Accreditation		
A- Staff involvement.	5	(36)
B- Benefits of accreditation.	9	(36)
8- Provider satisfaction.	8	(37)

- The questionnaire was translated into Arabic using a double-translation approach.

Pilot study

Before starting the field work a pilot study was done for testing the questionnaire.

Statistical analysis

Analyses were done using the statistical package for social science (SPSS) version 16. And significance was considered at p value <0.05.

Principal component factor analysis with orthogonal rotation (varimax) was conducted which resulted into 12 scales, one factor score resulted for each scale. Reliability was tested using Cranach's alpha.

Characteristics of the participating doctors and nurses were displayed as frequency distribution, besides mean and standard deviation. Median scores and range were computed for every scale and compared between doctors and nurses using Mann-Whitney test.

Multiple linear Regression was performed considering factor score for quality results to be the dependent variable and factor scores of the other scales as independent variables together with; job (doctor or nurse), gender (male or female), age (quantitative), experience (quantitative) and years worked in the same hospital(quantitative).

Results

The study comprised healthcare providers who accepted to participate (186 nurses (74.4% of nurses) and 43 doctors (86% of doctors)); most of the nurses were females (85.5%), half of them were in the age 30-<40 and 25.3% were 40-<50 years old. They were professional nurses in 57.6%, Bachelor of Science of Nursing in 60% and technical nurses in 7 %. On the average, they had an experience of 11 ± 7 years and worked in the hospital for 4.1 ± 2.3 years. Only 27.2% had training courses on quality of care. As regards doctors, 65% were males, 62.8% aged 40-<50 and 27.9% aged 50-60 years. All of them had doctorate degree. They had an average experience of 19 ± 7 years and worked in the hospital for 6.5 ± 0.9 years. (Table2)

Table 3 displays the number of component of each subscale resulting from factor analysis and their Cronbach's alpha coefficient which indicated good reliability.

Table 4 reveals that the average perceived score for improvement of Quality Results in the hospital ranged from 2.8-5 with a median score of 4; this did not differ between doctors and nurses. The perceived benefits of accreditation score ranged from 3.6-5 with an average on 4.9, this was slightly higher for doctors than nurses. The perceived Support as an outcome of accreditation score ranged from 2-5 with an average of 4.7, this was slightly higher for doctors than nurses. Improvement in Leadership score ranged 2-5 with an average of 4; this was also slightly higher for doctors than nurses. Improvement in the use of data, education and training and commitment were more perceived by nurses than by doctors, but in general the average perceived score was 4 for each component. The least perceived improvement due to accreditation was for

the difficulties met at work with an average score of 3, and this did not differ between doctors and nurses.

Table 5 represents the regression model; the dependant variable was quality results and factor scores as independent variables together with job, gender, age, experience and years worked in the same hospital. Perceived benefit of accreditation was the only significant factor associated with quality scores together with the years of experience in working at the hospital.

Discussion

General accreditation programs of healthcare organizations including subspecialties should be emphasized to improve the health services quality. One of the most important barriers for the implementation of accreditation programs is the skeptical attitude of healthcare professionals towards accreditation.⁽¹⁴⁻¹⁵⁾ Therefore, there is a great need to increase healthcare professionals' awareness regarding the potential benefits of accreditation on healthcare quality.⁽¹⁶⁾ Success is not measured by the number of institutions program acridities', but by the impact program makes in stimulating improvements in care for patients and communities.⁽¹⁷⁾

The current study reveals that, most of doctors and nurses have positive perceptions regarding the different contributing factors to quality results with their perceptions towards hospital's accreditation are close to each other. This finding is similar to that was reported in a Jordanian study but with statistically significant differences between the level of doctors' and nurses' perceptions regarding most of contributing factors to quality results.⁽¹⁸⁾ Positive perceptions of doctors and nurses regarding most of contributing factors to quality results in the current study are due to the fact that, the private hospitals in Egypt seek for accreditation certificate from an international agency in addition to the high level of competition between the private hospitals, that situation makes the hospitals train their staff to improve their perceptions, knowledge, abilities and skills regarding accreditation.

The results of the present study demonstrated that, both nurses and doctors achieved the highest score for the variable "benefits of accreditation" (Median =4.9 and Median=5.0). Moreover, the present study demonstrated an average perceived score for improvement of quality results in the hospital ranged from 2.8-5 with a median score of 4 and this did not vary between doctors and nurses. This finding complies with that of a study conducted among the Lebanese nurses (Mean 4.09, SD 0.72).⁽⁹⁾ The high score for the variable 'Quality Results' indicates that nurses and doctors perceived an improvement in quality during and after the accreditation process

There is a universal agreement that accreditation is considered as a highly important method to improve the quality of the health care's structures together with periodical evaluation of the institutional resources to ensure services quality according to pre-designed standards.⁽¹⁸⁾ In a cross-sectional survey (n=145) conducted in the Philippines, the quality of clinical care was significantly higher among physicians in accredited facilities compared to those in non-accredited facilities.⁽¹⁹⁾ However, in a large data analysis of 216 state psychiatric hospitals, there was a weak relationship between accreditation and indicators of quality of care.⁽²⁰⁾ Also, a substantial number of the plans with low quality were accredited. These findings suggested that accreditation does not ensure high-quality.⁽²¹⁾

The current study presented a regression model where quality results was the dependent variable regressed against factors' scores together with job, gender, age, experience and years worked in the same hospital. Perceived benefit of accreditation was the only significant factor associated with quality 6 scores together with the years of experience in working at the hospital. The model had an R^2 of 0.173 and revealed that, the predictors of better quality results were benefits of accreditation and years of experience in hospital. The highest association between benefits of accreditation ($p=.000$) and quality results is consistent with what was mentioned previously where both doctors and nurses perceived improved quality as a result of accreditation. However, the finding of the study conducted among Lebanese nurses showed that the predictors of better quality result were leadership, commitment and support, use of data, quality management, staff involvement and hospital size. (9) Although “the use of data” variable was not considered as a predictor of quality results in the study hospital ($P=.187$), doctors and nurses have positive perceptions concerning the data use (median= 4.0 and median= 4.3 respectively. This demonstrated the important role of using data in implementing quality improvement activities. In spite of lacking literature that document the relation between the use of data and accreditation, it is important to identify the role of using data in the accreditation process in tracking the improvement activities, measuring performance and also providing evidence for compliance with accreditation standards. (9)

Although “the use of data” variable was not found to be a predictor of quality results in the study hospital ($P=.187$), doctors and nurses have positive perceptions regarding the use of data (median= 4.0 and median= 4.3 respectively. This demonstrated the importance of using data in driving quality improvement activities. While no literature was found to document the association between the use of data and accreditation, it is important to note that the use of data in the accreditation process can help hospitals track improvement activities, measure performance and provide evidence for compliance to accreditation standards. (9)

Although “staff learning and involvement” variable was not stated to be a predictor of quality results in the study hospital ($P=.702$), doctors and nurses have positive perceptions regarding the factor of staff learning and involvement with equal median score of 4.0. Since organizations require high short-term investment to reach accreditation with long-term benefits that are not always guaranteed, staff involvement at all stages of accreditation process can be beneficial for achieving the ultimate goals of the organization. Therefore, administration has an important role in providing management and support for staff participation in the accreditation process. (22-23)

There is an increasing demand for healthcare quality, and for mechanisms such as accreditation to promote and maintain it. Moreover governments, inter-governmental and funding agencies provide a great support for such mechanisms for many reasons including supporting health reform, management of services and promoting continuous quality improvement. (1)

We acknowledge that there are limitations to the current study. The first limitation for the Present study was that our findings are based on the perception of nurses and doctors without analysis of patient outcome data. The second limitation is that although outcome indicators are good indicators for quality improvement, it was very

difficult to measure such indicators in the private hospital in which we conducted our study.

Training is very important to improve doctors' and nurses' awareness towards the important effect of accreditation on the health services. Motivating healthcare providers to implement accreditation standards because of the valuable role they have in enhancing service quality is also important. Further studies to assess quality using patient outcome indicators to make accreditation an effective regulatory instrument are recommended.

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Tables

Table (2): characteristics of doctors and nurses

	Job				Total	
	Nurses (n = 186)		Doctor (n = 43)		No.	%
	No.	%	No.	%	No.	%
Age (Years)						
20-	27	14.5	-	-	27	11.8
30-	94	50.5	4	9.3	98	42.8
40-	47	25.3	27	62.8	74	32.3
50-60	18	9.7	12	27.9	30	13.1
Gender						
male	27	14.5	28	65.1	55	24.0
female	159	85.5	15	34.9	174	76.0
Educational level						
Diploma of Secondary Technical Nursing School	60	32.3	-	-	60	26.2
Diploma of Technical Health Institute	12	6.5	-	-	12	5.2
Bachelor of Science of Nursing	112	60.2	-	-	112	48.9
Diploma	1	0.5	-	-	1	0.4
Master	1	0.5	-	-	1	0.4
Doctorate	-	-	43	100.0	43	18.8
Occupational categories						
Nurse	66	35.5	-	-		
Technical Nurse.	13	7.0	-	-		
Professional Nurse	107	57.6	-	-		
Experience (years)						
<5	25	13.4	1	2.3	26	11.4
5-	82	44.1	5	11.6	87	38.0
10-	43	23.1	11	25.6	54	23.6
20+	36	19.4	26	60.5	62	27.1
Experience (years) Mean ± SD	11 ± 7		19 ± 7		12 ± 8	
Experience in the hospital (years)						
<1	32	17.2	0	.0	32	14.0
1-	104	55.9	3	7.0	107	46.7
5+	50	26.9	40	93.0	90	39.3
Mean ± SD	4.1 ± 2.3		6.5 ± 0.9		4.50 ± 2.3	
Training courses on quality of care						
No	134	72.8	-	-	134	72.8
yes	50	27.2	-	-	50	27.2

Table (3): Cronbach's alpha for components of each subscale resulting from factor analysis

Scale/ Number of items	Items subjected to the interviewee's scoring	Cronbach's Alpha
Quality results. /5	(i) Over the past 4 years, the hospital has shown steady, measurable improvements in the quality of customer satisfaction. (ii) Over the past few years, the hospital has shown steady, measurable improvements in the quality of services provided by the administration (finance, human resources, etc.) (iii) Over the past few years, the hospital has shown steady, measurable improvements in the quality of care provided to patients (e.g. medical, surgical, obstetric and paediatric patients). (iv) Over the past few years, the hospital has shown steady, measurable improvements in the quality of services provided by clinical support departments such as laboratory, pharmacy, and radiology. (v) Over the past few years, the hospital has maintained a high quality health services despite financial constraints.	0.844
Benefits of accreditation/8	Enabling: (i) improvement of patient care. (ii) motivation of staff and encourages team work and collaboration. (iii) development of values shared by all professionals at the hospital. (iv) hospital to better use its internal resources (e.g. finances, people, time, and equipment). (v) hospital to better respond to the populations needs. (vi) hospital to better respond to its partners (other hospitals, diverse hospitals, private clinics, etc.) (vii) Accreditation contributes to the development of collaboration with partners in the health care system. (viii) Accreditation is a valuable tool for the hospital to implement changes.	0.946
Use of data/7	(i) The hospital does a good job of assessing current patient needs and expectations. (ii) The hospital does a good job of assessing future patient needs and expectations. (iii) Nurses promptly resolve patient complaints. (iv) Patients' complaints are studied to identify patterns and learn from them to prevent the same problems from recurring. (v) The hospital uses data from patients to improve services. (vi) Data on patient satisfaction are widely communicated to hospital staff. (vii) The hospital uses data on patient expectations and/or satisfaction when designing new services	0.886
Work environment and income/5	(i) The availability of supplies, tools and equipment (ii) Satisfaction with the work load (iii) Relationship with colleagues (iv) Relationship with managers and directors (v) Income from work at the hospital	0.763
Support/3	(i) Senior hospital executives provide highly visible leadership in maintaining an environment that supports quality improvement. (ii) The top management is a primary driving force behind quality improvement efforts. (iii) Senior hospital executives allocate available hospital resources (e.g. finances, people, time, and equipment) to improving quality.	0.788
Education and training/3	Nurses are given (i) education and training in how to identify and act on quality improvement opportunities based on recommendations from accreditation surveys (ii) continuous education and training in methods that support quality improvement. (iii) the needed education and training (through nursing education programs) to improve job skills and performance.	0.829
Strategic quality planning/2	(i) The hospital's quality improvement goals are known throughout your unit (ii) Middle managers (e.g. Nurse heads, Director of Nursing or Clinical specialist) play a key role in setting priorities for quality improvement.	0.627
Commitment/3	Senior hospital executives (i) consistently participate in activities to improve the quality of care and services. (ii) have articulated a clear vision for improving the quality of care and services. (iii) demonstrated an ability to manage the changes (e.g. organizational, technological) needed to improve the quality of care and services.	0.780
Staff learning and involvement/3	(i) You learned of the recommendations made to your hospital since the last survey (if it's the case). (ii) These recommendations were an opportunity to implement important changes at the hospital. (iii) You participated in the changes that resulted from accreditation recommendations.	0.695
Keeping records of quality problems/1	The hospital encourages nurses to keep records of quality problems through documentation.	
Leadership/1	Based on the accreditation results, senior hospital executives have a thorough understanding of how to improve the quality of care and services.	
Difficulties met at work/1	Your satisfaction about handling difficulties met at work	

Table (4): scores of different contributing factors to quality results

	Job									Mann-Whitney Z , p	
	Nurse			Doctor			Total				
	Median	Min	Max	Median	Min	Max	Median	Min	Max		
Benefits of accreditation*	4.9	3.8	5.0	5.0	3.6	5.0	4.9	3.6	5.0	-2.811	0.005
Use of data*	4.3	3.3	5.0	4.0	3.3	5.0	4.0	3.3	5.0	-4.429	0.000
Work environment and income	3.8	3.0	4.0	3.8	3.0	4.0	3.8	3.0	4.0	-0.568	0.570
Support* ^a	4.7	3.0	5.0	4.7	2.0	5.0	4.7	2.0	5.0	-2.465	0.014
Education and training*	4.0	1.0	5.0	3.3	2.0	4.7	4.0	1.0	5.0	-6.667	0.0001
Strategic quality planning* ^b	4.0	2.5	5.0	4.0	2.5	5.0	4.0	2.5	5.0	-3.042	0.002
Commitment*	4.3	2.3	5.0	3.7	2.0	5.0	4.0	2.0	5.0	-4.828	0.0001
Staff learning and involvement	4.0	2.0	5.0	4.0	2.7	4.3	4.0	2.0	5.0	-1.119	0.263
Leadership* ^a	4.0	2.0	5.0	4.0	3.0	5.0	4.0	2.0	5.0	-4.172	0.0001
Keeping records of quality problems* ^b	4.0	2.0	5.0	4.0	3.0	5.0	4.0	2.0	5.0	-2.216	0.027
Difficulties met at work	3.0	1.0	4.0	3.0	3.0	4.0	3.0	1.0	4.0	-0.297	0.766
Quality results	4.0	2.8	5.0	4.0	2.8	5.0	4.0	2.8	5.0	-0.726	0.468

(a) median ranks was higher in doctors (b) median ranks was higher in nurses

Table (5): Multiple linear Regression for factors associated with quality results

Factors associated with “quality results”	Unstandardized Coefficients		Standardized Coefficients		p	95% CI for B	
	B	SE	Beta	t		Lower	Upper
(Constant)	4.347	0.252		17.262	0.0001	3.850	4.843
Job	-0.090	0.141	-0.067	-0.637	0.525	-0.368	0.188
Gender	-0.106	0.093	-0.086	-10.140	0.256	-0.288	0.077
Age (in years)							
20- [®]							
30-<40	-0.189	0.130	-0.179	-10.449	0.149	-0.446	0.068
40-<50	-0.094	0.157	-0.084	-0.601	0.548	-0.404	0.215
50-60	-0.115	0.196	-0.074	-0.588	0.557	-0.500	0.271
Experience (in years)	0.001	0.007	0.008	0.074	0.941	-0.013	0.014
Experience in hospital (in years)	0.045	0.019	0.202	20.310	0.022	0.007	0.083
Factor score :							
Benefits of accreditation	0.133	0.036	0.254	30.749	0.0001	0.063	0.204
Use of data	0.049	0.037	0.094	10.324	0.187	-0.024	0.123
Work environment and income	0.041	0.038	0.077	10.080	0.281	-0.033	0.115
Support	0.032	0.034	0.061	0.940	0.348	-0.035	0.100
Education and training	0.070	0.038	0.133	10.814	0.071	-0.006	0.145
Strategic quality planning	0.066	0.034	0.127	10.969	0.050	0.000	0.133
Commitment	0.018	0.036	0.034	0.493	0.623	-0.054	0.089
Staff learning and involvement	0.013	0.034	0.025	0.383	0.702	-0.054	0.081
Keeping records of quality problems	0.034	0.033	0.065	10.025	0.307	-0.032	0.100
Leadership	0.012	0.036	0.023	0.341	0.733	-0.058	0.083
Difficulties met at work	0.022	0.033	0.042	0.654	0.514	-0.044	0.088

F of the model = 2.426, P= 0.001, R²= 0.173

Anti-oxidant Effects of Black Tea Extracts in Pork Sausages

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Abstract:

Lipid oxidation in meat products can adversely effect on the health and well-being. Various synthetic antioxidants are used to retard lipid oxidation. However, some concerns about the associated risk of cancer with synthetic antioxidants hasten the research on new plant based antioxidants. Tea is considered as an important and cheap source of natural antioxidants and the present study was carried out to evaluate the antioxidant effect of black tea in uncured pork sausages in comparison with green tea extract.

Tea extracts were prepared and total polyphenol content and antioxidant activity were determined before and after extraction. Thearubigin (TR) and Theaflavin content (TF) in black tea were evaluated. Different concentrations (0.05%, 0.1%, 0.2% and 0.3%) of black tea extracts (BTE) and green tea extracts (GTE), 0.1% butylated hydroxyl toluene (BHT) and control without any antioxidant were used in pork meat model system and lipid oxidation was measured using 2-thiobarbituric acid-reactive substances (TBARS).

There were no significant differences in TF% and TR% between initial sample and extracts of black tea. All BTE and GTE concentrations showed significantly lower ($p < 0.05$) TBARS values compared to control. Furthermore, BTE 0.05% was equally effective as 0.1% BHT in reducing TBARS. Whereas other BTE and all GTE had significantly lower TBARS compared to 0.1% BHT. Thus, 0.05 %, 0.3% BTE, 0.05% GTE and control sausages were selected for further analysis of pH, sensory panel scores, instrumental colour, water holding capacity (WHC) and total plate count (TPC).

Sensory panels did not detect any differences in color, odor, texture, juiciness and taste in pork sausages with addition of 0.05% BTE, 0.3% BTE, 0.05% GTE and control. There was no significant effect of concentrations of tea on WHC and TPC. Thus, 0.05% BTE can be incorporated to meat products as natural antioxidants without any adverse effect on sensory attributes.

Key words: Lipid oxidation, Natural antioxidant, Tea, Sausages

Associations between Communicative and Critical Health Literacy and the Health Behavior

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Objectives: There have been few reports of investigations of associations between communicative and critical health literacy (HL) and health behavior. We analyzed associations between the communicative and critical HL and the health behavior.

Methods: We conducted an anonymous questionnaire survey of ordinary residents ranging in age from 30 to 74 years old and analyzed the replies of the 840 subjects who answered all of the items in the questionnaire. We analyzed associations with high and low communicative HL and critical HL, lifestyle habits, subjective sense of well-being, financial status, and attributes by the χ^2 test. We also performed a rank correlation analysis of the relations between communicative HL and critical HL and social support scores.

Results: The women had higher communicative HL than the men. The items that were significantly associated with both communicative HL and critical HL were: regular exercise, smoking, frequency of going out, subjective sense of well-being, and financial status. The results of the rank correlation analysis showed weak correlations between social support scores and both communicative HL and critical HL.

Discussion: Correlations between both communicative HL and critical HL and health behavior were revealed.

Biography

Keiko Suzuki, Ph.D., R.N is a professor in the School of Health Sciences of Akita University in Akita, Japan.

Awareness and Perception of Health Care Providers of Pharmacovigilance at Khartoum Locality Public Hospitals (2013-2014)

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Abstract

Aim to search and gather information's regarding awareness and perception of healthcare providers towards Pharmacovigilance activities perceptibly ADRs reporting at Khartoum locality public hospitals (2013 - 2014).

Materials and Methods: A cross-sectional study was done by a self-administered structured questionnaire. The questionnaire was distributed to 189 healthcare providers working at eight hospitals of Khartoum locality.

Results: The overall response rate was 94.0% among healthcare providers at Khartoum locality public hospitals. Out of all respondents, 114 (60.3%) had poor knowledge, 67 (35.4%) had fair knowledge and 8 (4.2%) had good knowledge about pharmacovigilance. About 34 (18%) of healthcare providers were aware of the ADRs reporting program in Sudan. The majority 139 (73%) considered the reporting of ADRs is an obligation part of their professional responsibility and 119 (63%) aware about which adverse reactions should be reported. Almost all the respondents 179 (94%) do think that pharmacovigilance aspects need to be educated. And 121 (64%) agreed on establishing ADRs monitoring center in each hospital. The study also showed many factors that affecting ADRs reporting such as 33 (17.5%) said that there is no factor that prevents them from reporting. And the rest said which factors influenced them; in 8 (4.2%) of health care providers it was uncertainty of the ADRs. 50 (26.5%) report may be wrong. 6 (3.2%) unawareness of the reporting procedure. 11 (5.8%) lack of time to fill-in a report and 33 (17.5%) combined of seven factors together. There was no statistically significance between knowledge and demographic data as well as Training (P-value > 0.05). Reading article on ADRs reporting shows statistically significant versus knowledge (P-value < 0.05).

Conclusion: Most of respondents have poor knowledge towards pharmacovigilance and ADRs reporting. Strengthen local pharmacovigilance program in addition to raising awareness among healthcare providers, education and training would likely improve ADRs reporting.

Keywords: pharmacovigilance, adverse drug reactions reporting, awareness, perception

Effect of chronic training on cardiovascular risk factor in obese men

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Abstract

Obese individuals are more susceptible to develop cardiovascular diseases resulting from the excessive amount of adipose tissue. This study was aimed to determine effects of exercise training on some cardiovascular risk factors in obese or overweight men. For this purpose, twenty healthy adult obese or overweight men matched for age 35.1 ± 2.8 years and BMI 32.5 ± 1.11 kg/m² was selected to participate in this study by accessible sampling. Then they selected to exercise (Aerobic training, 3 months/3 times weekly) and control group. Blood samples were collected prior and at the end of exercise program in order to measurement C-reactive protein (CRP), Total cholesterol (TC) and low density lipoprotein (LDL) in two groups. Anthropometrical indexes were also measured before and after exercise program. No significant differences were found in all cardiovascular risk factors by exercise program with compared to baseline ($p \geq 0.05$). These findings suggest that exercise training does not independently affect the fasting serum CRP and lipid profile markers in healthy obese or overweight men. Further studies are necessary to elucidate the inflammatory property of exercise training in obese men.

Keywords: Cardiovascular risk factor, Aerobic exercise, Lipid profile

Introduction

The problem of obesity and its related chronic diseases has been recognized as a health problem and recently referred to as a major public health problem. It underlies many diseases related to being overweight that have a major role in mortality; such diseases as heart disease, diabetes and respiratory diseases, atherosclerosis, asthma, immune system problems, and some types of cancer or infectious diseases (Klötting et al., 2010).

Research evidence supports a close relationship between inflammatory cytokines and visceral adipose tissue and insulin resistance in obese individuals as well as in other chronic diseases (Bouletl, 2008; Alexandraki et al., 2006). Pro-inflammatory cytokines such as tumor necrosis alpha (TNF- α), C-reactive protein (CRP) and interleukin-6 (IL-6) identified as mediators of insulin resistance in obese patients (Stefanyk et al., 2010).

C-reactive protein is a key inflammatory factor produced by the liver in response to acute infection or inflammation and its plasma concentration can be increased up to 1000 times in response to injury or infection (Schultz et al., 1990). CRP is synthesized predominantly by hepatic ducts and is regulated by some other cytokine such as IL-6. CRP is determined to be a better indicator of other cytokines in predicting cardiovascular diseases (Nicklas et al., 2005). Most studies consider measurement of CRP the only factor of identifying inflammation although measuring other inflammatory markers, along with CRP provides better information about the mechanisms involved in inflammation (Julia et al., 2010). Reduced CRP occurs subsequent to body weight loss which is associated with increased blood levels of adiponectin (Ouchi et al., 2003).

Increase in plasma CRP is associated with coronary artery disease, obesity, diabetes, smoking and sedentary lifestyles (Bruun et al., 2003). In a study on a large population of Greek men and women, it was found that CRP along with age, hypertension and diabetes, is the most important factor for CVD in this population (Panagiotakos et al., 2008). In untrained subjects, baseline levels of CRP increase through such mechanisms as increased oxidative stress or reduced insulin sensitivity (Pedersen, 2006). There are conflicting studies regarding the effects of exercise on CRP levels as studies on the elderly or people with cardiovascular disease, report interventional role of sport as an anti-inflammatory agent (Julia et al., 2010). Also some others report a significant reduction in its levels following long-term training programs (Campbell et al., 2008). However some studies report no change in its levels after long-term training programs (Kim et al., 2008). Also in another study on obese men in spite of significant reduction in IL-6 no change was observed in serum CRP following 12 weeks of aerobic exercise (Dekker et al., 2007). Due to the lack of a general consensus on the response of this inflammatory cytokine to exercise, in this study, too, the effect of long-term exercise training on its levels in obese men is explored.

Method and Subjects

Twenty adult healthy sedentary (35.1 ± 2.8 years mean \pm standard error of mean (SEM)) obese or overweight (BMI= 32.5 ± 1.11 kg/m², height= 177.5 ± 4.55) men participated in the study. All subjects were randomly assigned to one of two exercise or control groups. The Study Protocol was approved by the Ethics Committee of Islamic Azad University, Iran. The purpose of this study was to investigate the potential roles of exercise training for long time on some cardiovascular risk factors such CRP or lipid profile markers in above mentioned subjects. For this purpose, anthropometrical characteristics and fasting Blood samples were collected prior and at the end of an aerobic exercise program in order to measurement C-reactive protein (CRP), Total cholesterol (TC) and low density lipoprotein (LDL) in two groups.

Participants were non-athletes, non-smokers and non-alcoholics. Participants were included if they had not been involved in regular physical activity/diet in the previous 6 months. Study subjects had a BMI between 26 – 36 kg/m². Subjects were excluded if they had a known history of stroke or transient ischemic attack, cardiovascular disease, uncontrolled hypertension, liver disease, diabetes or asthma, or any other serious chronic disease requiring active treatment. An informed consent was obtained from all participants before the studies were carried out.

The weight and height of the participants were measured by the same person when the participant had thin clothes on and was wearing no shoes. Abdominal circumference and hip circumference were measured in the most condensed part using a non-elastic cloth meter. Abdominal-to-hip ratio was calculated as abdominal circumference divided by hip circumference as measured to the nearest 0.5 cm with a standard measuring tape. BMI was calculated as weight (kilograms) divided by height squared (square meters).

All subjects were randomly assigned to one of two exercise or control groups. Subject in exercise group were completed an aerobic exercise program lasted three months and control subject did not participate in exercise program in this period. The exercise program involved 1 h of exercise training, three times per week for 12 weeks. Each exercise session was supervised by an exercise physiologist or one of the study physicians. In each session, subjects completed a 5-10 min warm-up, followed by 60 min of aerobic exercise at 60-80% VO₂max (with continuous heart rate monitoring) and a 5-min cool down. Aerobic exercise involved Running on a flat surface with no slope or treadmill. Adherence to the exercise prescription was documented through the use of Polar heart rate monitors, and subjects received feedback if training intensities were either too high or low in comparison with desirable intensities. Attendance was taken at each exercise session to monitor compliance with the program.

Blood sampling and anthropometrical measurements were performed before and after exercise program 48 hours after lasted session). After sampling in ETDA- or serum-tubes, blood was

immediately chilled on ice, centrifuged and aliquots were frozen at -80°C until assayed. Serum CRP was determined by ELISA method. Biochemical indicators of total cholesterol and low-density lipoprotein were measured by enzymatic method by Kobas Auto-analyzer (German). Statistical analysis was performed with the SPSS software version 16.0. Normal distribution of data was analyzed by the Kolmogorov-Smirnov normality test. Pre- and post exercise program variables were compared between conditions using a paired-samples t-test. All statistical tests were performed and considered significant at a $P \leq 0.05$.

Results

Pre and post exercise training anthropometrical and Clinical characteristics are shown in table 1. The data were reported as mean \pm SD. Data of independent analysis showed no differences in anthropometrical parameters between two groups ($p \geq 0.05$). We also did not observe difference in serum CRP between exercise and control groups at baseline ($p \geq 0.05$). In addition, significant differences were not found in total cholesterol and low density lipoprotein in two groups at baseline ($p \geq 0.05$).

Serum CRP concentrations did not change with long-term exercise training in exercise group ($p = 0.908$, Fig 1). No significant differences were found in Lipid profile markers; total cholesterol ($p = 0.451$) and low density lipoprotein ($p = 0.121$, Fig 2) between pre and post training in exercise group. Anthropometrical and clinical markers also remained without change in control group between pre and post test ($p \geq 0.05$).

Table 1: Pre and post exercise training anthropometrical and Clinical characteristics in studied groups.

parameters	Exercise subjects		Control subjects	
	Pretest	post-test	Pretest	post-test
Weight (kg)	102.5 \pm 4.39	97.6 \pm 4.9	103.4 \pm 3.6	102.9 \pm 2.9
Waist circumference (cm)	108.9 \pm 3.03	103.8 \pm 3.22	107.6 \pm 2.11	108.1 \pm 3.4
Hip circumference (cm)	108.5 \pm 2.82	105.1 \pm 2.97	107.9 \pm 3.4	108.7 \pm 3.3
BMI (kg/m ²)	32.5 \pm 1.11	30.9 \pm 1.23	32.81 \pm 3.3	32.66 \pm 2.9
Body fat (%)	32.05 \pm 1.06	28.2 \pm 0.83	32.42 \pm 1.14	32.3 \pm 2.31
CRP (ng/ml)	1911 \pm 650	1861 \pm 369	1890 \pm 511	1950 \pm 412
Total cholesterol (mg/dl)	181 \pm 9.56	191 \pm 14.4	191 \pm 7.5	186 \pm 6.5
LDL (mg/dl)	105.1 \pm 9.31	122 \pm 11.1	190 \pm 5.6	182 \pm 12.2

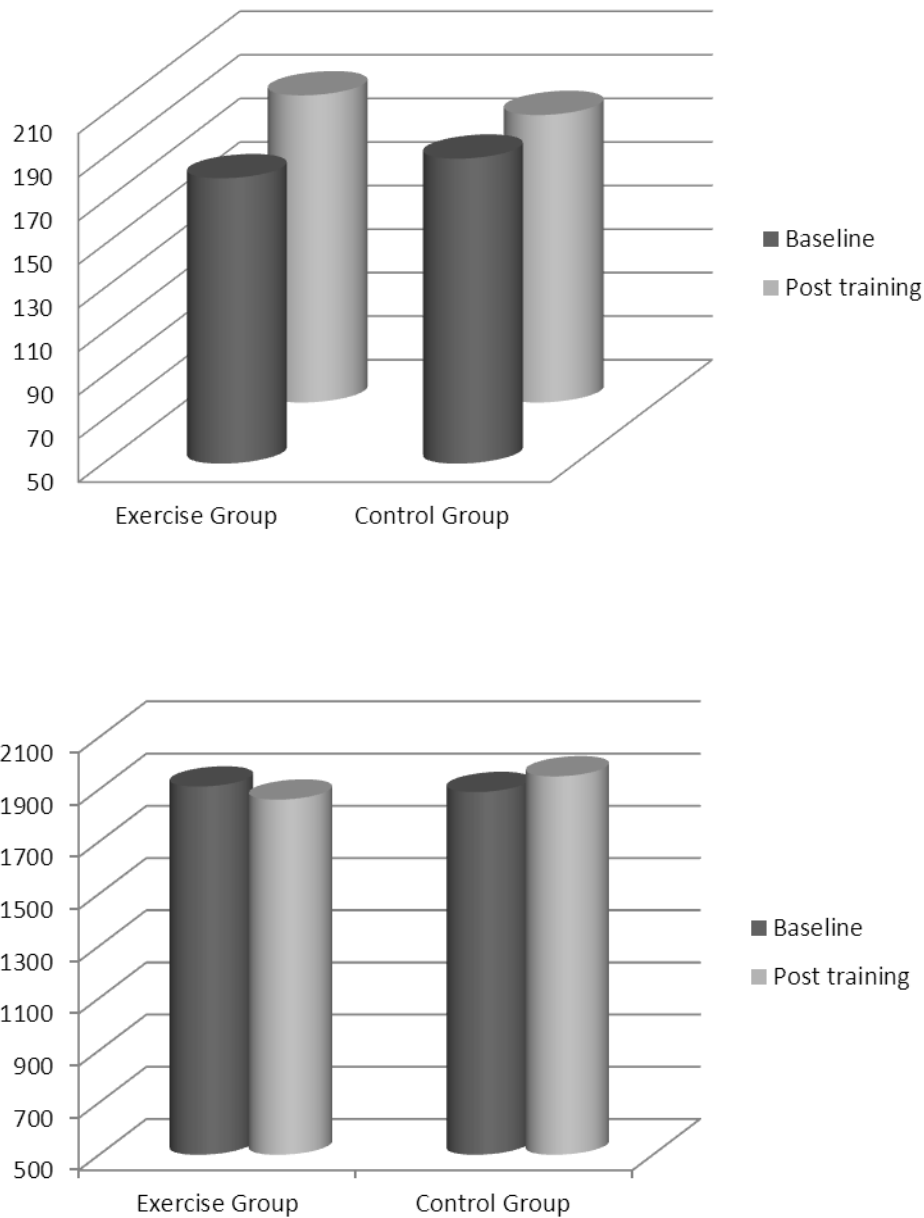


Figure 2: Serum CRP in response to aerobic program in obese subjects.

Discussion

The main finding of this study was no change in serum CRP in response to the three-month training program. In this study, the levels of each risk factor of cardiovascular disease such as triglycerides, low-density lipoprotein and total cholesterol did not change significantly either after three months of training. These risk factors remaining unchanged was observed while the three-month training program was associated with a significant reduction anthropometric parameters such as weight, body fat percentage and body mass.

This phenomenon that CRP is increased several times in response to stress or infection is also noted in previous studies (Schultz et al., 1990). America Heart Association and the Center for Disease Control and Prevention in the United States, introduce CRP as the most important and

most useful clinical marker in the identification of inflammation and assessment of cardiovascular risk factors (Pearson et al., 2003). Increased CRP and its conjuncture with LDL and vLDL inhibit blood coagulation and has anti-clotting properties (De Ferranti et al., 2002).

Although the findings of this study are somewhat unexpected, some other studies even with longer training periods, have also reported no change in CRP or some other cytokines (Hammett et al., 2006; Fischer et al., 2004; Bautmans et al., 2005). Some recent studies, however, have observed no significant difference in serum levels of these cytokines after 12 months compared to baseline levels (Kim et al., 2008). On the other hand, a significant reduction in CRP levels in response to prolonged exercise has been reported in some other studies (Kadoglou et al., 2007). In another study, too, a 6-month exercise program led to a significant reduction CRP (Campbell et al., 2008). CRP remaining unchanged in response to the three-month aerobic exercise program in the subjects is somewhat controversial. However, it is rather difficult to understand the mechanisms responsible for changes or cytokine response to external interventions such as exercise or diet, because some scientific sources consider reduction or change in cytokine in response to a variety of exercise subject to a significant reduction in body weight (Varady et al., 2009; Sheu et al., 2008). These researchers have noted that long term training programs are associated with a decrease of inflammatory cytokines or an increase of anti-inflammatory cytokines the only when the exercise program is associated with a weight loss equivalent to at least 5% of body weight (Varady et al., 2009; Sheu et al., 2008). However, in this study, despite a weight loss equivalent to 6% of body weight, no change was observed in the levels of inflammatory cytokine. Moreover, some studies report a significant reduction in inflammatory cytokines in response to diet or different training programs in the absence of body weight loss (5, 28, 166). Hence, it appears that changes in inflammatory mediators in response to long-term training programs are independent of changes in body weight. It is also possible that training programs lead to significant changes in the cytokine receptors or gene expression, rather than their serum level. Hence, it seems that measuring gene expression or cytokine receptors provide researchers with more important information. Some researchers have noted that the measuring inflammation is not the only determinant of the beneficial effects of exercise (Snehalatha et al., 2008).

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EFFECTIVENESS OF SELF-ESTEEM GROUPS FOR MAINSTREAM TEENAGERS WITH SPECIAL NEEDS

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Introduction: Research has shown that children with special needs have challenges with socialization and self-esteem. In order to support the children's development, National University Hospital System (NUHS) occupational therapists conducted self-esteem groups.

Aim: To investigate the effectiveness of occupational therapy self-esteem group conducted for teenagers.

Methods: A pre-post intervention design was used. Data was collected via a 24-question self-rated 3-scaled questionnaire on self-esteem, adapted from Talkabout Relationships. 2 groups were conducted over a period of 2 weeks. Each group comprised of 7 and 8 children respectively and spans over 5 group sessions and 1 individual review session. Qualitative feedback was gathered through open-ended questionnaires.

Results: 15 children completed all pre and post-intervention measure, 60% shown an improvement in scores, 6.67% displayed no change, 33.33% shown a decrease in self-esteem scores.

Further analysis revealed a negative correlation ($R^2 = 0.414$, $p < 0.05$) between the decreased in post-intervention self-esteem scores with the increase in age of children who are 12 years 6 months and above. Awareness of self-esteem issues for the older children could likely cause them to rate their self-esteem lower after the intervention.

Qualitative feedback gathered from children indicated that they are keen to maintain the friendship. Parents reported an increase in confidence level for the children and suggested future booster sessions.

Conclusion: Findings supported the implementation of the self-esteem group with positive outcomes. Social relationships were developed and maintained with the scaffolding of interaction facilitated during the group. Future research should examine the prospects for generalization and maintenance of the relationships formed during the group.

FIXED DOSE DRUG COMBINATIONS IN INDIA – A TO Z ANALYSIS

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Introduction:

Fixed Dose Drug Combinations (FDCs) are defined by the World Health Organization as a combination of two or more active ingredients in a fixed ratio of doses. To be useful a FDC should be of known efficacy and rationality.

Material & Methods:

This study was carried out to analyse the Fixed Dose drug Combinations (FDCs) in the pharmacological systems of musculoskeletal drugs, antimicrobial agents and vitamins and minerals. All the FDCs available in India were analyzed quantitatively. The FDCs available in the three above mentioned systems were in addition also analyzed qualitatively and for their cost. For quantitative analysis of FDCs; the number of individual drugs, the number of FDCs and the number of drug formulations were assessed. The number of constituents in the FDCs was noted. For the qualitative analysis of FDCs, the amount of constituent in each FDC per unit dose and the presence and absence of banned constituents of FDCs was assessed. The availability of scientific evidence for the FDCs was assessed using accessible electronic and print sources of drug information. The FDCs were analyzed using a rationality score which was based on the WHO criteria of a rational and irrational FDC; a higher score indicated higher rationality and a lower score indicated low rationality. Cost analysis was done for the FDCs; where the cost of each FDC per unit dose was assessed, a cost comparison was done between the cost of the FDC and the cost of individual constituents. Also the variation in the cost of same FDC that was being marketed by different pharmaceutical companies was assessed. A prescription audit was conducted in a public, tertiary care teaching hospital for the prescribing patterns of FDCs.

Results:

In all the pharmacological drug systems, there were more than 1,000 individual drugs. These drugs were present in more than 3,500 Fixed Dose drug Combinations (FDCs). There were more than 37,000 total drug formulations. Vitamins and minerals had the presence of maximum number of FDCs followed by musculoskeletal system and antimicrobial agents.

In musculoskeletal system; there were 64 individual drugs which were available in 421 FDCs. Most of the FDCs had two or three constituents. Scientific evidence was available for only a few (<5%) of these FDCs. The rationality score of most of these FDCs was in the intermediate range. Majority of the FDCs were cheaper in cost as compared to their individual constituents. In the system of antimicrobial agents; there were 151 individual drugs which were available in 380 FDCs. Majority of the FDCs had 2 constituents. Scientific evidence was available only for a few FDCs (3.7%). Most of the FDCs had high rationality scores (7 or 8 out of 10) and cheaper in cost as compared to their individual constituents. In vitamins and minerals, there were 27 individual drugs and the number of FDCs was more than 25 times the number of individual drugs. Majority of the FDCs had more than five constituents. Almost thirty percent FDCs had presence of banned constituents and scientific evidence was present only for less than one percent FDCs in this class. The rationality score was low (1 or 2) for most of the FDCs. The cost comparison between a FDC and its individual constituents was possible only for a very few FDCs (less than 3 percent).

In the prescription audit; a total of 3,548 prescriptions were analyzed. These prescriptions contained 12,417 drugs. The audit showed that approximately 7.5% of the prescribed drugs contained FDCs. Most of the prescribed FDCs were not included in the WHO Essential Medicine List (81%) and the National Essential Medicine List (82%). FDCs from vitamins and minerals constituted more than 60% of the prescribed FDCs followed by the antimicrobial agents and gastrointestinal system drugs. There was a repetition of certain brands of FDCs in the analyzed prescriptions.

Conclusion:

This study shows that the number of FDCs available in the Indian market is very high. Scientific evidence for most of these FDCs is lacking and a significant fraction of these FDCs are either banned or contain banned constituents. The rationality score for the existing FDCs ranges from low to high. However the FDCs offer a pharmacoeconomic advantage to the patients.

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GENTRAS (Gerakan Anti Diskriminasi Kusta dan Pembekalan Kreativitas)

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ABSTRACT

Leprosy is a chronic infectious disease caused by *Mycobacterium leprae*. According to official reports received from 115 countries, the number of new cases reported globally in 2012 was 232.857 compared to 226 626 in 2011. Pockets of high endemicity still remain in some areas of many countries but a few are mentioned as reference: Brazil, India and Indonesia. No disease has been more closely associated with stigma than leprosy. Persons affected by leprosy were forced to leave their home and live in segregated areas and suffer economic and social losses causing physical and emotional distress. So, it is needed to increase the socialization about leprosy to cure the stigma of it. One of the empowerment that we offer is *GENTRAS*, an empowering movement to foster self-confidence and increase the social and economic productivity of people affected by leprosy.

Methods used in this paper are primary and secondary data collecting. Another method used in this program refers to the PRECEED as a framework in the development of health education. Expected by this method, the program can be optimized in the application and its output. There are several activities such as providing motivation to people affected by leprosy, training skills on the manufacture of *BONTAR* (study lamp shaped doll made of sawdust), the training of “*Laskar GENTRAS*” as the agent of change that ensures the sustainability of the program, and Healthy way.

GENTRAS program expected to increase people that affected by leprosy with their knowledge about leprosy itself, they can explain to others about leprosy, and improve their own behavior to stay productive, self-sufficient and able to socialize with the community, so that leprosy discrimination can be decreased, particularly in Indonesia.

Keywords : Leprosy, Empowerment, *GENTRAS*

INTRODUCTION

Indicators of well-being of a country can be seen from the level of health of its citizens. Health problems in Indonesia are increasingly complex. All age groups, gender, level of education, and the economy level high and low, they can be attacked by various diseases. Diseases that attack can be divided into infectious and non-infectious diseases. One of the most infectious diseases but not contagious is leprosy. Leprosy is a chronic infectious disease caused by *Mycobacterium leprae* and affects mainly nerves, skin and upper respiratory tract mucosa. People with leprosy are usually accompanied by physical disability. In Indonesia, people infected by leprosy are usually termed *OYPMK* (*Orang Yang Pernah Mengalami Kusta*).

WHO (2011) Indonesia holds the third rank in the world with the largest number of leprosy sufferers after India and Brazil. The area has the most lepers in the north coast of the island Madura and Java¹. According to the Chief Medical Officer of East Java, Dr. Budi Rahayu, MPH, endemic leprosy spreads in Sumenep, Probolinggo, Jember, Pamekasan, Bangkalan, Tuban, Lumajang, Pasuruan, Sampang, and Situbondo³.

Physical disability experienced by lepers indeed looks very terrible, for example finger which are not intact lesion and redness similar to ringworm which is found on the body. The disease affects the productivity of the sufferers, they become less-productive because they are no longer capable in mobilization. In addition to physical health problems experienced in the form of disability due to leprosy, sufferers also carry psychological burden. This Psychological burden is due to a public stigma towards leprosy. People would often relate the disease to a "curse" or the impact of "guna-guna,". Eventually many people finally feel scared at the sight of lepers and fear of contracting the disease⁴.

Tuban is one of the endemic area of leprosy in East Java. Discrimination on *OYPMK* and sufferers of leprosy are found in the Nganget, Tuban. The former lepers opted to stay at UPT Rehabiltasi social (Integreted Service Unit for Social Rehabilitation) under the auspices of the social service of the province of East Java. UPT Rehsos is located in the area of Nganget in the village of Kedung Jambe, Singgahan sub district Tuban. UPT Rehsos provides shelter and the leprosy is getting help in the form of daily needs. Residents of Rehsos UPT are mostly elderlies who were former lepers⁵. Potential resources of the area of Nganget, Tuban majority exists in its natural wealth. One of the potential attractions there are the thermal baths. The natural result of which could be used was labeled an economic support is wood. According to one of the newspaper. Wood produced in this area are among the best wood.

MATERIALS AND METHOD

The method used in this program refers to the Precede-PROCEED framework (Green and Keuter, 1991) as a framework in the development of health education. Precede-PROCEED model provides a comprehensive structure to assess the health and quality of life as well as things that are needed to design, implement, and evaluate health promotion programs and other public health to meet the needs of the community². Precede (predisposing, reinforcing, and enabling constructs in educational diagnosis and evaluation) is planning a series of stages, while PROCEED (policy, regulatory, and organizational constructs in educational and environmental development) is the process of implementation and evaluation of intervention programs. The method is described in detail in the following scheme. If the Precede-PROCEED Model is realized in *GENTRAS* program, it will obtain the following chart :

PRECEDE FRAMEWORK

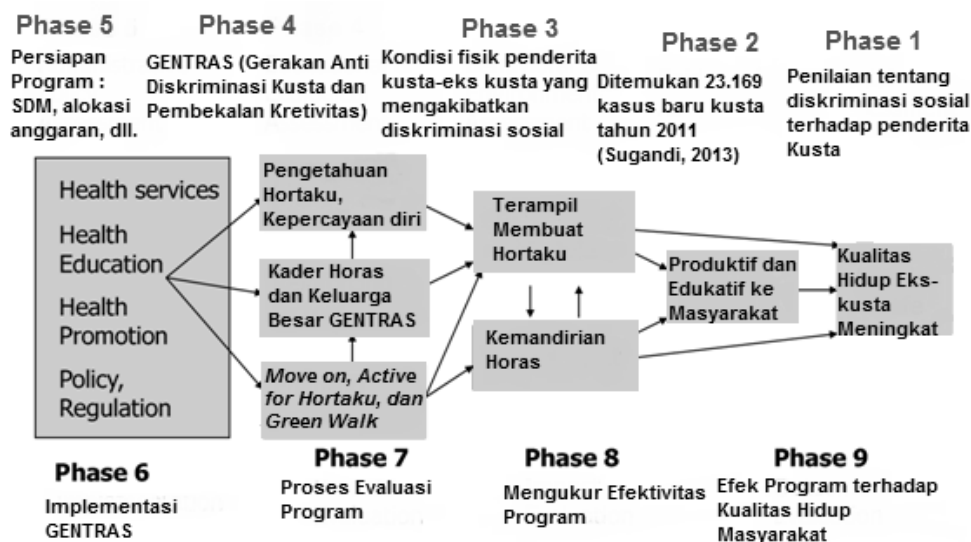


Figure 1. PRECEDE-PROCEED Chart (Green dan Keuter, 1991)

In Fact, the approach which is taken-- include preliminary observations, are conducted to determine the real condition of the location of the partnership, the former leprosy sufferers in the Social Rehabilitation Unit, Nganget, Tuban. The second is, cooperation with relevant party. This is done to support the success of the course of the program. This cooperation covers cooperation with related party. By using this approach, it is expected to be psychic as capable of successful implementation of the program in the community. Third, the implementation of the program. Fourth, assistance in order to ensure the sustainability of the program. Lastly, to do an evaluation. Evaluations are conducted to determine the indicator of successful implementation of the program.

RESULT AND DISCUSSION

Health Promotion and Empowerment

Based on WHO (2007) Health promotion is the process of enabling people to increase control over, and to improve, their health. It moves beyond a focus on individual behaviour towards a wide range of social and environmental interventions. Health Promotion is divided into 3 groups: advocacy, social support and empowerment. Empowerment is the process of increasing the capacity of individuals or groups to make choices and to transform those choices into desired actions and outcomes. Central to this process are actions which both build individual and collective assets, and improve the efficiency and fairness of the organizational and institutional context which govern the use of these assets. Our program, namely *GENTRAS* is an effort in realizing health promotion and community development.

An Overview Of Community Objectives

The selected target communities in the program is former *OYPMKs* in the UPT Rehsos Nganget, Tuban, East Java, Indonesia. UPT Rehsos is an institution under the auspices of the social office of East Java Province⁵. UPT Rehsos is located in the area of Nganget in the village of Kedung Jambe Jambe, Singgahan, Tuban. Located 35 km south of the town Tuban and 15 km north of the town Bojonegoro. The number of inhabitants according to the latest data, reached 175

families whom are *OYPMK*. The *OYPMK* lived on the land area of Social Service's 105.695 m² of East Java Province.

Nganget area is a mix of residents means that the villagers are becoming a healthy person (not a former sufferer) that people who are not suffering from leprosy but is married to a *OYPMK*. They occupy about new Nganget area in 1935 as the Dutch colonial government's efforts to handle the *OYPMKs*. Their social mobility is confined to the community or the people who are already known, if not well known outside the community or there is a sense of inferiority and lack of confidence⁶. Moreover, the pattern of their social relationships include adjacency and friendships, the organization only in the religious field. Society in general has a wrong assumption to former leprosy patients as (1) a disease or influence God curse occult powers; (2) is an infectious disease and the patient should be exiled derivative remote place; (3) was horrified and disgusted extreme when in contact with patients.

Social Rehabilitation Unit occupants are mostly former leprosy patients in old age. According to recent data from the website of the Department of Social East Java Province Liponosos mention that this capacity is 90 people with main criteria has been declared cured of leprosy, usually it's recommended source of Glagah Hospital, Mojokerto and come from poor families. So, people who visit the area can increase knowledge about leprosy. Not just look at the negative side of them but trying to build a positive public stigma about them. Therefore this program would bring *OYPMK* in the outside of community.

Implementation Program

The program includes a variety of activities that supports increased productivity of ex-leprosy residents in the area Nganget, Tuban, East Java. In addition, the program series also supports the efforts of the former anti-discrimination movement against leprosy in the community. A series of programs aimed to optimize the ability of ex-leprosy residents who may already be working in order to remain productive, the means for the citizens of the former leprosy in fostering the spirit and confidence, as well as education and socialization of leprosy center in East Java. The program package, involves various parties to participate realize the objectives of the program. The details of this program include:

a. Move On (Motivation for Go On)

One of the early events is the awarding of *GENTRAS* motivation and morale support to the former *OYPMKs* at Nganget, is an efforts to foster a sense of trust to be able to open up to the society. This Program will be packaged in the form of an interactive talk show and SGD (Small Group Discussion) with *OYPMKs*, so authors can find out activity and hear the outpouring of hearts of the former *OYPMKs*. Hopefully the motivation can be uplifting and passion of their lives to remain productive and not only receive assistance from the Government.

b. Active (Action and Productive) For *BONTAR*

This Program is a solution that we provide to the *OYPMK*, the majority of whom are still unemployed (for his wife) by utilizing the existing potential in the area of Nganget. It is well known that the majority of the workers are seekers and makers of wooden handicrafts from the raw materials. But their work was less successful in the market. Some of the factors that may be a constraint are the shape they make, craft, and marketing that have yet to reach out to the wider community. So we packed up the Active (Action and Productive) for *BONTAR* program in the form of-doll-making skills training. The main composition of this doll is the waste sawdust. The expectation after the skills training, the public can continue to develop stronger works he made as well as becoming more innovative. Therefore,

optimizing the use of raw material for handicrafts can provide a more optimal results in the marketing and selling of products is more than the value of handicrafts has ever made before.

c. Launching *BONTAR*

This is an extension of the Active program for *BONTAR*. After skills training to optimize the existing potential. We also make the container or the central marketing of the product *BONTAR* and other crafts that have been made by ex-lepers. Referring to the potential of nature that had also been there are thermal baths (Nganget) Prataan Parengan, Tuban which is famous enough in the city and around the area. So we wanted to set up a home *BONTAR* and Crafts in the area of the thermal baths. In addition, we will also be a partner for them (third party) by aiding them to market their products through online shop which we will manage.

d. Socialization of Health behavior for *OYMPK*

Most of the *OYMPK* who lived in Nganget is the elderly. So it is needed a socialization about the importance of Healthy and clean Life Behavior for the elderly. This is done because the people who live there still have not been able to practice living clean and healthy behavior in everyday life. It is expected their knowledge increased and behaviors that meet health standards could be accomplished.

e. The Formation of Laskar *GENTRAS*

Program formation of *BONTAR* products from *GENTRAS* Irregulars aims to become an ambassador in maintaining production and the sustainability of the program. Laskar *GENTRAS* will become a milestone in educating the public about the problem of leprosy in Nganget, Tuban. Formation of Laskar *GENTRAS* starts from the process of selecting youth aged 15-25 years. The selection was based on their knowledge and practice of conditioning a healthy and clean living that is applied to each individual. The selected individual will then undergo a series of follow-up activities as an attempt of training cadres.

f. Training for Laskar *GENTRAS*

In the training activities, will be given training in public speaking, making *BONTAR*, and an effective product marketing. *Laskar GENTRAS* is expected to ensure the sustainability of the program.

g. Green Walk (Healthy Way)

Healthy way this was done as an attempt to improve the degree of health of *OYMPK* and as a means of mind refreshment. Healthy road began in the morning with a duration of about 2 hours. The healthy carried out around the neighborhood and liponsos followed by *OYMPK* and liponsos as well as of the local community. At the end of the session prizes were given for participants in the healthy road of the former lepers. Prizes awarded when participants can answer the questions correctly.

CONCLUSION

GENTRAS is an activity that is held as a form of our dedication towards *OYMPKs* in the area of Nganget, Tuban living in Social Rehabilitation (Rehsos). Tuban is one of the endemic area of leprosy in East Java. Discrimination on *OYMPKs* and sufferers of leprosy were found in the Nganget, Tuban. The former *OYMPKs* opted to stay in UPT Rehsos under the auspices of the social service of the province of East Java. The number of inhabitants according to the latest data, reaching 175 families whom are *OYMPKs*. The *OYMPKs* lived on the land area of Social Service's 105.695 m² of East Java Province. Some can also live in the land belonging to the Forestry

Department. Nganget Village Community is a healthy person (not sufferers) who are not suffering from leprosy but married to *OYPMKs* and sufferers ex-leprosy himself. Potential of the area of Nganget, Tuban majority exists in its natural wealth. Much of the natural beauty that can be explored one of these hot springs that made one of the tourist places that can be an attraction. In addition, this village is also surrounded by the soothing green trees.

GENTRAS is one of the efforts to harness the natural results. The purpose of *GENTRAS* is to increase the productivity of the former *OYPMKs*, both socially and economically. A series of activities on motivation *OYPMKs*, stuffed *BONTAR* (Horticulture) that will be sold, the selection and training of *BONTAR*, as well as the Green Walk. The methods used in this program refers to the framework – PROCEED as a framework in the development of health education. But in fact, the approach includes preliminary observation, cooperation with relevant parties, implementation of programs, health socialization, mentoring in order to guarantee the sustainability of the program, as well as evaluating the impact. Expected by this method, the program can be optimized in the application and its output.

Therefore, the benefits of the desired activity is to change the negative stigma of society to be more positive against leprosy, *OYPMK* improves productivity through self-reliance and confidence in the economy, as well as fostering confidence in succumbed to the community.

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Healthy Housing as a Manufacturer of Organic Fertilizer Through Excreta Waste Treatment to Reduce River Pollution in Surabaya

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Abstract

Surabaya has a high population because it is the second largest city in Indonesia. Inhabitants of Surabaya by 2014 is approximately 2.820.745, while daily producing waste exskreta is about 83 grams of feces and urine of about 970 grams. This means that every day there will be built a ton of waste, 252.970 exskreta. And it also leads to a 62% water pollution of rivers in Surabaya. Provision of means especially exskreta fecal waste disposal that is applied for is largely using the system on-off site of processing not optimal so that it only produces a substance that is not useful. When it is linked to a housing where human beings live, then there are things to watch out for. Namely, the problem of sewage treatment exskreta of every home. Then it needs a new innovation, eco-friendly housing that has its own feces sewage treatment installations. So, the produced water is clean and for fecal sludge, it can be used for organic fertilizer to improve soil fertility in rural areas. That means, there is a continuity between life in towns and villages with mutualisme symbiosis.

Keywords: off-site, excreta, environment, fertilizer, resident

Introduction

As the second largest city in Indonesia, Surabaya is a destination place for the villagers to move to the city. This leads to an increasing a large numbers of the population in the city. Based on data from the city of Surabaya, in 2012 the population density reaches 8.298,257 people/km² with a total area of Surabaya 33.306 .30 hm². And by 2014, Surabaya's population reached 2.820.745 inhabitants. In fact, everyone is going to produce the waste ekskreta in form of stool approximately 83 grams and urine 970 grams per day. So, if the accumulated acquired approximately 2,960 tonnes per day. While the use of wastewater treatment systems in Surabaya itself on site using the majority system, streamed into the River, or even directly defekasi on the River, thus causing the pollution of the river.

If returned, the condition is evaluated as a dense, causing Surabaya every home built has no lawns or front page. In fact, the majority of homes in the city use on site systems. This system requires the land yard for the placement of septic tanks (Suwondo, 2009), so the condition of the housing is not an ideal system for the city of Surabaya. In fact, in some areas the disposal of domestic waste is directly at the waste into the river. The result is a river as a source of clean water needs of the citizens of surabaya became a medium for the occurrence of digits in pain. In addition, in Surabaya itself there was only one place the ekskreta sewage treatment installations processing waste ekskreta the whole area of Surabaya.

So, it can be seen as a problem, but when viewed in terms of positifnya, human feces contains components that are normally used as the active ingredient in fertilizer. It can be associated with the condition of Indonesia as an agricultural country, the manure is a very important thing. Moreover, it is related to the magnitude of the opportunity in Surabaya as the spread of disease, it is necessary the presence of an innovation in solving as well as having leverage against other issues.

Excreta in Indonesia

In Indonesia, research sewage treatment ekskreta problems are still very little. The study conducted just ended on it's own sewage treatment discussion to get clean water. However, for this waste mud in Indonesia there hasn't been research to exploit it.

However, in some other countries ekskreta sewage treatment has been expanded to be better exploit it as organic fertilizer. In addition, in Indonesia itself is usually only limited to develop into biogas.

New Manner Excreta

The problem must be tackled, Surabaya seriously, then the innovation to be developed should be different from existing ones. Then the innovation is to build housing that uses off site system with organic fertilizer processing home. However, in detail the content of human stool is as follows:

Table 1. The Physical and Chemical Composition of Feces

No	Zat yang dikandung	Prosentase
1.	Air	66 – 88
2.	Bahan padat	87 – 97
3.	Nitrogen	5 – 7
4.	Phospor (sebagai P ₂ O ₅)	3 – 5.4
5.	Potasium (sebagai K ₂ O)	1 – 2.5
6.	Carbon	40 – 55
7.	Calcium	4 – 50
8.	C/N	5 – 10

As for the sewage treatment system of ekskreta consists of two parts, namely:

1. The Collection/Drainage Systems

This section consists of several components:

a. Stem Pipe

The pipe diameter is 350 mm by laying the pipe at a depth of 1.5-2 meters. The pipe is equipped with a manhole that connects between the stem pipes with pipes and collectors have the flatness of 0.45%-0.9%

b. Pipe Collectors

This pipe has a function for collecting waste from every home to the stem pipeline.

c. The Control Bak

Bak serves to control the smooth flow of waste from every home to the stem pipeline. The tub is located in every alley housing.

d. Connection Home

This is a pipe with all the trimmings that are installed in your home or the home page of which is directly linked to the way out of the bathroom or WC.

e. CSD (Combine Sewer Drainage)

CSD is the coupling between channels of sewage water with rainwater. The merger aims to dilute the waste water. CSD is only effective during the rainy season. During the dry season in this system complete with regulators, which serves to divert waste from the drainage channels.

2. Installation of the Processing

a. The Preliminary Processing Stage (Pre Treatment)

This stage is used to filter the floating objects, and objects that have a diameter of which is able to settle by itself. The cleaning is done by manual.

b. The First Processing Stage (Primary Treatment)

At this stage there is a flotation. This serves as a Catcher of fat or oil. This is due to the incoming waste, one of which is sourced from the kitchen. Then the unit will go to waste a primary clarifier is used as a precipitator of solids waste.

c. The Second Processing Stage (Secondary Treatment)

At this stage of processing is performed by means of a biology unit on Rotation Biological Contactor (RBC). On the stage of decomposition occurs RBC conducted by microorganism living in a rotating disk-disk (rotodisk). Microorganism form a biofilm/biomass attached and grow in rotodisk.

Waste water going into the rotozone system with a draw and divided into four zones with the size and number of different disk as follows:

- The inlet into the rotozone position is located diagonally across from the entry of waste into drains, waste processing units with a zig-zag way.
- The waste stream gravitation where zone 4 zone is lower than 3, 2 and 1. Biomass processing waste on the disk will be band on each zone respectively. Biomass in rotodisk will experience the exchange of oxygen in the air at the time on the water. Most biomass growth are on the disc the band zone 1 and the least

is in zone 4. Physical color biomass on zone 1 dark brown colored whereas in zone 4 light brown or yellow coloured.

- Waste water zone 4 is pretty clear with BOD and suspension materials are low. This zone produced water will be put back to the initial deposition of tubs and some will go to a shelter. The purpose of this is to provide a recirculation direct contact with low BOD content but have fairly high oxygen content so that it helps load waste into new unit IPAL.

d. The Final Processing Stage

The final stage of the clarifier acts as a decrease in biomass and suspended solids precipitate that is chipped.

After obtained clean water, sludge processing ekskreta the rest of the results were processed using the composting techniques with soil. It was chosen because it has the shortest time among other techniques. This technique requires time for 3-4 months for all processing. Then the last step after the manure is so is to shape it into a tablet with a diameter of 10 mm. This needs to be done because the use of powdered fertilizers are usually less effective because it is easily flown by wind caused by his childhood. However, for the tablet form has a better effectiveness, because it has a greater period.

These activities are carried out in addition to the benefit for reducing environmental pollution of the River, it will also help other areas to restore the fertility of the soil by using organic fertilizer. Henceforth, this fertilizer will be distributed to rural areas. Thus, cooperation will be established and the continuity of life in the cities and in the villages.

Conclusion

The focus of this Paper is to discuss about building an environmentally friendly residential sewage treatment by having a ekskreta with its own principle of off site system as well as the establishment of organic fertilizer processing has packed in tablet form to enhance the effectiveness of the fertilizer plant. This is done in addition to reducing environmental pollution in Surabaya, also to improve cooperation between the urban areas and acts as a fertilizer producers and rural areas which act as a consumer of fertilizer with soil fertility returns benefit with organic fertilizer.

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Immunization coverage amongst children of Female Sex Workers in Mumbai

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Abstract:

Studies on Female Sex Workers have focused on their reproductive & sexual health. There is a dearth of studies on the health needs of their children. One of the most important ways of avoiding a spectrum of communicable diseases, in childhood is immunization. Thus it is important to study the health needs of these children who are often stigmatized and whose mothers face barriers in accessing health services.

Objectives were, to assess immunization coverage of children, assess disparities & mother's knowledge about immunization.

We conducted a Cross Sectional study. Background characteristics of sex workers were collected, their knowledge level assessed along with their child's immunization status. Consent was taken from the participant before the interview.

A convenience sampling was employed to reach sex workers with the help of the key informants from NGO – Aastha Parivaar. The sample was selected from a huge slum habitation in North Mumbai populated by bar based, call based & home based (or hidden) sex workers.

Results –

The data was collected for 233 children of 120 sex workers. Full immunization was 50.42% (across four birth order), is lower than 84 % for suburban Mumbai. Other findings were decreased immunization with subsequent births & higher immunization for male children. 36% sex workers had no or a vague idea of Immunization, & only 10% who were aware of health benefits of immunization for more than one disease. Chi square test was computed & found significant for comparing mother's characteristics with child's immunization status.

Thus it highlights the need for the health services to strengthen their IEC activities & outreach services to the FSW mothers with the help of NGOs & CBOs in these areas. Thus further studies are required to highlight child health of sex workers.

Introduction

Immunization has been looked upon as the most cost effective way to reduce morbidity and mortality due to vaccine preventable communicable diseases; especially so in resource poor developing countries. The expanded program of immunization was introduced in India in 1978. Initially, it offered Bacillus Calmette Guérin (BCG), Oral Polio Vaccine (OPV) and Diphtheria Pertussis and Tetanus (DPT); however implementation was limited to urban areas. Subsequently, the Universal Immunization Program was extended to the entire country and the Measles, Mumps and Rubella (MMR) vaccine was added. Since then, the program has gone through several changes and was included under the ambit of Reproductive and Child Health (1995) and National Rural Health Mission (2005). The success of Pulse Polio Initiative in India in recent years has been acknowledged by all over the world. Despite this accomplishment, there are vast disparities within the country [Vashishtha, 2009].

In India, children are considered 'fully immunized' after receiving one dose of BCG at birth; 3 doses each of DPT and OPV, each at 6th, 10th and 14th weeks from birth and one MMR vaccine (reference). Receiving any one of the above mentioned doses, but not all, leads to a partially immunized status of the child. A child is considered as non-immunized when s/he has not received even a single dose of the same. Hepatitis B vaccine one at birth and 3 with DPT was added to the basket in 2005 along with the 9 prescribed doses of Vitamin A until the child turns 5 years old.

India claimed that it would achieve Universal Immunization coverage by 2010, but the goal remains far from being accomplished. Nevertheless, there has been a significant change in terms of a drop in non-immunized children from 30% during NFHS-1 in 1992-93 to that of only 5% during NFHS 3 (NFHS 3, 2006). The variations in immunization coverage have been linked to wealth inequalities and urban versus rural residence [Gaudin, Yazbeck 2006]. Despite India aiming to reach full immunization by 2010, the full immunization coverage remains around 63% [NFHS 3, 2006]. Though there is a considerable drop in non-immunized children from 30% during NFHS 1 to 14% in NFHS 2 to mere 5% in NFHS 3, only 44% of children are fully immunized. Thus despite the drop in non immunized children, there are large number of children getting only partial immunization.

Factors impacting immunization

Several determinants have been recognized which have an impact on the child's immunization status, many of these are demographic and socio-economic in nature. Likelihood of full immunization decreases with subsequent children born and is lower for the girl child as compared to the boy child [Patra, 2008]. Studies have shown that urban residence shows positive correlation with full immunization & better access to health care [Sharma, 2007]. Urban residence shows positive correlation with full immunization & better access to health care, but urban poor often have lower access to health care facilities [Banerjee, 2010]. Maternal factors have been seen to have significant effect on the child immunization [Patra, 2008; Banerjee, 2010]. Likelihood of child's immunization increases with mother's age at child's birth, mother's educational level, awareness about immunization [Biswas, 2001] and availing antenatal care during pregnancy [Patra, 2008].

Research on sex work and with Female Sex Workers (FSWs) across the world has focused on their sexual health. Some studies have highlighted their demographic profile and reasons for coming into this profession [Dandona, 2006], while some have focused on their vulnerability

[Pyett & Warr, 1997], violence and abuse they face [Panchanadeswaran, 2010] their rights [Misra, 2000] and also on their empowerment [Nag, 2005]. Most of this literature, however, looks at health issues of sex workers or that of their children from the perspective of HIV/AIDS prevention and/or treatment. It is therefore important to look at health concerns of FSWs and their families from a broader health perspective.

Sparse literature is available on the children of sex workers. Past studies have reported these children as having inadequate access to health care, witnessing violence and exploitation and also being trafficked or being forced to enter illegal professions [Willis, 2013]. They are often stigmatized and discriminated against too, with psychological issues around the societal acceptance of their mother's profession [Beard, 2010].

Thus the purpose of this study was to understand an important aspect of child's health, i.e. immunization, among children of FSWs (a relatively understudied population) in Mumbai and to explore factors related to their immunization.

Research Objectives

The objectives for the study were:-

- To assess immunization coverage amongst children of female sex workers in a slum in Mumbai based on birth order.
- To assess disparities in immunization based on female sex worker's typology of work.
- To assess the female sex workers knowledge about immunization of her children.

Methodology

This is a cross sectional study. The study was conducted in notified slums of North Mumbai. Malvani, as the area is known, has a mixed population of Hindu and Muslims, most of them are migrants from northern and eastern states and some are from Mumbai. The area is a sought after residential area for bar girls and other sex workers.

Aastha Parivaar is a non-government organization that works predominantly for HIV/AIDS prevention and control. Much of the organizations work has focused on interventions for key population for HIV/AIDS, which includes female sex workers, male sex workers, bar dancers and transgendered people. Aastha Parivaar has an intervention running in this area where they regularly conduct Information-Education-Communication (IEC) activities and health camps for the key population. These individuals are also routinely offered HIV testing services along with catering to their overall sexual health. The organization has been working since 10 years in Malvani and thus, has established a good network of peer educators and sex workers in the community.

Sampling -

A non probability convenience sampling strategy was employed to reach out to individual female sex workers with the help of the outreach workers of the Aastha Parivaar. The respondents were FSWs currently having at least one child in the age group of 0-5 years. Only those sex workers were interviewed who were currently engaged in the profession of commercial sex work. Participants who were registered with Aastha Parivaar were the only

ones who were interviewed. Data was collected from 120 mothers. The total N for the study was 233 children as each mother was asked questions about all her children below the age of 12 years. Sex workers who did not meet the inclusion criteria were not approached for the study.

Out of 120 mothers 32 were engaged in bar-based sex work, 55 were engaged in call-based sex work and 33 were engaged in home-based sex work. For the purpose of the study floating and bar based female sex workers are compiled into one category as both require them to leave for work in the evenings and stay out mostly for the entire nights. While brothel based has been compiled with call based, as in Malvani the activity continues on phone due to space constraints for brothels. Out of the data collected for 233 children 96 were first born, 77 were second born, 47 were third born and 13 were fourth born.

Tools

An interview schedule was developed to assess the variables of interest. The sex workers were asked questions about their age, monthly income, partner status, type of family, child care arrangement and type of sex work they engaged in. With regards to the immunization status of the children the women were asked about the immunization cards and if unavailable, were asked to recall the immunization histories for each of their children. The sex workers were asked some general questions to assess their knowledge of immunization.

Operational Definitions

Female sex worker (FSW) – is any woman who engages into sexual activity in exchange of money.

Bar based – is when the woman engages in sex work as a consequence of working at a bar.

Call based – is when the customer directly contacts the sex workers and she obtains clients via telephonic calls.

Home based – is when a particular sex worker is secretly engaged in sex work without revealing this to her family. Sex work may not be a regular activity for her, but based on immediate financial need. These sex workers are harder to distinguish from the general population.

Floating/ Street based – is when the customers are searched for on the streets, mostly late at night.

Brothel based – is when an agent procures female sex workers for the customers and a section of earnings are offered as commission to them. These female sex workers usually share rooms rented out to them by the agent.

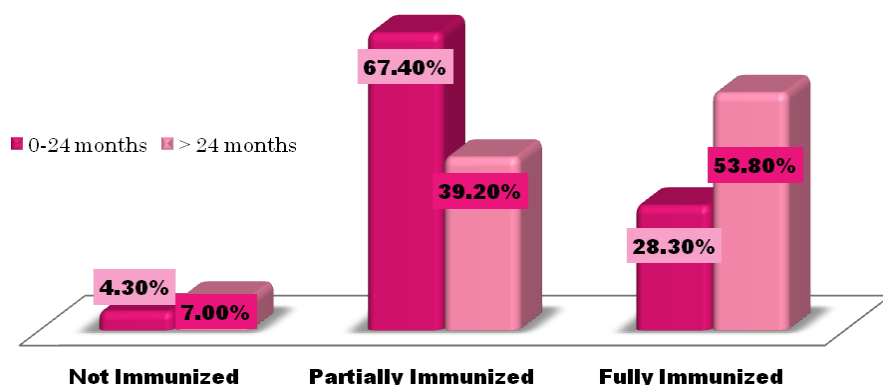
Regular partner – is usually a sexual partner of the female sex workers whom she may attend the most. The relation with the regular partner is often more emotional than merely professional. This may or may not culminate into a marriage but regular partners usually care for the female sex workers children financially.

Full immunization (FI) – Full immunized child is the one who has received one dose each of BCG and MMR along with 3 and 4 doses of DPT and OPV respectively. For infants, full immunization was assumed if they had received the age appropriate vaccines at the time of data collection.

Partial immunization (PI) – is considered if even a single dose is dropped in any of the six vaccinations.

Not Immunized (NI) – are children who have not received even a single dose of immunization since birth.

Fig 2 - Immunization Coverage



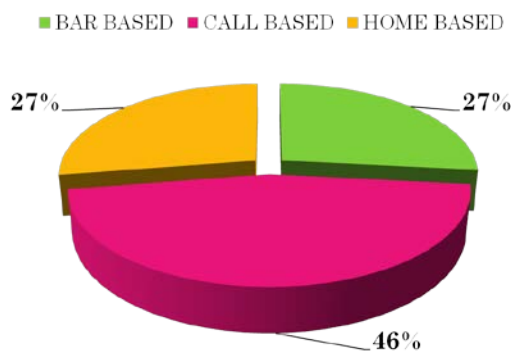
Procedure of Data Collection –

The peer educators and staff at Aastha Parivaar helped in identifying the sex workers who met the inclusion criteria. Participants were initially approached to obtain consent. No identifying information was obtained from the participants. After obtaining consent, the interviews were

conducted at the homes of the respondents. In situations where the family members were unaware of the individual’s engagement in sex work, care was taken to conduct the interviews at the organization and maintain confidentiality regarding their sex work status. The immunization details were collected from the immunization cards of their children or from the verbal recall of the mothers (if cards were not available).

Results

Fig 1 – Mother’s work Typology



Data was collected for 233 children (107 girls and 126 boys) of 120 mothers. Data was collected for children up to 12 years of age.

Mothers Profile –

60% of the respondents were Muslims as against only 36% Hindus the rest were Christian or Buddhist. Most of them were migrants from other states but living in Mumbai for more than 15 years. The family structure was also found to be nuclear in most these families (66.7%) followed by joint family (22.5%) as against extended (9.16%). Only 2 mothers were sharing their

homes with other sex workers (1.16%). The mother’s marital status was also recorded. While most of them were married (65.2%), 21.5% were single mothers and 13.3% were residing with their regular partners. These characteristics were recorded to understand if they had any relation with the immunization status of the child.

Out of 233 children, 50.42% were fully immunized. Only 6.41% of children were not immunized, while 43.16% of children were partially immunized between 0-12 years of age. Full immunization drastically dropped to 28.3% for children of 0-24 months who are largely partially immunized (67.4%). More boys (50.8%) are fully immunized than girls (46.7%) while more girls (48.6%) are partially immunized than boys (41.3%). Among the non immunized children, 4.29% are boys and 2.14% are girls.

The first objective was to look at immunization coverage amongst the children across birth order (first, second, third, fourth). Full immunization dropped from 57.3% amongst the first born to 30.8% amongst the fourth born children.

Fig 3 – Immunization of child & Mother's work Type (in percent)

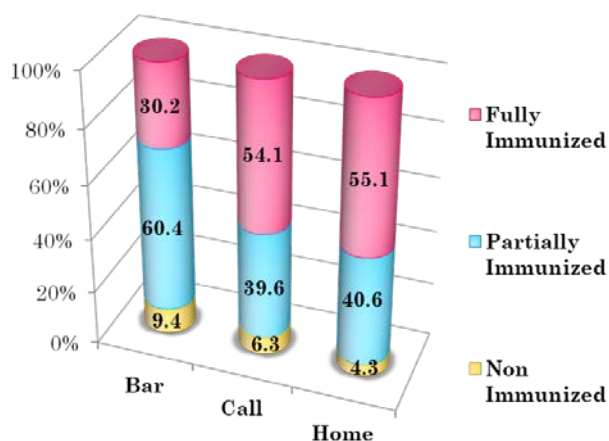


Table 1 – Immunization status across Birth order

Birth Order	Not Immunized		Partially Immunized		Fully Immunized		Total	
		%		%		%		%
1	3	31.1	38	39.6	55	57.3	96	100
2	9	11.7	34	44.2	34	44.2	77	100
3	2	4.3	24	51.1	21	44.7	47	100
4	1	7.7	8	61.5	4	30.8	13	100

The second objective was to look at the disparities in immunization based on mother's typology of sex work. Call based sex work is more prevalent at Malvani, followed by bar based and then home based. There are significant income disparities between these typologies. Almost 17% of bar based sex workers were earning more than Rs. 20000 per month as against 8% of call based and 4% of home based sex workers.

The number of children, who were fully, partially or not immunized, were compared based on the mother's work type. It was found more that children of call-based and home-based sex workers were fully immunized than that of bar based sex workers children. On the other hand, bar-based sex workers had more proportion of children who were partially (60.4%) and not immunized (9.4%) as compared to call-based or home-based sex workers (as shown in fig 3).

The difference between full & partial immunization status of children of bar based, call based and home based sex workers were compared and a Chi Square (χ^2) test was applied. The χ^2 value ($\chi^2 = 0.012$, $p < .05$) was significant suggesting that there is a relationship between typology of sex work and immunization status of the child. Childs immunization status was also compared with if Tetanus Toxoid (TT) was administered to the sex worker for her last pregnancy. The value obtained 22.543 was found to be significant at 0.01 level of significance.

Descriptive analysis of differences in uptake based on the vaccine were also done. The uptake was 91.84% for BCG, but only 63.5% for MMR. Completion of dosage is even lower for hepatitis B vaccine with only 27% completing 4 doses. Around 70% of children were born in government hospitals, as compared to 19% in private hospitals, while 11.1% were born at home. Table 2 shows the number of children in each facility based on their place of delivery.

Table 2 – Immunization coverage as per Place of birth

Place of birth	Non Immunization	Partial Immunization	Full Immunization	Total [N]
Home	34.6%	30.7%	34.6%	26
Gov Hosp	3.7%	41.9%	54.3%	162
Pvt. Hosp	0%	62.2%	37.8%	45

Lastly we were interested to assess the mother's knowledge about immunization. They were asked a single open ended question asking them why immunization was important. The responses were then later categorized based on the understanding of the benefits of immunization. Mothers were also asked about TT vaccination and its benefits for children at the age of 10 years and about the source of their information about immunization. Only 10.8% of mothers were aware about benefits of immunization as 'to protect against more than one disease'. Most commonly they were aware of immunization having some health benefits (30.8%) while others considered it to be important only for preventing polio (22.5%).

More than 50% of full immunization coverage is seen for children when mothers had some clarity of benefits to clarity of benefits for more than one disease, but it dropped to 26.8% for mothers with no idea why children are immunized. Out of 120 mothers, only 46 (38.33%) were aware about the TT vaccination at age 10. Out these 46 mothers who said they were aware, 91% were willing to administer the same to their child when they turn 10 years old. Among the children of mothers who received immunization information from the health provider (N=186), 47.3% were fully immunized and 45.1% were partially immunized. This shows that the health provider is not only the most common source of information for young mothers, but also considerably effective too. NGO/trust or advertisements show only 4.8% of contribution to mother's source of knowledge.

Discussion

Female sex workers are often neglected by society, ostracized or simply not accepted. In such a scenario, along with them their children also carry the burden of this social apathy, which can have serious ramifications for their health as well.

The trend found in this study is similar to national statistics. A drop in immunization based on birth order is one of the most important barriers in accomplishing the goal of full immunization. Though there are very few children who have not been immunized at all, this reduction does not convert into larger numbers of children with full immunization. Thus there are in this study (like national samples), large numbers children who remain partially immunized. Gender differences also show similar trends with girl children being less likely to be fully immunized than boy children [Sahoo, 2012] . In contrast, with this sample, more boys were non-immunized as against the girls; however, these were small numbers.

Apart from low full immunization, the data also shows variation in vaccine uptake for different vaccines. BCG had the highest uptake, which may be due to the fact that it is given

at birth in the place of delivery. Greater numbers of doses for Hepatitis B possibly decreased the full compliance rate for this vaccine.

Maternal characteristics were studied in relation to the immunized status of children. Higher literacy and higher incomes of the mother have been seen as positively related to the immunization (ref). But with female sex workers who are bar-based, may give less time to their children, due to their work schedule as against call-based or home-based sex workers, who may not be required to stay away from their child for long. Also, immunization was found to be higher in children who were looked after by their mothers as against children who looked after by their mother plus a close relative or only a close relative (mostly a grandmother of the child, father or regular partner of the mother). This is consistent with prior studies that have highlighted mother's lack of time and dependence on other sex workers, maiden families or partners to help in child care [Willis, 2013; Pardeshi, 2006].

Mother's knowledge about vaccination is of importance as it can help improve compliance and reduce dropouts in immunization. It is also a better predictor of intention to provide the child with vaccinations, so is the availability of health services in the vicinity [Patra, 2008]. It is also possible that most health education programs target mothers and neglect to provide information to other caregivers, which may explain poorer uptake for those children not taken care of by their mothers. Most mothers reported receiving information from health providers.

Conclusion –

To conclude, full immunization in children of sex workers in Malvani area (28.30% across 4 birth order), between 0-24 months, is considerably lower than the urban Mumbai rate of 84 % for children between 12-23months [DLHS 3, 2008]. Only 10.8% mothers had sufficient knowledge about the health benefits of immunization for more than one disease. This shows a dearth of health education services that need to reach out to these women.

Further studies are needed to explore reasons for variation in immunization based on birth order and type of sex work.

Recommendations would be to not only enhance the health services to reach out to this population but also to provide better knowledge to the mothers about the benefits of immunizing their children. The NGOs working on these issues can take larger share in helping the urban health services and providers reach out to these sections and provide a strategic support. Many of these programs also need to factor in differences in immunization based on birth order and typology of sex work that women engage in. Inclusion of anganwadi workers for outreach services can also be a viable option.

Limitations of the study-

The study was first attempt to look at immunization coverage amongst children of female sex workers. One of the limitations of this study is collecting data for a larger range of age (from 0-12years of age) of the sample. Secondly the study could have benefitted with larger number of respondents in each category of the type of sex workers for better comparison. Thus future studies are recommended to investigate health status of children of sex workers.

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Annexure

Fig 4 - BCG Coverage for children of sex workers

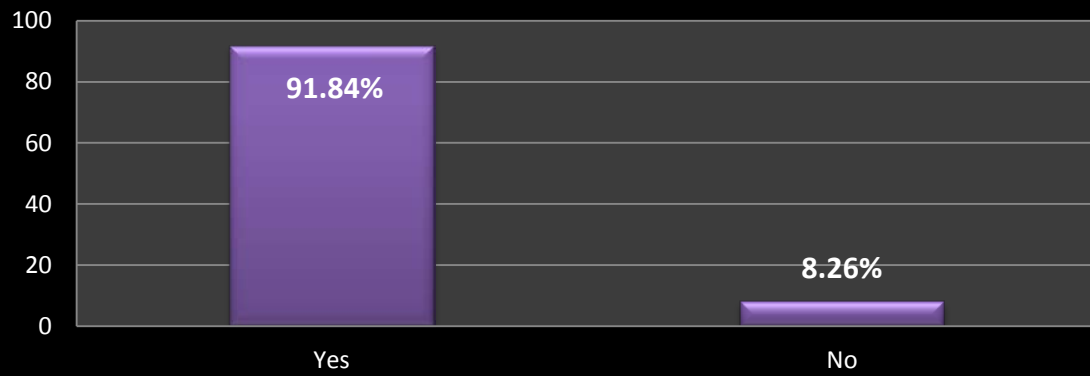


Fig 5 - DPT Coverage for children of sex workers

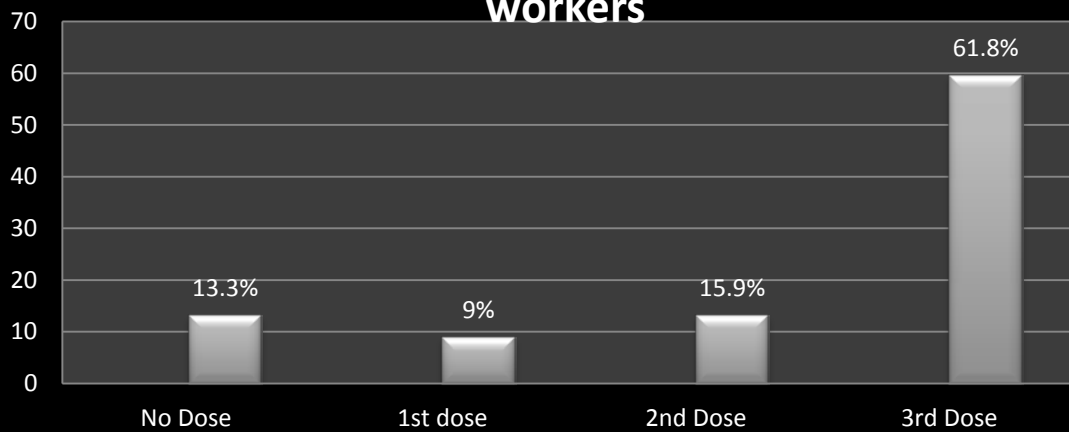


Fig 6 - OPV Coverage for children of sex workers

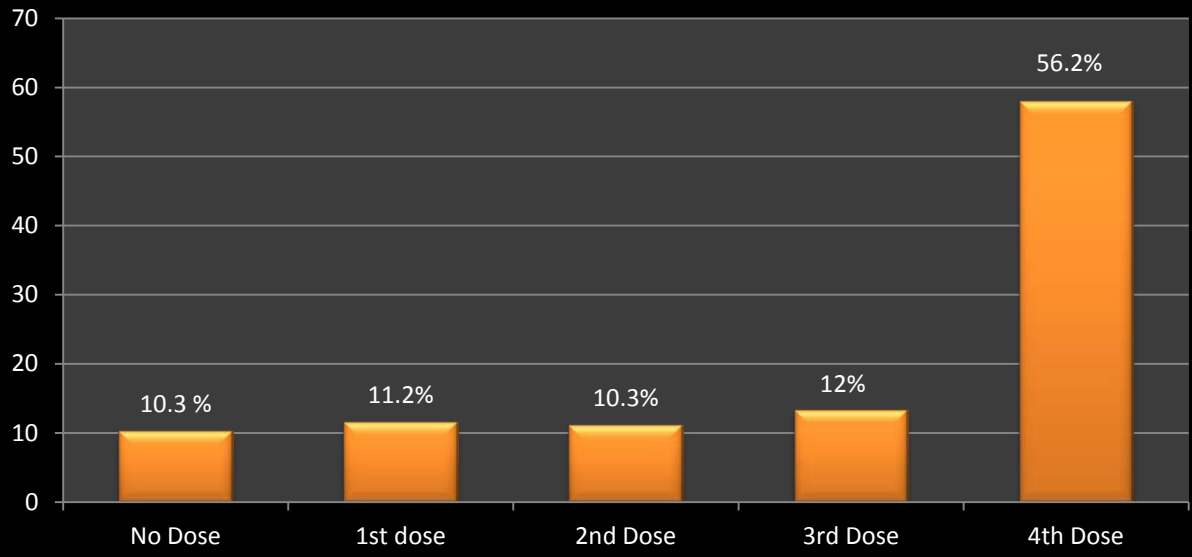


Fig 7 - MMR Coverage for children of sex workers

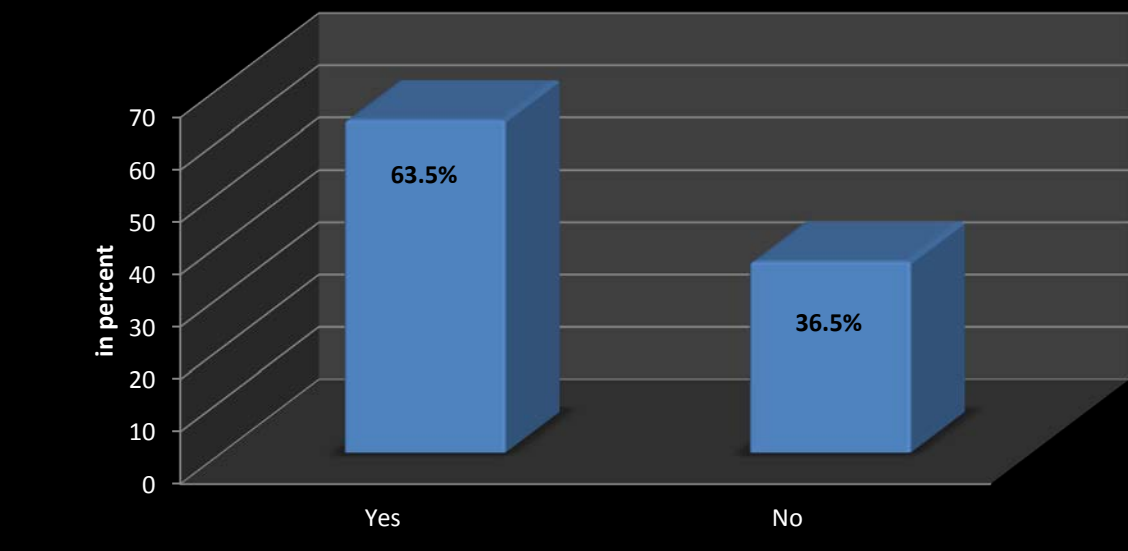


Fig 8 - Hepatitis B Coverage for children of sex workers

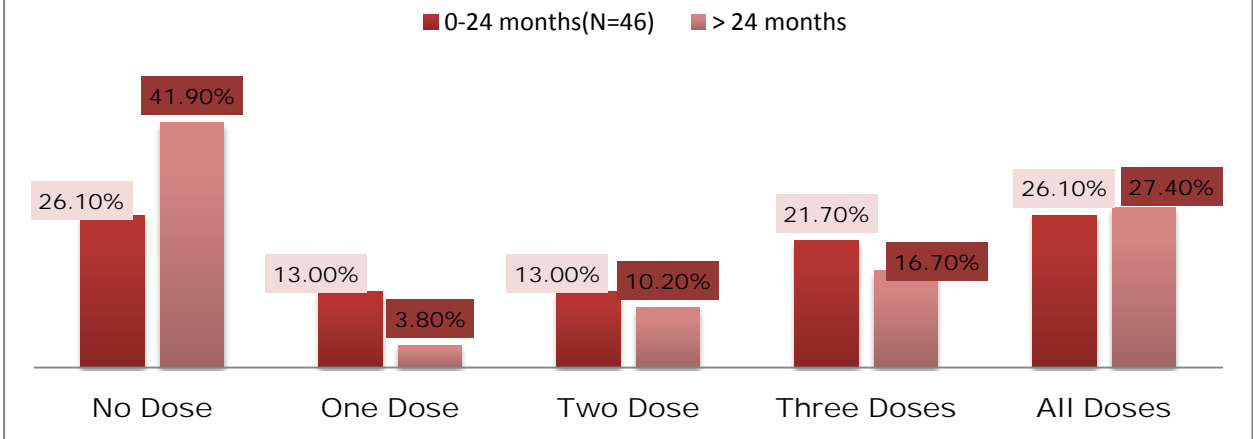
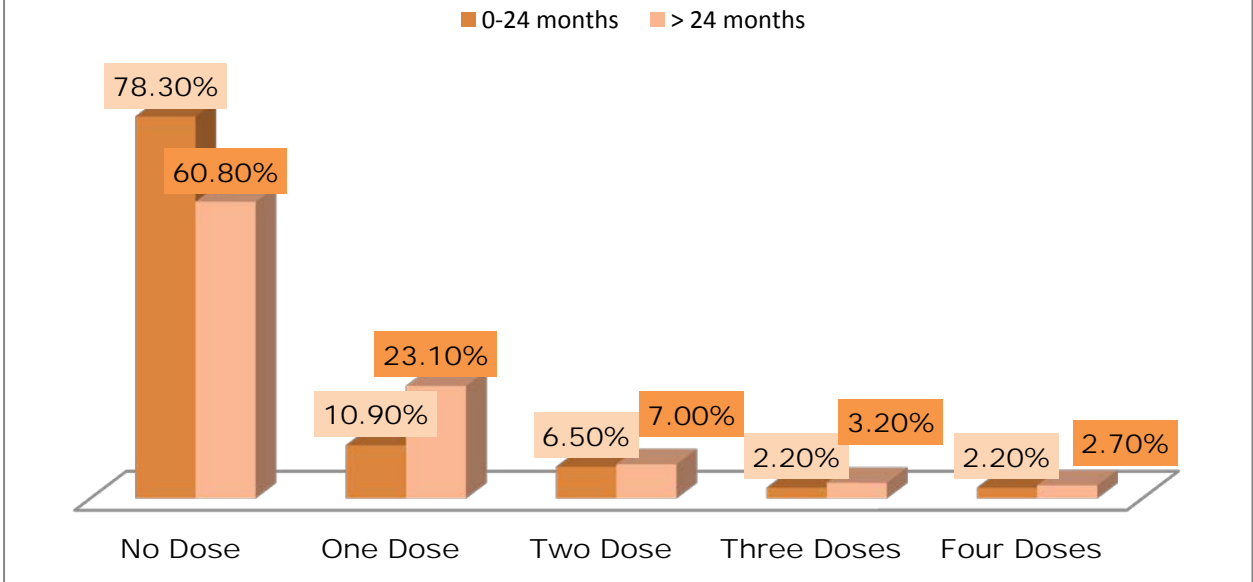


Fig 9 - Vitamin A Coverage for children of sex workers



Leachate/Lye Usage to Optimize the Function of Biopori

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ABSTRACT

Every day, Indonesia population produces 100.000 tons of garbage that almost everything goes to the landfill area. Due to the large amount of garbage that should be maintained every day, sometimes not all waste that can be managed properly. Biopori is one from a thousand effort to resolve this issue. Through biopori and natural decomposer in a soil, organic waste can be managed and changed into agricultural fertilizer.

Biopori has been applied in several areas in Indonesia. But because of some problems that arose from biopori installation itself, this biopori program eventually stopped and not attracted anymore. One of the main problems was the groundwater contamination called “leachate” that comes out from biopori organic waste. In addition, biopoti itself can also make the pedestrian fell into biopori hole and it potentially be the residence of vectors of disease, such as rats.

The method used is take information from a literature review of books, scientific journals, articles and information from the internet which is appropriate. Data and information collected is about the amount of garbage produced per day in Indonesia, biopori-making techniques, groundwater conditions around the landfill, the type of water that is absorbed by plants, and also vectors that often nest in biopori and how to get rid of it.

Through literature review obtained information that leachate contains many elements that plants need, namely nitrogen, ammonium nitrogen, nitrate, phosphorus and iron. That can be used to perform metabolic processes. This fact could become a solution to the problems of organic waste leachate generated in biopori. Biopori later could be planted close to trees or plants to facilitate plant roots to absorb leachate. And then leachate will be used for plant metabolism or become a liquid fertilizer and does not pollute groundwater.

Key Words : Garbage, Biopori, Biopori Problems, Leachate, Leachate Benefits

Definitions of Biopore

- a. Biopore is spaces or soil's pores that are formed naturally by the activity of living organisms in the soil such as plant's roots, worms, termites and the other microorganisms. (erabaru.or.id, 2008).
- b. Biopore is spaces or soil's pores that are formed by living organisms, such as soil microorganisms and plant's roots. Biopore's shape is similar with the burrows (small tunnel) in the ground, have some branches and very effective to deliver water and air into the soil. The hole pores formed by the growth and development of plant's roots, also the activities of living organism in the soil such as worms, termites, and ants in the soil. (Brata 2008).
- c. Biopore is the hole pores in the ground made by the biology organism of the soil such as worms, mouse, ants, termites, etc, including holes that plant roots are die and root in the ground. The existence of many Biopore will improve soil's water absorption, because the water will more easily enter the body (profile) of soil. Biopore's shape is similar with a small hole and branched which is very effective to absorb water into the ground. Various sizes and types of organisms live in the soil's pores and through the pores the organisms obtain water and oxygen, while the food derived from weathering of plants and the other organisms. Population and activity of soil organisms can be improved by providing sufficient organic matter in the soil, so the soil organisms will have enough food to live and breed. Conversion of natural vegetated areas into residential areas or other activities will have the impact in soil compaction and simultaneously destroys holes in the soil pores. That matter certainly affects the reduction of the rate of water infiltration into the soil during the rainy season. (Rauf, 2009).

Biopore Absorption Hole

- a. Infiltration Biopore hole is a hole which is dug into the ground vertically with the cylindrical shape diameter 10 cm, with depth \pm 1 meter (not to exceed the water table). Infiltration hole is excavated using Bipore Drill in order to produce diameters with same size. The application of infiltration biopore hole technology is to increase the number and broad pore formed hole in all directions in the ground, with the increase of hole pore's vast so the number (volume) of water infiltration into the soil will increase. In accordance with its goal is to improve water infiltration into the soil, so the setting of infiltration biopore holes must be located through the water or places where stagnant water is usually flooded when rain. The recommended place for installation Biopore are : The rain water drains, around trees, contours garden, on the side of the fence, and other places deemed appropriate. Biopore must be placed at the point of its potential inundation, because Biopore construction on rather high location will cause the rate of water absorption is not maximal. (Brata 2008).

Benefits of Biopore

- a. Reduce the Puddle

Generally in the urban areas the development increase so fast so the covered area (waterproof) also increase. It will reduce the catchment area which resulted in a decreased volume of water infiltration into the ground. Beside that, the open land around the settlement / housing generally in the solid state due to human activities. This condition causes increase the amount of rain water is wasted as runoff water which resulted in a puddle, so that during the rainy season flooding will occur. To cope the flooding in urban areas not only through improved drainage, but also by extending the catchment areas (water reservoir), one of them

is to make a infiltration biopore hole. By applying the infiltration Biopore hole, so the formed Biopore hole will serve improve water infiltration into the soil, so that the use of infiltration Biopore hole with the appropriate amounts will reduce the occurrence of flooding and could control the flooding. (Rauf, 2009).

b. Increase the ground water

Rainwater which enter into the soil in the form of free water will continue to move slowly toward the lowest places. If it continuously replenished, underground water reserves can be maintained even if the use of underground water for human needs rather high (Asdak, 2001). With the increasing of water infiltration into the soil so the underground water availability will increase too. The availability of underground water reserves are very important and should be maintained, particularly in urban areas because the underground water reserves is one of clean water source for communities and entrepreneurs activities. According to Rauf (2001) the method of Infiltration Biopore hole is one appropriate action performed to improve water infiltration in residential land / urban, because the water that goes into Biopore can easily move in the soil profile and enters as the underground water (ground water). On land that has been broken where the top layer of soil (top soil) is thin due to eroded by runoff water, infiltration biopore hole can help accelerate the rate of water infiltration into the subsurface (sub-soil) which are relatively dense, also help the importing of organic materials into the soil. With the improvements of the condition of the sub soil so the water recharge more smoothly, and then the ground water reserves more secure (BPLHDs JABAR, 2009).

If not replenished, the underground water reserves will be reduced due to come out as a spring, undergo evaporation and evapotranspiration on open land agricultural land. Besides that, in urban areas the reduction soil water availability is strongly influenced by the utilization of underground water is very high in a variety of business sectors and the daily needs. That matter should be recovered through the efforts of water infiltration into the soil when it rains. Infiltration biopore hole serves as a place to accommodate the water to infiltrate into the ground and store the ground water.

c. Reduce the volume of organic waste

Organic waste in Medan partly derived from household waste from residential areas, such as food waste, etc .beside that, the waste was also derived from crop residues such as clipping former garden plants, crops leftover unsold and straw, resulting in increase in the number of residents increase in the volume of waste that must be transported to temporary landfills and landfills.

Limitations of waste management facilities and infrastructure caused waste management execute not maximal, so the people seek other treatment alternatives such as burning, throw garbage into the river, piled across that is very disturbing aesthetics of the environment, also will have a negative impact to the environment.

By applying the technology of infiltration biopore hole, so the organic waste produced every day is no longer a problem, but can be used with put it in the excavated soil (infiltration pits). To obtain the nutrition, soil microorganisms will decompose organic materials, so that the population will continue to increase and activity will form pores in the soil.

Leachate

- a. Leachate is a liquid percolating through the waste that contains the elements of the dissolved and suspended or fluid through landfills and mixed and suspended substances or materials that are in landfill. Liquids in landfills is the result of the decomposition of waste and fluids that go into landfills such as flow or surface drainage, rainwater and groundwater. Meanwhile, according to Darmasetiawan (2004), Leachate is water that is formed in the landfill waste that dissolves a lot of existing compounds that have very high particular pollutant content of organic matter. Leachate is a potential cause of water pollution, both ground and surface water that needs to be handled properly. (Tchobanoglous, 1993).
- b. Leachate is water degradation from waste and can cause pollution if not treated before in the exhaust into the environment. This leachate in general are toxic because they contain high amounts of microorganisms, contain heavy metals that are harmful if exposed to the environment, and others. In addition the rate capability leachate degradation is low, it is characterized by the low value of the ratio of BOD / COD. (Trihadiningrum, 1995).

The content of element in the leachate

Leachate is the liquid that contains dissolved and suspended substances that very smooth as a result of decomposition by microbes, usually consisting of calcium (Ca), magnesium (Mg), sodium (Na), potassium (K), iron (Fe), chloride (Cl), sulfate (SO₄), zinc (Zn), nickel (Ni), carbon dioxide (CO₂), water (H₂O), water, nitrogen (N₂), ammonia (NH₃), acid sulfide (H₂S), organic acids and hydrogen gas (H₂) (Soemirat, 1999).

Leachate is rich in organic matter, inorganic and microorganisms, besides that leachate also contains heavy metals rather high so that if the leachate is not processed, discharged untreated directly into the soil, it can contaminate soil and groundwater. Environmental pollution by leachate generated from municipal waste mound land is one of the issues that arise in applications of accumulation garbage. Mound land farming areas are generally located near the rice fields so that the leachate can flow to this area. The influence of leachate on soil and rice crops is still unknown. Although leachate contains almost of all the nutrients of the plants, but leachate containing heavy metals quite high among other copper (Cu) and mercury (Hg), which can be toxic to plants. (Munawar, 2011).

The elements that needed in the process of plant's growth

Based on the number of required plant nutrient, nutrient elements are divided into two classes, namely, macro and micro nutrient elements. Type – this type of macro nutrient elements namely Nitrogen (N), phosphorus (P), potassium (K), Sulfur (S), calcium (Ca), and Magnesium (Mg). Three elements that are absolutely necessary for the plants and there are Nitrogen (N), phosphorus (P), potassium (K). As for types – types of nutrient elements required in the least amount of (micro) it is chlorine (Cl), manganese (Mn), iron (Fe), copper and potassium, as well as a forgotten source of strength for facing drought and crop diseases.

Nutrients for the plant are necessary to meet the needs of life such as growth and reproduction. Plant derived nutrients are retained in the body of the herbs, and used. The body of a plant most consists of three elements, namely, carbon (C), hydrogen (H), and oxygen (O). These elements are the elements of builders of carbohydrates and fats. These elements constitute the main components of the plant cell wall builders. The items taken from the air in the form of carbon dioxide (CO₂) and O₂ as well as from the soil is water (H₂O). It is not possible to live with the plants of the third element. Plants need to form protoplast containing protein from the elements C, H, O, N and nucleic acids of C, H, O, N, S, P, and other elements. (Yuwono, 2006).

Discussion

Every day, Indonesia population produces 100.000 tons of garbage that almost everything goes to the landfill area. Due to the large amount of garbage that should be maintained every day, sometimes not all waste that can be managed properly. Biopori is one from a thousand effort to resolve this issue. Through biopori and natural decomposer in a soil, organic waste can be managed and changed into agricultural fertilizer.

Biopori has been applied in several areas in Indonesia. But because of some problems that arose from biopori installation itself, this biopori program eventually stopped and not attracted anymore. One of the main problems was the groundwater contamination called “leachate” that comes out from biopori organic waste. This problem is quite serious, since there are many people who think that the leachates did not have their benefits. Another problems are, biopori can also make the pedestrians fallen into the hole, it took places and biopori really potential to be the “house” for the vector of disease, for example mouse.

As we know that one of the uses of biopori is to absorb rainwater, automatically in the biopori hole there is a organic waste and rain water will mixed each other and this could give rise to the name of leachate. Leachate alone can pollute the water, both groundwater and surface water. Surface water that has been polluted by lindi can cause the death of fish, loss of aesthetic values and changes the balance of flora and fauna that living in the water. In the case of pollution of groundwater, contamination will run continuously for a long period. This is caused by the content of heavy metals are high enough in the leachate.

Leachate also contains a lot of all nutrient elements of plant which is especially useful for plant breeding and growth developments such as Nitrogen (N), phosphorus (P), potassium (K), Sulfur (S), calcium (Ca), and Magnesium (Mg). This content can be utilized by plant to perform the process of metabolism. That fact can be the solution to leachate problems that produced by organic waste in biopori. As we know that one of the biopori works is using the plant roots that searching water, if leachate can be discovered by plants then the looses of leachate can be solved. So the solution is biopori be planted close to trees or plants in order to facilitate the plant roots to absorb leachate. So lindi will be utilized for plant metabolism (and liquid fertilizer) and do not pollute the ground water.

The second problem is the pedestrian can fallen into this hole, there are many complain about biopori hole because that can make young children mired in it. The solutions that can be offered are makes the cover of biopori using PVC and the lid can be opened at any time, so later biopori is no longer open but covered in condition. Next is the issue of land, biopori is take places even not too much. The solution if biopori planted around the house is at least made the rule that every house must prepare its range between 0.5-1 meter for biopori absorption hole. The last issue was as a vector of disease, namely mice nest, the solution is the same as the second issue which makes the cover of PVC so that the mouse cannot enter into the hole and biopori can not be their nests.

The method used is take information from a literature review of books, scientific journals, articles and information from the internet which is appropriate. Data and information collected is about the amount of garbage produced per day in Indonesia, biopori-making techniques, groundwater conditions around the landfill, the type of water that is absorbed by plants, and also vectors that often nest in biopori and how to get rid of it.

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POLYHOUSE FARMING - HEALTH RISKS

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ABSTRACT:

Polyhouses are essentially microcosms aimed at providing physical environment suitable for the survival and growth of plants with high degree of temperature, humidity and carbon dioxide. Working at unsuitable temperature combined with stress to the body from heavy physical activity, and exposure to chemicals can be very dangerous to man's health. So present study was conducted to find out effect of unsuitable working environment and posture on workers health. In study it was found that in walk-in-tunnel (WIT) and natural ventilated polyhouses (NVPH) the temperature was 69.54% and 52.29% higher and the humidity was 96.37% and 85.19 % higher in comparison to open farming in the months of January and May. No significant different was found in temperature, humidity, dust, solar radiation and CO₂ level between open and anti insect net shade house (AINH). In Hi-tech polyhouse, the environment was totally controlled by computer and was not found to much strenuous. The posture analysis of 8 activities was done by REBA score sheet and bed washing and tying work were at high risk level with score 12 and 11 and required necessary action. In case of occupational health hazards both biological and psychological aspects were found more risky with mean value 3.22 and 2.86. Health status of workers was checked by doctor, and it was found that in polyhouse farming workers were more prone to problems of allergy and asthma.

Key words: Polyhouse, unfavorable climate, walk-in-tunnel and psychological aspect.

INTRODUCTION:

Polyhouses are essentially microcosms aimed at providing physical environments suitable for the survival and growth of plants. High temperature (up to 40 °C) and humidity (70-80%) exhibits a significant influence on the rate of photosynthesis, generally, the higher temperature and humidity, assuming CO₂ and light are abundant, and the faster photosynthesis takes place (**Grimes and Williams, 1990**). Working at unsuitable environment combined with stress to the body from heavy physical activity, and exposure to chemicals, can be very dangerous to man's health. Vegetables need very high levels of temperature with a peak of 30°C and 80% of relative humidity but these levels cannot be considered favorable to operators who work in this environment. Polyhouse farming is done in vertical form and in all these activities workers have to move frequently, working in a bent over position for any prolonged period of time, or from excessive bending and have to stretch their body to perform the task. Excessive head, back and knee bending may predispose to other lower extremity musculoskeletal disorders. Nearly one-quarter of injuries result from overexertion, usually when moving or lifting objects such as equipment, supplies, or debris. All of these injuries are costly, both in human terms and in terms of time lost from work and work disruption.

So the study was conducted to find out the extreme environment condition in polyhouses and their effect on workers health

METHODOLOGY

The present study was conducted in polyhouses at indo-Israel project on vegetables, at Karnal district. Four different types of polyhouses viz., Hi-tech, Naturally ventilated polyhouse, Walk-in-tunnel and Anti-insect net house were taken. Comparison of environmental parameters was done between open farming (control) and polyhouses to find out the extreme environmental condition

Physiological response of workers in different polyhouses

Effect on environmental parameters on workers' health was studied in terms of physiological parameters i.e. heart rate, blood pressure and lung function capacity.

The posture of workers was studied in 8 different activities; bed washing, bed making, field preparation, sowing, tying, pruning, irrigation and fertilizing and harvesting which were carried out in polyhouse farming.

The posture was accessed by REBA score analysis.

REBA stands for rapid entire body assessment, designed to provide a quick and easy observation postural analysis tool for whole body activities. In REBA, position of individual body segments was observed in different polyhouse activities.

Mental workload: On account of the different causes of the negative effects of mental workload individual checklists have been drawn up for the assessment of stress, mental satiation. Each checklist contains features of activities, working conditions, performance and behavior. The data are evaluated quantitatively in relation to the number of ticked off answers per feature (expressed as percentage).

Table-1 Action category of mental workload checklist

NO RISK	INCREASED RISK	HIGH RISK
Need for action regarding some features	Redesign recommended	Redesign urgently required
0-33%	34-66%	67-100%

Analysis of data: To find out the increasing and decreasing level of environmental parameters in different polyhouses in comparison to conventional farming were assessed by following equation:

$$\frac{\text{Level of environmental parameter in conventional framing} - \text{Level of environmental parameter in polyhouse}}{\text{Level of environmental parameter in polyhouse}} \times 100$$

**Environmental parameter (temperature, humidity, CO₂, dust)*

ANOVA test was used to find out the difference of climatic data (temperature, humidity, and CO₂) between polyhouses and open farming (control). Response surface methodology (quadratic model) was used to find out the effect of environmental parameters (temperature, humidity and CO₂) on workers' physiological responses (Heart rate, Blood pressure and Lung function capacity). By RSM software analysis on the basis of three environmental values and three physiological responses the calculation was done on 8 parameters that were assuming by software itself to analyze the data. The values are as follow:

- A (temperature)**- Value of temperature
- B (humidity)** - Value of humidity
- C (carbon-dioxide)**- Value of carbon-dioxide
- AC (temp.-CO₂)**- Ratio of temperature and carbon-dioxide
- BC (Humidity-CO₂)**- Ratio of humidity and carbon-dioxide
- A² (temp.²)**- Assuming double value of temperature
- B² (Humidity²)**- Assuming double value of humidity
- C² (CO₂²)**- Assuming double value of carbon-dioxide

RESULTS AND DISCUSSION:

In Karnal, at indo-Israel project, study was conducted on 16 different polyhouses viz; 1-Hi-tech, 2- NVPH, 10-WIT and 3-AINH. The total area under polyhouses was 11048 m² and installed with total cost of RS. 78,24,732. Hi-tech polyhouse was used to be for nursery production other side NVPH, WIT and AINH polyhouses for crop production/farming like; capsicum, cucumber, tomato, brinjal and chilli. A total 50 people were found to be engaged in polyhouse organization including 10 experts and 40 labors. Environmental parameters were accessed during working hours in different polyhouses and posture was accessed during different during work.

Table-2. Association between environmental parameters and heart rate of different polyhouses workers n=15

Environmental parameters	Hi-tech		AINH		NVPH		WIT	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
A (temperature)	ns	ns	ns	ns	52.57**	106.48**	18.86**	28.1*8
B(humidity)	ns	ns	ns	6.30*	28.08**	ns	117.90**	58.92**
C(carbon-dioxide)	ns	ns	87.50**	ns	8.11*	575.24**	24.3**	28.3**
AB(temp.-humidity)	ns	ns	ns	ns	ns	ns	42.5**	36.8**
AC(temp.-CO ₂)	ns	ns	ns	ns	ns	7.62*	ns	16.7*
BC(Humidity-CO ₂)	16.00**	ns	ns	7.78*	13.83**	ns	ns	7.28*
A ² (temp. ²)	ns	ns	ns	ns	8.22*	5.89*	ns	8.92*
B ² (Humidity ²)	ns	5.36*	ns	ns	ns	ns	10.29*	21.73**
C ² (CO ₂ ²)	ns	ns	ns	ns	ns	ns	8.85*	0.91
R ²	0.91	0.83	0.93	0.70	0.92	0.99	0.95	0.91

Table-2 shows the association between different environmental parameters (temperature, humidity and CO₂) and heart rate of different polyhouse workers. Regarding hi-tech polyhouse, in summer high concentration of humidity-CO₂ was significantly increasing heart rate of workers, in winter assuming double value of humidity was significantly increasing heart rate of workers. Other side in AINH polyhouse humidity and increasing ratio of humidity: CO₂ were significantly affecting heart rate of workers. NVPH workers heart rate was found to be significantly affected by temperature, humidity, CO₂, humidity:CO₂ and temperature² in summer and by temperature, CO₂, AC, A² in winter, respectively. As table reflect that high concentration of temp., humidity, CO₂, AB, B² and C² were significantly affecting heart rate of WIT polyhouse workers.

Table-3 Association between environmental parameters and blood pressure of different polyhouses workers

Environmental parameters	n=15							
	Hi-tech		AINH		NVPH		WIT	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
A (temperature)	ns	ns	ns	ns	- 101.21**	-7.08*	ns	- 12.68**
B(humidity)	ns	ns	ns	- 16.68**	ns	ns	-9.31*	ns
C(carbon-dioxide)	ns	-5.33*	ns	- 24.91**	9.70*	- 81.30**	- 501.39**	- 53.73**
AB(temp.-humidity)	ns	ns	ns	12.6*	ns	7.83	-18.49**	-32.7*
AC(temp.-CO ₂)	ns	ns	ns	ns	-13.89**	-5.29*	-4.61*	-8.93*
BC(Humidity-CO ₂)	ns	ns	5.21*	ns	ns	ns	ns	-3.21
A ² (temp. ²)	ns	ns	- 21.16**	ns	-12.08**	-4.24*	-28.03**	-18.3*
B ² (Humidity ²)	ns	ns	ns	ns	- 63.90***	ns	ns	ns
C ² (CO ₂ ²)	ns	ns	ns	ns	ns	- 43.61**	- 124.34**	-10.73*
R ²	0.86	0.49	0.80	0.86	0.97	0.93	0.98	0.67

Data in Table-3 represent the effect of environmental parameters on blood pressure of different polyhouse workers. Regarding Hi-tech polyhouse, only high concentration of CO₂ was significantly decreasing the blood pressure of workers. In AINH polyhouse high concentration of BC (humidity: CO₂) B² (humidity²) in winter and high value of B (humidity), C (carbon-dioxide), AB (temperature: humidity) in summer were significantly decreasing the blood pressure of workers. Alongside high concentration of A, C, AC, A², B² was significantly affecting blood pressure of workers in both seasons; summer and winter in NVPH and WIT polyhouse.

Table-4. Association between environmental parameters and lung function capacity of different polyhouses workers

Environmental parameters	n=15							
	Hi-tech		AINH		NVPH		WIT	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
A (temperature)	ns	ns	ns	ns	- 27.07*	-6.21*	ns	- 18.71*
B(humidity)	ns	ns	3.64*	ns	ns	ns	ns	ns
C(carbon-dioxide)	ns	ns	ns	ns	ns	- 40.98*	- 110.91*	-15.91*

AB(temp.-humidity)	ns	ns	ns	ns	ns	ns	-	-
							23.75**	74.45*
AC(temp.-CO ₂)	ns	ns	ns	9.33*	ns	ns	ns	ns
BC(Humidity-CO ₂)	ns	ns	9.13*	12.3*	-7.28*	-3.36*	ns	ns
A ² (temp. ²)	ns	ns	ns	ns	ns	ns	-10.58*	ns
B ² (Humidity ²)	ns	ns	ns	ns	-6.81*	-7.83*	ns	-5.57*
C ² (CO ₂ ²)	ns	ns	ns	ns	ns	Ns	-	ns
							30.78**	
R ²	0.90	0.96	0.65	0.78	0.84	0.88	0.96	0.79

Results in Table-4, represent the association between environmental parameters and lung function capacity of different polyhouse workers. Regarding Hi-tech polyhouse no significant effect of temperature, humidity and CO₂ was found on workers lung function capacity. In AINH polyhouse high concentration of B (humidity), BC (humidity: carbon-dioxide) was significantly affecting the lung function of workers in summer season. Regarding winter AC and BC value were significantly decreasing the lung function capacity. In NVPH and WIT polyhouses, high concentration of temperature, humidity and carbon-dioxide and their ratios were significantly ($R^2= 0.96, 0.79$) negatively associated to lung function capacity of workers in both seasons; summer and winter.

Table-5 REBA posture analysis of different polyhouse activities n=15

Activity	Activity score						REB A score	Risk level	REBA action category
	Trunk	Neck	Leg	Upper arms	Lower arms	Wrist			
Bed washing	5	3	3	2	1	3	12	Very high	Necessary now
Bed making	2	2	2	2	1	2	3	Low	May be necessary
Field preparation	3	2	2	2	1	2	5	Medium	Necessary
Sowing	5	3	3	1	2	2	9	High	Necessary soon
Tying	3	3	3	5	2	3	11	Very high	Necessary now
Pruning	2	3	2	4	2	3	7	Medium	Necessary
Irrigation and fertilizing	2	2	1	2	1	2	3	Low	May be necessary
Harvesting	2	2	2	4	2	2	5	Medium	Necessary

Observation in Table 5 shows posture analysis of different activities by REBA scale. Results unveiled that maximum score (12 and 11) was found in bed washing and tying with very high risk level and necessary action in redesigning. In bed washing and tying activities score were 533213 and 233523 for the body parts of trunk, neck, legs, upper arm, lower arm and wrist. Sowing activity in polyhouse farming got activity score 533122 and REBA action score 9 which reflect high risk level and action should be taken as soon as possible. Three polyhouse activities; pruning, field preparation and harvesting were observed at medium risk level with REBA score 7, 5 and 5 and activity score 232423, 322212, 222422, respectively. Low postural problem was found in bed making and irrigation and harvesting with REBA score 3 and activity score 222212, 221212, respectively.

Table -6 Mental workload in polyhouse workers n=15

Mental workload						
Polyhouse	Stress	Metal fatigue	Monotony	Mental satiation	Overall	Action
Hi-tech (4)	50	68.3	66.7	38.3	55.8	INCREASE RISK
NVPH (4)	33.3	31.6	33.3	26.6	31.2	NO RISK
WIT (4)	48.3	46.6	41.6	30.0	53.5	INCREASE RISK
AINH (3)	28.3	26.6	23.3	15.0	23.3	NO RISK
Overall	39.9	43.2	41.2	27.4	40.9	INCREASE RISK
Action	NO RISK	INCREASE RISK	INCREASE RISK	INCREASE RISK		

Findings in Table-6 elucidate that level of mental workload in different polyhouse workers. High level of workload was observed in Hi-tech (55.8%) followed by WIT (53.5%) and NVPH (31.2%). Regarding stress, mental fatigue, monotony, mental satiation. The high level of problem was found to be in Hi-tech polyhouse workers with action category of increased risk and recommendation of redesign of workplace.

Table-7 Occupational health diseases in workers n=15

Diseases	Frequency	Percentage
Allergy	4	26.7
Asthma	2	13.3
Low BP	6	40.0
Skin burning	3	20.0

On the basis of doctor checkup it was found that low blood pressure (40.0%) was the main problem in polyhouse workers followed by allergy (26.7%) and skin burning (20.0%) due to extreme environmental condition.

CONCLUSION

In study high level of temperature, humidity and CO₂, were observed higher in different polyhouses in comparison to open farming. The level of increasing of temperature, humidity and CO₂ was found to be higher in WIT and NVPH polyhouses in comparison to open farming. Regarding effect of environmental parameters on workers health, the increasing level of temperature, humidity and CO₂ was significantly increasing the level of heart rate and decreasing the BP and lung function capacity of workers of WIT and NVPH workers. The workers, especially from WIT and NVPH polyhouses were found to be suffering from asthma problem with low expiratory and inhale capacity in forced vital capacity (1.54 l/s), slow vital capacity (1.59 l/s) and maximum ventilation volume (40.93 l/m). Data on lung function thus suggest that employment in greenhouses may contribute to the development of chronic ventilatory impairment although the role of smoking cannot be quantitated. (**Zuskin et al., 1988**). The mental workload was observed higher (51.17%) in Hi-tech polyhouse. In polyhouse workers the main mental problem was monotony (48.33%) and 73.3 percent workers were in category of increasing risk with mental workload level 33-66% demands redesigning of job and environment. The posture in bed washing and tying activities were found to be at higher risk with action category of redesign workplace as soon as possible. **Gangopadhyay (2005)** conducted a detailed posture analysis study on 50 male and 50 female workers of polyhouse on the base of Ovako Working Posture Analysis System (OWAS). It was observed that those workers worked continuously in awkward postures during certain activities. Consequently they suffered from discomfort in different parts of their body. Even though they were very young, they were likely to suffer from serious musculoskeletal disorders in the future.

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Rapid diagnostic of *Escherichia coli* O157 H7 coagglutination test using Protein A *Staphylococcus aureus* in food

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Abstract

Outbreak of *Escherichia coli* O157 H7 in many countries due to contaminated food of *E. coli* O157 H7 is a global problem. Such problem needs a rapid detection technique. In recent years, it has become widely recognized that Protein A *Staphylococcus aureus* has a potential application in diagnostic tools. It has been suggested as alternatives to culture in a laboratory test for detecting pathogenic bacteria in specimen. Protein A is 42-kDa surface protein, which binds to fragment crystallizable (Fc) of antibodies or immunoglobulin G (IgG). This study is designed to make a rapid, simple, practical diagnostic kit to detect *E. coli* O157:H7 in contaminated food. This study uses the principle of Protein A interacting with Fc IgG in a coagglutination test. The candidate of *S. aureus* which has much of protein A will be identified by serum soft agar technique and it will be used as carrier matrix of specific antibody in coagglutination test. Rabbits will be used to obtain specific antibody against *E. coli* O157:H7. The antibody specificity will be measured by an absorption technique and cross-reaction with the other *Enterobacteriaceae*. Other techniques such as immunoblotting, enzyme linked immunosorbent assay (ELISA), and polymerase chain reaction (PCR) will be used to calibrate the result. This research is expected to promising kit for a rapid and specific diagnostic detection of *E. coli* O157:H7 in food.

Keywords: *Escherichia coli* O157 H7; Protein A; Detection; Rapid

1. Introduction

Escherichia coli O157:H7 is known as one of foodborne pathogen that has a hazard potential to human health. This microorganism produces shiga toxin like (Stx) which is released in bowel [1]. The toxin can cause a potentially fatal human illness whose clinical spectrum includes diarrhea, haemorrhagic colitis, and the haemolytic uraemic syndrome [2]. The infection is typically acquired through the ingestion of contaminated food [2]. In Indonesia, *E. coli* O157:H7 has been isolated from clinically human feces indicated that the zoonotic agent has been transmitted to human [3]. Thus, there is a need for rapid test for the presence of *E. coli* O157:H7 in food to prevent the infection in human. This study will generate a new test for *E. coli* O157:H7 that detects both O157 and H7 antigen in food.

2. Materials and methods

The test kit will consists of reagent that can only react to *E. coli* O157:H7 in sample. The reagent is a matrix of *Staphylococcus aureus* that has protein A on the surface. Protein A will play role to bind antibody which specific to *E. coli* O157:H7 . The test reagent will incorporate antibodies against O157:H7. The reagent will be drop on the sample pad that there is a sample suspected contain *E. coli* O157:H7. When *E. coli* O157:H7 is present in the sample, the microorganism bind to the antibodies and show as coagglutination. The test will be taking 30 sec.

3. Discussion

In this paper, we have considered the various strategies have been performed to detect *E. coli* O157:H7. This pathogen can cause disease so that a rapid detection such as kit is needed. Many approaches have been successes in developing sensitive and specific detection methods [4]. However, there is many problems remain. The problems of existing test are needed an expensive cost, long time result, and personal trained. For example, conventional methods need several days to obtained the result [4]. However, plating is a gold standard that always used to detect hazard especially in Indonesia. Therefore, new methods should be has a same performance with the gold standard to guarantee the result of detection.

The method that will be carrying out can solve such problems. It will promise in terms of speed, reliability, specificity, and sensitivity. Also, this kit will reduce the use of laboratory time will come.

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Role of community based health workers in promotion of essential Maternal, Neonatal and Child Health (MNCH) in Northern region of Pakistan

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Role of community based health workers in promotion of essential Maternal, Neonatal and Child Health (MNCH) in Northern region of Pakistan

Background: Globally, Pakistan is ranked third for the absolute number of neonatal deaths and seventh for maternal deaths¹. This is due to high proportion of unskilled deliveries and low postnatal care utilization². To attain MDG 4 & 5, WHO recommends availability and utilization of essential health services at community level³. In developing countries such as Pakistan, community based health workers (CBHWs) symbolize the foundation of health system⁴. There is growing evidence that skilled, motivated and supported health workers have close correlation with better maternal and child health. The Aga Khan Foundation Pakistan (AKFP) is implementing a three year project (2011-2015) on Mother Care and Child Survival (MCCS) in mountainous region of Gilgit-Baltistan, Pakistan. MCCS project has leveraged the community level MCH interventions through active involvement of community midwives (CMWs), Lady Health Workers (LHWs) and Traditional Birth Attendants (TBAs) to ensure availability and quality of services, increase utilization of services and improved nutritional practices for mothers and under-five children in Gilgit, Hunza-Nagar, Astore and Ghizer districts.

Methods: Review of the project MIS and other project documents was conducted to evaluate outputs and outcomes of community based interventions.

Results: The results revealed that project has trained 40 CMWs, 496 LHWs and 220 TBAs on MNCH care. Membership of CBHWs (CMWs, LHWs, TBAs) was found active in 40 village health committees; formed under MCCS project. Village committees not only contributed to better health system governance but also abridged gap between community and health workers. From baseline value of 1033 referrals per year, the number of referrals from community to health facility increased to 1300 per year. The proportion of CBHWs who were aware of appropriate nutrition practices improved from baseline value of 59% to 68%. Through project interventions, about 48% of CBHWs in project population underwent MNCH in-service training in the past three yrs as compared to baseline value of 39%.

Conclusion: Training and deployment of CBHWs facilitated community based skilled deliveries and strengthened referral mechanisms. Active involvement of women and CBHWs in committees and therefore in decision making process to safeguard MNCH care is promoted under MCCS project. Community sensitization events and trainings of CBHWs and facility health staff steered increase demand and utilization of MCH services and improved nutritional practices.

Keywords: Community health workers, Community health workforce, MNCH, Referral, Pakistan.

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Scaling up Voluntary Medical Male Circumcision in Zambian Prisons-The Mansa Central Prison Experience

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Background: The Zambia Defense Force Prevention, Care and Treatment (ZDFPCT), funded by PEPFAR through the US Department of Defense, supports the Zambia Defense Forces (ZDF) to strengthen and scale up HIV/AIDS prevention, care and treatment services including the provision of Voluntary Medical Male Circumcision (VMMC) in 43 ZDF facilities in seven of Zambia's ten provinces and has piloted work in Mansa Central Prison, in the northern part of Zambia.

Description: Prisoners are vulnerable to HIV infection and are too often overlooked in the provision of HIV- prevention services. Currently, there are very few prisoners in Zambia who are provided with HIV counseling and testing (HCT) and VMMC services. ZDFPCT extends VMMC services to a rural provincial prison (Mansa Central Prison) in Zambia on an outreach basis using staff trained in HCT and VMMC services.

We used trained prison warders to sensitize inmates on HIV/AIDS and create demand for VMMC. Over a six day period in April and August 2013, a team composed of FHI360 and ZDF staff, collaborating with Prison authorities, counselled, tested and circumcised 110 male prisoners. These 110 prisoners represented 35.4% of the total number of male prisoners in this prison. Of these 110 prisoners, 16 (14.5%) tested positive for HIV. All the 110 were circumcised and followed up 48 hours and 7 days after circumcision. Only 2 cases (1.8%) of mild swelling on the circumcision site were reported after 48 hours.

Lessons learned: The demand for VMMC was high in this prison. With collaboration among funders, recipients and prison authorities, it is feasible to safely conduct and scale up quality VMMC services within prisons despite the challenges

Conclusions/Next steps: Prisons provide an opportunity to scale up HIV prevention services that reach a very high risk population. FHI360 in collaboration with ZDFMS plans to scale up the provision of VMMC services in all seven major prisons in the seven provinces of Zambia, to reach as many vulnerable men as possible.

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Sexual practices of people living with HIV on anti-retroviral treatment

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Abstract

Sexual behaviour of people living with HIV and AIDS is currently a topical issue worldwide. There has been a rapid increase in the use of anti-retroviral drugs among people living with HIV and AIDS. The present study was designed to explore the sexual behaviour of people living with HIV who were on antiretroviral treatment. A phenomenological study was conducted with a purposive sample of 12 participants (gender: females = 6 and males 6; age: youth = 6 and adults = 6; ethnicity: Black Africans). Open coding was used to analyse data. The study found that most people on anti-retroviral treatment engage in protected sex or abstain from sex. However, female participants continue to engage in unprotected sex due to power imbalances in sexual relationships. There is a need to help people who are HIV positive to embrace safe sex practices in order to prolong their lives and prevent the further spread of HIV. Women need to be empowered to negotiate for safe sex with their partners.

Keywords: Behaviour, people living with HIV, anti-retroviral treatment, Limpopo Province.

SOLID WASTE MANAGEMENT PRACTICES, AWARENESS, AND PERCEPTIONS OF A COMMUNITY IN BENGUET, PHILIPPINES

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ABSTRACT

Solid wastes have always been regarded as a problem in our society. According to the United States Environmental Protection Agency (2002), improperly managed solid waste poses a risk to human health and the environment. A report from the Asian Development Bank (2004) stated that the Republic Act 9003, also known as the Ecological Solid Waste Management Act of 2000, has the potential to effectively address solid waste management in our country. The goal of this study was to determine the practices, level of awareness, and perceptions of selected community residents in Benguet, Philippines on Solid waste management. The study utilized a quantitative descriptive type of research with the use of a questionnaire involving 314 respondents. Results showed that most of the residents practice good solid waste management activities including selling of used plastic materials or used papers. The study also showed that they are moderately aware on the solid waste laws/legislation, health impacts, and environmental impacts. There was a significant difference on their level of solid waste management awareness as to their gender and educational attainment. The study also revealed that they agree on factors that lead to environmental health threat of improper solid waste management while they strongly agree on the solutions to proper solid waste management. There was no significant difference on their level of solid waste management perceptions in terms of gender and educational attainment. The study concluded that the residents are satisfactorily aware and have favorable perceptions on solid waste management. The study recommended an intensified information dissemination campaign regarding solid waste management to the community.

Keywords: awareness, perceptions, solid waste management practices, Republic Act 9003, Philippines

INTRODUCTION

Solid wastes have always been regarded as a problem to our society. According to the United States Environmental Protection Agency (2002), waste generation increases with population expansion and economic development. Improperly managed solid waste poses a risk to human health and the environment. Uncontrolled dumping and improper waste handling causes a variety of problems, including contaminating water, attracting insects and rodents, and increasing flooding due to blocked drainage canals or gullies. (US EPA, 2002) Solid Waste Management, as defined in the Republic Act 9003, is the discipline associated with the control of generation, storage, collection, transfer and transport, processing, and disposal of solid wastes in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetics, and other environmental considerations, and that is also responsive to public attitudes.

The Asian Development Bank (2004) mentioned that at the barangay level, materials recovery facilities are to be established for final sorting, segregation, composting, and recycling, with residual wastes to be transferred to a sanitary landfill or other long-term facility. RA 9003 has the potential to effectively address solid waste management. However, implementation is behind schedule, source reduction and segregation are happening on an individual barangay level or not at all, and there is little or no active public participation. Significantly, the Solid Waste Management Fund has not been set aside. A comprehensive, integrated information, education, and communication plan is critical to the successful implementation of RA 9003.

Schübeler (1996) stated that there are four contexts in which solid waste management is to be studied. First is the socio-cultural context, where the functioning of the waste management systems is influenced by the waste handling patterns and underlying attitudes of the population, and these factors are, themselves, as conditioned by the people's social and cultural context. Another is the economic context, where the character of waste management tasks and the technical and organisational nature of appropriate solutions depend a great deal on the economic context community in question. The level of economic development is an important determinant of the volume and composition of wastes generated by residential and other users, for example. At the same time, the effective demand for waste management services the willingness and ability to pay for a particular level of service is also influenced by the economic context of a particular area. Next is the environmental context where the size and structure of a settlement has an important influence on the character and urgency of waste management needs, the interaction between waste handling procedures and public health conditions is influenced by climatic conditions and characteristics of local natural and ecological systems, and environment health conditions may also be indirectly affected through the pollution of ground and surface water by leachates from disposal sites. Lastly is the political context, where solid waste management is a permanent and continuous responsibility to be assumed by elected representatives when they take office.

In the local setting, there are certain initiatives done by the government to implement the RA 9003. This act is incorporated in the province of Benguet's Environment Code of 2005. As stated in Article VIII of its implementing rules and regulations, the elements of the Solid Waste Management system are the following: 1. Waste Generation and Characterization, 2.) Handling and On-site storage, 3.) Collection, Transfer, and Transport, 4.) Processing and Recovery, and 5.) Disposal. Included in this article is the creation of the Barangay Ecologic Solid Waste Management Board (BESWMB) where its main task is related to general hygiene and sanitation, beautification and waste segregation, and collection and establishment of a Materials Recovery Facility (MRF).

The goal of this study was to determine the practices, level of awareness, and perceptions of the residents of Barangay Natubleng, Buguias, Benguet on Solid waste management. The specific objectives were: to determine the solid waste practices of Barangay Natubleng, Buguias, Benguet residents; to identify the level of awareness of the residents of Barangay Natubleng, Buguias, Benguet on Solid waste management in terms of laws/ legislations, health impacts, and environmental impacts; to identify the perceptions of Barangay Natubleng, Buguias, Benguet residents on improper solid waste management as to factors that lead to environmental threat of improper solid waste management and solutions to proper solid waste management; and to determine the significant difference of the level of solid waste management awareness and perceptions of Barangay Natubleng, Buguias, Benguet residents in terms of gender and educational attainment.

METHODOLOGY

Research Design

The study made use of a quantitative descriptive type of research. The study specifically wanted to determine the practices, level of awareness and perceptions on solid waste management with the use of a survey method. Interviews were also conducted among selected point persons in the community in order to gather additional inputs on their situation on their solid waste management. A review of records on the barangay profile of Natubleng was also taken from the Municipal Planning and Development Office of Buguias.

Population and Locale

Natubleng is one of the fourteen (14) barangays of the municipality of Buguias. It is situated along Halsema Highway which is the main thoroughfare of Benguet and Mountain Province. The barangay has a land area of 1,781 Hectares, with a total population of 2,351 and 520 households as of 2009. (Buguias Municipal Planning and Development office, 2009) The barangay residents aged 15 years old and above participated in the study, which means that the population of the study was only 1,445. Therefore, when computing for the sample size of the study using the Slovin's formula, the result was 314 respondents.

Data-gathering tool

The questionnaire consisted of four (4) parts. The first part is the respondents' profile, which includes the respondents' gender and educational attainment. The second part is a checklist of the Solid Waste Management practices, in which the respondents' are instructed to check the practices that they do in their household. The third part is about the respondents' level of awareness on Solid Waste Management in terms of laws, health impacts, and environmental impacts. The respondents were asked to rate the following statements using a 4-point Likert scale with 4 being extremely aware, 3 for moderately aware, 2 for somewhat aware, and 1 for not aware. The last part includes the respondents' perceptions on the factors on the solid waste threat to the environment and solutions to improper solid waste management. The respondents were also instructed to rate the statements using a 4-point Likert scale with 4 as strongly agree, 3 as agree, 2 as disagree, and 1 as strongly disagree. Before the questionnaire was administered to the respondents, a test was conducted among three experts to ensure that the questions are valid. A pre-test was eventually performed to 15 barangay Natubleng residents (who were not part of the main respondents) and Cronbach's alpha score was also obtained to ensure that the questions were reliable. When the questionnaire was proven to be valid and reliable, the questionnaire was then translated to their local dialect (*Kankana-ey*).

Data analysis

The results of the study were analysed with the use of percentage particularly on the solid waste management practices. Weighted mean was also used to analyse the data gathered from the levels of solid waste management awareness and perceptions. The study also made use of T-test assuming equal variances in determining if there was a significant difference on the levels of solid waste management awareness and perceptions according to gender while a single factor Analysis of Variance (ANOVA) was used in determining if there was a significant difference on the levels of solid waste management awareness and perceptions according to educational attainment. The results of the treated data were calculated with the use of Microsoft Excel 2010.

RESULTS AND DISCUSSION

Profile

Table 1 presents the frequency, percentage and distribution of respondents according to gender.

Table 1
Distribution of Respondents as to Gender

GENDER	FREQUENCY	PERCENTAGE
Male	149	47.45%
Female	165	52.55%
TOTAL	314	100%

Table 1 showed that 47.45 percent or 149 of the respondents are males and 52.55 percent or 165 of the respondents are females. It is necessary to know the gender of the respondents to determine the gender composition of the barangay residents.

Table 2 presents the frequency, percentage and distribution of respondents according to educational attainment.

Table 2
Distribution of Respondents as to Educational Attainment

EDUCATIONAL ATTAINMENT	FREQUENCY	PERCENTAGE	EDUCATIONAL ATTAINMENT	FREQUENCY	PERCENTAGE
Elementary level	37	11.78%	Vocational/ technical course	36	11.46%
Elementary graduate	45	14.33%	College level	45	14.33%
High school level	51	16.24%	College graduate	47	14.97%
High school graduate	53	16.88%	TOTAL	314	100%

Table 2 showed that 11.78 percent or 37 of the respondents have reached the elementary level, 14.33 percent or 45 are elementary graduates, 16.24 percent or 51 of the respondents have reached the high level, 16.88 percent or 51 of the respondents are secondary graduates, 11.46 percent or 36 of the respondents reached vocational/technical course, 14.33 percent or 45 have reached college level, and 14.97 percent or 47 of the respondents are

college graduates. It is necessary to know the educational attainment of the respondents to determine the educational attainment distribution among the barangay residents.

Solid Waste Management Practices

Table 3 shows the frequency, percentage, and rank of solid waste management practices of Barangay Natubleng, Buguias, Benguet residents.

Table 3
Percentage of Solid Waste Management Practices of Barangay Natubleng, Buguias, Benguet residents

ACTIVITY	FREQUENCY	PERCENTAGE	RANK
1. Selling used plastic materials (bottles, cups, etc) and used papers	280	89.17%	1 st
2. Throwing garbage or litter on trash cans	268	85.35%	2 nd
3. Segregation of garbage from the following categories: “recyclables” – examples: empty plastic bottles, empty tin cans “residuals” – example: dirty plastic bags, used tissue paper “biodegradable” – examples: vegetable trimmings, food left-over “special waste” – examples: blood, empty pesticide container	247	78.66%	3 rd
4. Leaving the trimmings, vegetable wastes on the field	244	77.71%	4 th
5. Recycling plastic bottles, glass, and other recyclables	238	75.80%	5 th
6. Composting wastes that are biodegradable and use as fertilizers	229	72.93%	6 th
7. Burning of garbage	157	50%	7 th
8. Open-dumping garbage near the house and allowed to decay	79	25.16%	8 th
9. Throwing garbage in bodies of water like rivers and creeks	55	17.52%	9 th
10. Garbage are collected by garbage collectors / trucks	52	16.56%	10 th

Table 3 showed that selling of used plastic materials and used papers are mostly being practiced by the respondents with 89.17 percent, followed by throwing of garbage or litter on trash cans with 85.35 percent. The third most practiced solid waste management activity is the segregation of garbage according to “recyclables”, “residuals”, “biodegradable”, and “special wastes with 78.66 percent. The fourth most practiced solid waste management activity is leaving the vegetable trimmings or wastes in the field with 77.71 percent, followed by recycling of plastic bottles, glass, and other recyclables with 75.80 percent. The sixth most practiced solid waste management activity is composting of biodegradable wastes and used as fertilizers with 72.93 percent, followed by burning of garbage with 50 percent. The eighth most practices solid waste management activity is open dumping of garbage near the house and allowed to decay with 25.16 percent. The ninth most practiced solid waste activity is throwing of garbage in bodies of water like rivers and creeks with 17.52 percent. Finally, the least practiced solid waste management activity is collection of garbage by a garbage truck or by garbage collectors with 16.56 percent.

Basing from the activities mentioned in the table, these items can be classified as a good and bad practice. Items 1, 2, 3, 5, 8, and 9 belong to the good practices while items 4, 6,

7, and 10 belong to the bad practices. All of the activities mentioned are included in the Republic Act 9003, where the good practices are being promoted while the bad practices are prohibited. As with the case of Barangay Natubleng, most of the residents have been performing most of the good solid waste management practices but there are still those who opt to do prohibited activities. Most of the respondents sell used plastic materials like plastic cups, plastic bottles, and they also sell used papers. The barangay midwife stated during the interview that there are people coming from barangay Abatan who visit the community and they buy used plastic materials and used papers of the residents. The barangay residents mostly perform this practice as one of their sources of income.

Level of solid waste management awareness

Table 4 shows the weighted mean and interpretation of the level of solid waste management awareness on legislations/laws.

Table 4
Level of awareness of Natubleng, Buguias, Benguet residents on Solid Waste Management Legislations/ Laws

	WEIGHTED MEAN	INTERPRETATION
Republic Act 9003 or known as the Ecological Solid Waste Management Act of 2000 is the program by the national government on proper solid waste management	2.70	MA
A Barangay Ordinance, known as the B.O. # 2, series of 1998 is created in Barangay Natubleng to prohibit all travellers especially the vegetable dealers from dumping their garbage of any kind within the barangay area	2.66	MA
A Materials Recovery Facility (MRF) is recommended as a drop-off center, a composting and a recycling facility. Natubleng has its own MRF.	2.33	PA
Wastes should be segregated into four components - as to “biodegradable”, “recyclables”, “residuals”, and “special waste”	2.78	MA
The 4 Rs (Reduce, Reuse, Recycle, and Recover) of Waste Management helps solve the problem on solid waste disposal	2.76	MA
AVERAGE WEIGHTED MEAN	2.65	MA

Legend:

Rating Scale	Verbal Interpretation	Symbol
3.25 – 4.00	Highly Aware	HA
2.50 – 3.24	Moderately Aware	MA
1.75 – 2.49	Partially Aware	PA
1.00 – 1.74	Not Aware	NA

Table 4 showed that the respondents are moderately aware on the laws/ legislations of solid waste management with an average weighted mean of 2.65. The respondents are moderately aware on the segregation of wastes into four components (WM = 2.78), the good effect of 4Rs on proper solid waste disposal (WM = 2.76), the national government program on solid waste management or the RA 9003 (WM = 2.70), and their barangay ordinance on the prohibition of illegal dumping of garbage along the highway (WM = 2.66). However, the respondents are only partially aware (WM = 2.33) that a Materials Recovery Facility (MRF) exists in their barangay. Only few residents are aware because the facility is located at the back of Natubleng police station, where it is hidden from the public’s view.

Table 5 shows the weighted mean and interpretation on the level of solid waste management awareness on health impacts.

Table 5
Level of awareness of Natubleng, Buguias, Benguet residents on Solid Waste Management Health impacts

	WEIGHTED MEAN	INTERPRETATION
Improper solid waste management leads to a variety of diseases such as, but not limited to, dengue fever, diarrhea, typhoid fever, amoebiasis, and cholera among others	2.79	MA
Dumpsites could lead to respiratory diseases such as cough and asthma due to the odor emitted	2.66	MA
Improper solid waste disposal can lead to variety of skin diseases such as eczema	2.71	MA
Blood products, contaminated needles and syringes and other hospital wastes are hazardous wastes that should not be thrown in open dumpsites and trash cans	2.76	MA
Diapers and sanitary napkins thrown improperly are sources of health problems	2.70	MA
AVERAGE WEIGHTED MEAN	2.72	MA

Legend:

Rating Scale	Verbal Interpretation	Symbol
3.25 – 4.00	Highly Aware	HA
2.50 – 3.24	Moderately Aware	MA
1.75 – 2.49	Partially Aware	PA
1.00 – 1.74	Not Aware	NA

Table 5 showed that the respondents are moderately aware of the health impacts of improper solid waste management with an average weighted mean of 2.72. The respondents are moderately aware as to the improper solid waste management that leads to a variety of diseases such as diarrhea, typhoid fever, and the like (WM = 2.79). The respondents are also moderately aware on the effect of hazardous wastes to health and that it should not be thrown in open dumpsites and trash cans (WM = 2.76), followed by the bad effect of improper solid waste disposal on the skin (WM = 2.71). They are also moderately aware on the effect of improper disposal of diapers and sanitary napkins to health (WM = 2.70), as well as the effect of the odor emitted from dumpsites that can cause respiratory diseases.

A study in Sampaloc, Manila by Bernardo (2008) can be compared in the results mentioned above. The study stated that the respondents know that the dumped garbage becomes a breeding ground for disease-causing organisms. Some household respondents said that it is possible that the dumping in certain areas caused the dengue fever suffered by some of their family members.

Table 6 shows the weighted mean and interpretation on the level of solid waste management awareness on environmental impacts.

Table 6
Level of awareness of Natubleng, Buguias, Benguet residents on Solid Waste Management
Environmental impacts

	WEIGHTED MEAN	INTERPRETATION
Solid wastes are sources of pollution that could contaminate water sources especially spring and surface waters like rivers	2.82	MA
Burning of garbage is not allowed under the Clean Air Act because of potential air pollution.	2.83	MA
Improper solid waste management contributes to global warming due to emission of gases such as methane that affect the atmosphere	2.77	MA
Open pit dumping can threaten soil quality and may lead to alteration of the natural environment of the soil	2.73	MA
Improper disposal of used oils, petroleum by-products and greases could lead to groundwater contamination	2.76	MA
AVERAGE WEIGHTED MEAN	2.78	MA

Legend:

Rating Scale	Verbal Interpretation	Symbol
3.25 – 4.00	Highly Aware	HA
2.50 – 3.24	Moderately Aware	MA
1.75 – 2.49	Partially Aware	PA
1.00 – 1.74	Not Aware	NA

Table 6 showed that the respondents are moderately aware of the environmental impacts of improper solid waste management with an average weighted mean of 2.78. The respondents are moderately aware particularly on the prohibition of burning of garbage under the Clean Air Act because of potential air pollution (WM = 2.83), solid wastes being sources of pollution that could contaminate water sources especially spring and surface waters like rivers (WM = 2.82), improper solid waste management contributes to global warming due to emission of gases such as methane that affect the atmosphere (WM = 2.77), improper disposal of used oils, petroleum by-products and greases could lead to groundwater contamination (WM = 2.76), and open pit dumping can threaten soil quality and may lead to alteration of the natural environment of the soil (WM = 2.73). A similar study by Ahmed & Quader (2011) in Narangayanj city, Bangladesh showed that there is a significant link between the improper management of solid wastes and the environmental pollution.

Table 7 shows the effect of gender on the level of solid waste management awareness.

Table 7
Effect of Gender on the level of solid waste management awareness

Gender	Mean	Degree of Freedom	T comp	T critical	Result	Conclusion
Male	3.07	311	-2.86	1.97	Significant	Reject null
Female	3.24					

Level of significance = 0.05

Table 7 showed that female respondents are more aware on the laws, health impacts, and environmental impacts of solid waste management than the male respondents. The computed T value (2.86) is greater than the critical T value (1.97), which would mean that the

result on the difference of the level of awareness between males and females are significant. Women and men tend to have different social networks and different decision-making authority within the home, which can affect the ability of both women and men to influence decision making on household or community waste management (Maclaren & Thu, 2003).

Table 8 shows the effect of educational attainment on the level of solid waste management awareness among Barangay Natubleng, Buguias, Benguet residents.

Table 8
Educational attainment on the level of solid waste management awareness

Educational attainment	Mean	Source of Variation	SS	df	MS	F	P-value	F crit	Result	Conclusion
Elementary Level	3.00	Between Groups	11.18	6	1.86	6.47	1.96E-06	2.13	Significant	Reject null hypothesis
Elementary Graduate	2.86	Within Groups	88.52	307	0.29					
High school Level	3.14	Total	99.70	313						
High school Graduate	3.34									
College Level	3.18									
College Graduate	3.07									
Technical/ Vocational	3.5									

Level of significance = 0.05

Legend:

- SS** Sum of squares
- df** Degree of freedom
- MS** Mean square
- F** Computed value

Table 8 showed that the computed F value of 6.47 is greater than the critical F value of 2.13 which would mean that there is a significant difference on the educational attainment of the respondents on the level of solid waste management awareness. It is noted in this table that the respondents who have reached technical or vocational course are slightly more aware (mean = 3.5) than those respondents belonging to the other levels of education. A study done by Haile (2011) in Mekelle, Ethiopia concluded that the educational level show significant relationship with effective solid waste management. It implies that household heads, who educated more, are better in solid waste management than the uneducated ones. This is because when household head improve his/ her existing educational level that would be a grant to raise level of understanding and mind maturity.

Perceptions on Solid Waste Management

Table 9 shows the weighted mean and interpretation of the level of solid waste management perceptions among Barangay Natubleng, Buguias, Benguet residents on factors that lead to environmental threat of improper solid waste management.

Table 9
Level of perceptions of Natubleng, Buguias, Benguet residents on factors that lead to environmental threat of improper solid waste management

FACTORS	WEIGHTED MEAN	INTERPRETATION
Public littering and illegal dumping of garbage	3.14	A
Lack of leadership among the barangay authorities to implement the law	3.05	A
Lack of appropriate dump sites	2.77	A
Lack of will of the residents to comply with the Solid Waste Management Act	2.75	A
Lack of awareness of the existing law on Solid Waste Management	2.70	A
AVERAGE WEIGHTED MEAN	2.88	A

Legend:

Rating Scale	Verbal Interpretation	Symbol
3.25 – 4.00	Strongly Agree	SA
2.50 – 3.24	Agree	A
1.75 – 2.49	Disagree	D
1.00 – 1.74	Strongly Disagree	SD

Table 9 showed that the respondents agree on all of the factors mentioned that lead to environmental threat of improper solid waste management with an average weighted mean of 2.88. Public littering and illegal dumping of garbage has the most agreed factor (WM = 3.14), followed by lack of leadership among the barangay authorities to implement the law (WM = 3.05). The respondents also agree that one of the factors leading to the environmental threat of improper solid waste management is lack of appropriate dump sites (WM = 2.77), and this issue has been even raised by some of the point persons who were interviewed. The barangay captain verbalized that a lack of dumpsite has been the problem that they are trying to solve and that they have been consistently looking for acceptable locations of their own dumpsite. The respondents also agreed that a lack of will to comply with the solid waste management act is a factor leading to the environmental threat of improper solid waste management (WM = 2.75) followed by lack of awareness to the existing law on solid waste management (WM = 2.70).

A study done by Tatlonghari & Jamias (2010) on the Solid Waste Management knowledge, attitudes, and practices of Sta. Rosa, Laguna residents stated that turning intention to desirable behavior and creating favorable social and political environments should not only be the concern of local officials but also of residents in solid waste management. Another study done in Karnataka, India by Nandini (2013) found out that most of the households feel that the lack of stiff penalty and non-execution of law is the basic problem for the effective management of waste.

Table 10 shows the weighted mean and interpretation of the solid waste management perceptions among Barangay Natubleng, Buguias, Benguet residents on solutions to proper solid waste management.

Table 10
Perceptions of Natubleng, Buguias, Benguet residents on solutions to proper solid waste management

SOLUTIONS	WEIGHTED MEAN	INTERPRETATION
Recycling of plastic bottles, tin cans, other non-biodegradable wastes	3.53	SA
Paying for garbage collection service	3.10	A
Attending to waste management awareness seminars such as Information Education Communication (IEC) campaigns	3.13	A
Creation of a livelihood program related to solid waste management sponsored by Department of Environment and Natural Resources (DENR), Local Government Units particularly the General Services Office, or Non- Government Organizations	3.48	SA
Participating in clean up drives of the barangay	3.15	A
AVERAGE WEIGHTED MEAN	3.28	SA

Legend:

Rating Scale	Verbal Interpretation	Symbol
3.25 – 4.00	Strongly Agree	SA
2.50 – 3.24	Agree	A
1.75 – 2.49	Disagree	D
1.00 – 1.74	Strongly Disagree	SD

Table 10 showed that the respondents have a favourable perception on the solutions to proper solid waste management with an average weighted mean of 3.28. The respondents strongly agree on recycling plastic bottles, tin cans, and other non-biodegradable wastes (WM = 3.53) and creation of a livelihood program related to solid waste management (WM = 3.48) while they agree on participating in clean up drives of the barangay (WM = 3.15), attending to awareness seminars on solid waste management (WM = 3.13), and paying for garbage collection service (WM = 3.10). The respondents strongly agree on the perceptions on the solutions to proper solid waste management with an average weighted mean of 3.28.

A study on the knowledge, attitudes, and practices on Solid Waste Management in Mogadishu, Somalia prepared by Mwaura, Owillah, & Dahir (2012) stated that communities are ready to support a garbage collection service even if they are to take it to a central point away from the households and business premises and would further be willing to pay for the service. They would in addition support a set of rules that prevent illegal dumping of garbage and rather recycle food cans and plastics.

Table 11 shows the effect of gender on the level of solid waste management awareness.

Table 11
Effect of Gender on the level of solid waste management perceptions

Gender	Mean	df	T stat	T critical	Result	Conclusion
Male	3.33	312	-0.82	1.97	Not Significant	Accept null
Female	3.35					

Level of significance = 0.05

Table 11 showed that females (mean = 3.35) have slightly higher level of favourable perceptions than males (mean = 3.33), but this has no significant difference as to their level of perceptions on solid waste management since the computed T value (0.82) is lesser than the critical T value (1.97). Similarly, a study by Macawile & Su (2009) in Dasmariñas, Cavite on local government officials' perceptions and attitudes towards their community's solid waste

management found out that men and women have equal roles, responsibilities, perceptions and attitudes towards their community's solid waste management. The study added that men and women local government officials' perceptions and attitudes towards solid waste management are not significantly different from each other ($p>0.05$). The respondents recognized that attaining sustainable waste management is a joint responsibility of the government and its community members.

Table 12 shows the effect of educational attainment on the level of solid waste management awareness among Barangay Natubleng, Buguias, Benguet residents.

Table 12
Educational attainment on the level of solid waste management perceptions

Educational attainment	Mean	Source of Variation	SS	df	MS	F	P-value	F crit	Result	Conclusion
Elementary Level	3.42	Between Groups	1.18	6	0.20	0.98	0.44	2.13	Not significant	Accept null hypothesis
Elementary Graduate	3.24	Within Groups	61.18	307	0.20					
High school Level	3.32	Total	62.36	313						
High school Graduate	3.38									
College Level	3.28									
College Graduate	3.41									
Technical/Vocational	3.35									

Level of significance = 0.05

Legend:

- SS** Sum of squares
- df** Degree of freedom
- MS** Mean square
- F** Computed value

Table 12 showed that the computed F value (0.98) is lesser than the critical F-value (2.13) signifying that there is no significant difference on the level of perceptions on solid waste management in terms of the barangay residents' educational attainment. A similar case is also with the study of Lutui (2001) in Tonga where the waste management practices, perceptions, and attitudes seemed not to be influenced by educational level and other demographic variables. This implies that the groups which people identify in Tongan society regarding attitudes, feelings, and behaviours are strongly influenced by the society's prototypical and normative behaviour at large. Perceptions and attitudes of an individual are influenced by the transcending power of the broader Tongan social, economic, political, and cultural behaviour.

CONCLUSIONS AND RECOMMENDATIONS

The study concludes that most of the residents of barangay Natubleng, Buguias, Benguet have been performing most solid waste management practices that are promoted under the provisions of the Republic Act 9003. This means that as far as solid waste management is concerned, the residents are capable of doing such activities that would

contribute to the development of their barangay. Some residents still do prohibited acts such as burning of wastes due to the fact that they have no dumpsite.

The residents of barangay Natubleng, Buguias, Benguet are moderately aware on the solid waste management laws and regulations, health impacts, and environmental impacts. Their gender and educational attainment was proven to have an effect on their awareness. This denotes that the barangay residents' understanding of their solid waste management situation is satisfactory but they still need to have more intense awareness campaigns in order to achieve a better outcome.

Finally, the residents of barangay Natubleng, Buguias, Benguet have favourable perceptions on the factors that lead to the environmental threat of improper solid waste management and on the solutions to proper solid waste management. There was also no significant difference on the perceptions of the residents as to their gender and educational attainment. This means that they have a positive behaviour on managing their solid wastes regardless of their gender and educational attainment.

The researcher recommends the following to further enhance the study:

A. For the community

- An information dissemination campaign regarding solid waste management is a priority in the

barangay. This would involve the participation of the barangay residents and barangay authorities. This campaign would put an emphasis to the solid waste management legislations, health impact, environmental impact, and proper solid waste management solutions.

- A comprehensive barangay solid waste management plan that is adapted in their community should be created in order to have a clearer vision of a better solid waste management program.
- A similar study may need to be done on the nearby towns in order to come up with a more broad analysis of the current situation of Solid Waste Management in the locale which may somehow help in establishing their own dumpsite.
- The barangay officials can create sustainable solid waste management programs since most of the residents resort to selling of used plastic materials and used papers.

B. For the research

- The variables used in the study can be expanded with the inclusion of other demographic factors like age, occupation, or socio-economic status.
- A correlation among knowledge, attitudes, and practices of solid waste management can be utilized to improve the study.
- A similar study can be formulated in other communities in order to compare their solid waste management situations.

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Super Connectivity of Burnt Pancake Graphs

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Abstract

The reliability of an interconnection network is an important issue for multiprocessor systems. This paper studies a reliability measure, called super connectivity of the n -dimensional burnt pancake graph BP_n for $n \geq 2$. Given a graph G , the super connectivity of G , denoted by $\kappa'(G)$, is the minimum cardinality of vertices whose removal results in a disconnected graph that contains no isolated vertex. We determine that $\kappa'(BP_n) = 2n - 2$ for $n \geq 2$.

Keywords: *connectivity, super connectivity, burnt pancake graphs, fault-tolerance, multiprocessor systems, interconnection network*

1 Introduction

In multiprocessor systems, processors are connected based on a specific interconnection network. An interconnection network is usually represented by a graph in which vertices represent processors and edges represent links between processors. Let G be an undirected graph. We use $V(G)$ and $E(G)$ to denote the sets of vertices and edges of G , respectively. Also, $|V(G)|$ and $|E(G)|$ denote the numbers of vertices and edges of G , respectively.

Because of the rapid development of the VLSI technology, components within a multiprocessor system have been increasing. It is inevitable that they may be faulty while the system is in operation. Two important factors for measuring the reliability of an interconnection network are the connectivity and the edge connectivity. A graph is *trivial* if it is a vertex. The *connectivity* (respectively, *edge connectivity*) of a graph G , denoted by $\kappa(G)$ (respectively, $\lambda(G)$), is the minimum number of vertices (respectively, edges) whose removal results in a disconnected graph or a trivial graph. Hence, $\kappa(K_n) = n - 1$ where K_n is the complete graph having n vertices. A graph G is *k-connected* (respectively, *k-edge-connected*) if $\kappa(G) \geq k$ (respectively, $\lambda(G) \geq k$). It is well known that $\kappa(G) \leq \lambda(G) \leq \delta(G)$, where $\delta(G)$ is the minimum degree of G . The larger $\kappa(G)$ or $\lambda(G)$ is, the more reliable the network G is.

A more refined measure for the reliability of an interconnection network, called super connectivity, was proposed in [2, 4]. For an arbitrary subset $F \subseteq V(G)$, we use $G - F$ to denote the graph obtained by removing all the vertices in F from G . The *components* of a graph are its maximal connected subgraphs. Letting $F \subseteq V(G)$, F is called a *super vertex-cut* of G if $G - F$ is disconnected and every component has at least two vertices. Super vertex-cuts do not always exist. We say that a graph G is *k-super connected* if, for every $F \subseteq V(G)$ with $|F| \leq k - 1$, F is not a super vertex-cut. The *super connectivity* of a graph G , denoted by $\kappa'(G)$, is the minimum cardinality over all super vertex-cuts if there is any. The super connectivity or the super edge-connectivity of some interconnection networks has been studied [2, 5, 7, 8, 9, 10, 11, 12, 13].

In this paper, we obtain the super connectivity of the n -dimensional burnt pancake graph BP_n [6]. The burnt pancake graph is a variant of a pancake graph [1]. Burnt pancake graphs can fill the gaps of incremental expandability of pancake graphs. We shall prove that $\kappa'(BP_n) = 2n - 2$ for $n \geq 2$.

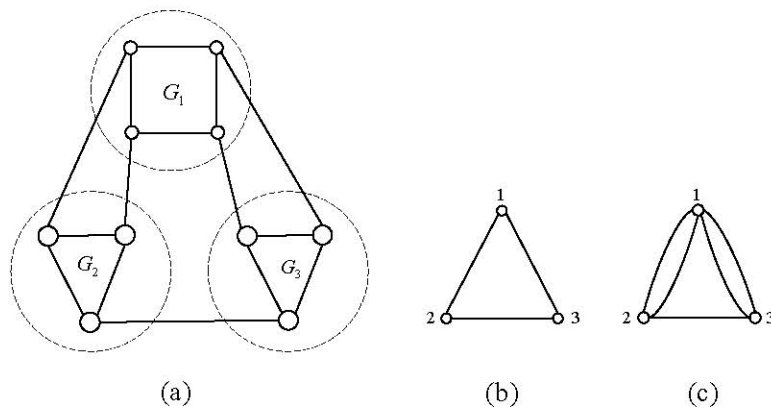
The outline of this paper is as follows. In Section 2, we give some notations and definitions which can be used in this paper. Section 3 determines the super connectivity of BP_n .

2 Preliminaries

A *matching* of a graph is a set of pairwise disjoint edges. A vertex is *saturated* if it is incident to an edge in the matching. A *perfect matching* is a matching which saturates all the vertices of the graph. We adopt the notation in [3]. The notation $PM(G_1, G_2, \dots, G_l)$ represents a graph constructed from G_1, G_2, \dots, G_l by adding a perfect matching PM in $\{(u, v) \mid u \in V(G_i) \text{ and } v \in V(G_j) \text{ for } 1 \leq i, j \leq l \text{ and } i \neq j\}$.

Let $G = PM(G_1, G_2, \dots, G_l)$. In what follows, we use $CS(G)$ to denote a condensed simple graph of G in which the vertex set $V(CS(G)) = \{1, 2, \dots, l\}$ and there is an edge between two vertices i and j of $CS(G)$ if there is an edge between G_i and G_j . Also, we use $CM(G)$ to denote

a condensed multigraph of G in which the vertex set $V(CM(G)) = \{1, 2, \dots, l\}$ and there are exactly k edges between two vertices i and j of $CM(G)$ if there are k edges between G_i and G_j . For instance, let $G = PM(G_1, G_2, G_3)$ be a graph as shown in Figure 1(a). Then, $CS(G)$ and



$CM(G)$ are illustrated in Figure 1(b) and 1(c) respectively. Let x be a vertex of G_i . For convenience, we also use x' to represent the neighbor of x which is a vertex of G_j with $j \neq i$.

Figure 1: (a) A graph $G = PM(G_1, G_2, G_3)$, (b) $CS(G)$, and (c) $CM(G)$.

For an arbitrary positive integer n , we denote the set $\{1, 2, \dots, n\}$ by $[n]$. A permutation $\langle a_1 a_2 \dots a_n \rangle$ is called a signed permutation of $[n]$ if $\{|a_1|, |a_2|, \dots, |a_n|\} = [n]$. In what follows, we use the notation \bar{i} to represent the signed value $-i$.

Definition 1 Let $u = \langle a_1 a_2 \dots a_n \rangle$ be a signed permutation of $[n]$. Then operations $u^{(i)}$, for $i \in [n]$, are defined as $u^{(i)} = \langle \bar{a}_i \bar{a}_{i-1} \dots \bar{a}_1 a_{i+1} \dots a_n \rangle$. These operations are called prefix reversal operations.

Definition 2 [6]. For $n \geq 1$, an n -dimensional burnt pancake graph, denoted by BP_n , is an undirected graph in which the vertex set $V(BP_n) = \{u \mid u \text{ is a signed permutation of } [n]\}$ and the edge set $E(BP_n) = \{(u, u^{(i)}) \mid u \in V(BP_n), 1 \leq i \leq n\}$.

From the above definition, the n -dimensional burnt pancake graph BP_n is n -regular, triangle-free, and has $n! \times 2^n$ vertices. Furthermore, $BP_n = PM(G_1, G_2, \dots, G_{2n})$ ($n \geq 2$) where, for $1 \leq i \leq n$, G_i (respectively, G_{i+n}) is a BP_{n-1} with the vertex set $V(G_i) = \{a_1 a_2 \dots a_{n-1} i \mid a_1 a_2 \dots a_{n-1} i \in V(BP_n)\}$ (respectively, $V(G_{i+n}) = \{a_1 a_2 \dots a_{n-1} \bar{i} \mid a_1 a_2 \dots a_{n-1} \bar{i} \in V(BP_n)\}$). Also, for $n \geq 2$, $CS(BP_n)$ is a graph in which the vertex set $V(CS(BP_n)) = \{i \mid i \in [n]\}$ and the edge set $E(CS(BP_n)) = \{(i, j) \mid |i|, |j| \in [n] \text{ and } j \neq i, \bar{i}\}$. Hence, $CS(BP_n)$ has $2n$ vertices and is $(2n - 2)$ -regular.

3 Super connectivity of BP_n

In this section, we discuss the super connectivity of the burnt pancake graphs. Two useful lemmas are as follows.

Lemma 1 Assume that $n \geq 2$. There are $2n - 2$ vertex-disjoint paths between two arbitrary vertices of $CS(BP_n)$. Furthermore, $CM(BP_n)$ is $(2n-2)$ -edge-connected and $CM(BP_n) - x$ is $(n - 1)$ -edge-connected for every $x \in V(CM(BP_n))$.

Proof. Let i and j be two arbitrary vertices of $CS(BP_n)$. We shall show that there are $2n - 2$ vertex-disjoint paths between them. If $j = \bar{i}$, then $\{i \rightarrow k \rightarrow j \mid k \in [n] \text{ and } k \neq i, \bar{i}\}$ is a set of $2n - 2$ vertex-disjoint paths between i and j . If $j \neq \bar{i}$, then $\{i \rightarrow k \rightarrow j \mid k \in [n] \text{ and } |k| \neq i, j\} \cup \{i \rightarrow j, i \rightarrow \bar{j} \rightarrow \bar{i} \rightarrow j\}$ is a set of $2n - 2$ vertex-disjoint paths between i and j . Furthermore, because there are $2n - 2$ vertex-disjoint paths between two arbitrary vertices of $CS(BP_n)$, $CS(BP_n)$ and $CM(BP_n)$ are $(2n - 2)$ -edge-connected. Also, $CM(BP_n) - x$ is $(2n - 3)$ -edge-connected for every $x \in V(CM(BP_n))$, which implies that $CM(BP_n) - x$ is $(n - 1)$ -edge-connected as $2n - 3 \geq n - 1$ for $n \geq 2$. \square

In what follows, we let $BP_n = PM(G_1, G_2, \dots, G_{2n})$ where G_i is a BP_{n-1} for any $1 \leq i \leq 2n$.

Lemma 2 BP_n is n -connected for $n \geq 1$.

Proof. We prove that BP_n is n -connected for $n \geq 1$ by induction on n . Since $BP_1 = K_2$, BP_1 is 1-connected. Assume that BP_{n-1} is $(n - 1)$ -connected for $n \geq 2$. Then, we show that BP_n is n -connected as follows.

Let F be an arbitrary vertex set of BP_n and f be $|F|$. For all $1 \leq i \leq 2n$, F_i denotes $F \cap V(G_i)$ and f_i denotes $|F_i|$. Assume that $f \leq n - 1$. We shall show that $BP_n - F$ is connected as follows. We consider the following two cases.

Case 1. $f_i \leq n - 2$ for all $1 \leq i \leq 2n$. By induction hypothesis, G_i is $(n - 1)$ -connected for every i , so $G_i - F_i$ is connected in this case. Further, by Lemma 1, $CM(BP_n)$ is $(2n - 2)$ -edge-connected for $n \geq 2$. Since $2n - 2 \geq n$ for $n \geq 2$, $CM(BP_n)$ is n -edge-connected, which implies that $BP_n - F$ is connected.

Case 2. $f_k = n - 1$ for some k . We have $F = F_k$ in this case. That is, $BP_n - V(G_k)$ is fault-free. By Lemma 1, there are $2n - 2$ vertex-disjoint paths between two arbitrary vertices of $CS(BP_n)$. Then $CS(BP_n)$ is 2-connected as $2n - 2 \geq 2$ for $n \geq 2$. Hence, $BP_n - V(G_k)$ is connected. Further, each vertex of G_k is directly connected to a vertex of $BP_n - V(G_k)$. This implies that $BP_n - F$ is connected. \square

Given a vertex u of a graph G , the neighborhood $N_G(u)$ of u in G is the set of all vertices which are adjacent to u . A graph G is said to be k -regular if $|N_G(u)| = k$ for each vertex u of G . Given a vertex set V' of G , $N_G(V')$ denotes $\bigcup_{u \in V'} N_G(u) - V'$. For brevity, $N_G(\{u, v\})$ is written as $N_G(u, v)$.

Theorem 1 $\kappa'(BP_n) = 2n - 2$ for $n \geq 2$.

Proof. We first show that BP_n is $(2n-2)$ -super connected for $n \geq 2$. Let F be an arbitrary vertex set of BP_n and f be $|F|$. For every $1 \leq i \leq 2n$, F_i denotes $F \cap V(G_i)$ and f_i denotes $|F_i|$. Assume that $f \leq 2n - 3$. We shall show that either (1) $BP_n - F$ is connected, or (2) $BP_n - F$ consists of isolated vertices and another component as follows. We consider the following two cases.

Case 1. $f_i \leq n - 2$ for all $1 \leq i \leq 2n$. By Lemma 2, G_i is $(n - 1)$ -connected for every i . Hence, $G_i - F_i$ is connected for every $1 \leq i \leq 2n$ in this case. Further, because $CM(G)$ is $(2n - 2)$ -edge-connected, $BP_n - F$ is connected.

Case 2. $f_k \geq n - 1$ for some k . We first claim that $BP_n - V(G_k) - F$ is connected and prove it as follows. We have $f - f_k \leq n - 2$ and $f_i \leq n - 2$ for all $i \neq k$ in this case. By Lemma 2, G_1, G_2, \dots, G_{2n} are $(n - 1)$ -connected, so $G_i - F_i$ is connected for all $i \neq k$. Further, by Lemma 1, $CM(G) - x$ is $(n - 1)$ -edge-connected for all $x \in V(CM(BP_n))$. Then $BP_n - V(G_k) - F$ is also connected since $f - f_k \leq n - 2$. Hence, the claim follows.

It now remains to prove that, for any vertex $x \in V(G_k - F_k)$, if x is not an isolated vertex of $BP_n - F$, there is a path connecting x to $BP_n - V(G_k) - F$. Suppose that $x \in V(G_k - F_k)$ is not an isolated vertex of $BP_n - F$. If x 's is fault-free, then we are done. Therefore, we suppose that x ' is faulty. Furthermore, since x is not an isolated vertex of $BP_n - F$, there exists a fault-free vertex $y \in N_{G_k}(x)$. Similarly, we suppose that y ' is faulty, otherwise $x \rightarrow y \rightarrow y'$ is a path connecting x to $BP_n - V(G_k) - F$ and we are done. By Lemma 2, G_1, G_2, \dots, G_{2n} are $(n - 1)$ -connected, which implies that $\delta(G_k) \geq n - 1$. Further, since G_k is triangle-free, $|N_{G_k}(x, y)| \geq 2(n - 1) - 2 = 2n - 4$. Then there exists a vertex $z \in N_{G_k}(x, y)$ such that z and z' are both fault-free, otherwise $|F| \geq |N_{G_k}(x, y)| + |\{x', y'\}| \geq (2n - 4) + 2 = 2n - 2$, which contradicts $|F| \leq 2n - 3$. Then, $x \rightarrow z \rightarrow z'$ or $x \rightarrow y \rightarrow z \rightarrow z'$ is a path connecting x to $BP_n - V(G_k) - F$.

Hence, BP_n is $(2n - 2)$ -super connected for $n \geq 2$.

Let (a, b) be an edge of BP_n for $n \geq 2$. Then $N(a, b)$ is a super vertex-cut of BP_n and $|N(a, b)| = 2n - 2$, which implies that $\kappa'(BP_n) \leq 2n - 2$. Hence, $\kappa'(BP_n) = 2n - 2$ for $n \geq 2$. \square

4 Conclusion

The super connectivity, a more refined measure than the connectivity, is able to demonstrate high resilience of an interconnection network. In this paper, we have shown that $\kappa'(BP_n) = 2n - 2$ for $n \geq 2$.

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Using social marketing model to persuade the women to do mammography

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Abstract:

Objectives: The role of mammography in early detection of breast cancer is evident and persuasion to do that is very important in health sector. Majority of the interventions are based on education and informing and there has been less attention to making mammography cost beneficent. This study aimed at assessing the effect of a social marketing-based intervention to persuade to do mammography in Bojnord, Iran.

Methods: In this quasi-experimental study, two villages around Bojnurd with similar demographic characteristics, considered as intervention and comparison groups randomly. All 35- years and older women consist of 343 women (151 in intervention and 191 in comparison groups) were identified. To obtain the main idea for intervention, and exploring the viewpoints of target group about mammography, a formative research combined of a quantitative survey (through completing the questionnaire for assessing the women's attitudes based on health belief model) and a qualitative study (through establishing four focus group discussions) was done. According to the gathered and analyzed data, an intervention focused on the main barriers designed and implemented through four weeks. One week after the intervention, the number of mammograms in two villages was determined and compared.

Results: Quantitative survey showed that the mean of the scores related to expending time and high economical costs (perceived barriers); not remember to do mammography and fear of exposure to x- ray is less than other constructs. In qualitative study, time expending and high economical cost considered as two main factors related to not doing mammography. After the intervention, 48.1 percent of the women in intervention group went to do mammography and there are no change similar results in comparison group.

Conclusions: Educational interventions are not enough to persuade women to do mammography and we have to consider their perceived barriers and concerns. One of the most effective approach to promote an idea, behavior or service, is identifying the viewpoints of target group and design them as consumer- oriented programs. So, acceptance of the idea and behavior will be cost-beneficent.

Key words: Breast Cancer, Mammography, Social marketing

Vaccination Rules for an Epidemic Model

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Abstract. This paper presents a simple SEIR (susceptible plus infected plus infectious plus removed populations) propagation disease model. The model takes into account the total population amounts as a refrain for the illness transmission since its increase makes more difficult contacts among susceptible and infected. It also describes the infectious population as the output of a dynamic system. Stability and positivity issues are discussed.

Keywords. Epidemic models, control, SEIR epidemic models, stability.

1. Introduction

Important control problems nowadays related to Life Sciences are the control of ecological models like, for instance, those of population evolution (Beverton-Holt model, Hassell model, Ricker model etc.) via the online adjustment of the species environment carrying capacity, that of the population growth or that of the regulated harvesting quota as well as the disease propagation via vaccination control. In a set of papers, several variants and generalizations of the Beverton-Holt model (standard time-invariant, time-varying parameterized, generalized model or modified generalized model) have been investigated at the levels of stability, cycle-oscillatory behavior, permanence and control through the manipulation of the carrying capacity. The design of related control actions has been proved to be important in those papers at the levels, for instance, of aquaculture exploitation or plague fighting. On the other hand, the literature about epidemic mathematical models is exhaustive. The sets of models include the most basic ones

- SI- models where not removed- by -immunity population is assumed. In other words, only susceptible and infected populations are assumed.
- SIR models, which include susceptible plus infected plus removed- by -immunity populations.
- SEIR- models where the infected populations is split into two ones (namely, the “infected” which incubate the disease but do not still have any disease symptoms and the “infectious” or “infective” which do have the external disease symptoms).

Those models have also two major variants, namely, the so-called “pseudo-mass action models”, where the total population is not taken into account as a relevant disease contagious factor and the so-called “true-mass action models”, where the total population is more realistically considered as an inverse factor of the disease transmission rates). There are many variants of the above models, for instance, including vaccination of different kinds: constant, impulsive, discrete - time etc., incorporating point or distributed delays, oscillatory behaviours etc. . On the other hand, variants of such models become considerably simpler for the illness transmission among plants . It is assumed that SEIR - model is of the true-mass action type.

2. SEIR epidemic model

Let $S(t)$ be the “susceptible” population of infection at time t , $E(t)$ the “infected” (i.e. those which incubate the illness but do not still have any symptoms) at time t , $I(t)$ is

the “infectious” (or “infective”) population at time t , and $R(t)$ is the “removed –by-immunity” (or “immune”) population at time t . Consider the SEIR-type epidemic model:

$$\dot{S}(t) = -\mu S(t) + \omega R(t) - \beta \frac{S(t)I(t)}{N(t)} + \nu N(t)(1 - V(t))$$

$$\dot{E}(t) = \beta \frac{S(t)I(t)}{N(t)} - (\mu + \sigma)E(t)$$

$$\dot{I}(t) = -(\mu + \gamma)I(t) + \sigma E(t)$$

$$\dot{R}(t) = -(\mu + \omega)R(t) + \gamma(1 - \rho)I(t) + \nu N(t)V(t)$$

subject to initial conditions $S_0 = S(0) \geq 0$, $E_0 = E(0) \geq 0$, $I_0 = I(0) \geq 0$ and $R_0 = R(0) \geq 0$ under the vaccination constraint $V: \mathbf{R}_{0+} \rightarrow \mathbf{R}_{0+}$. In the above SEIR –

model, N is the total population, μ is the rate of deaths from causes unrelated to the infection, $\rho \in [0, 1]$ takes into account the number of deaths due to the infection, ω is the rate of losing immunity, β is the transmission constant (with the total number of infections per unity of time at time t being $\beta \frac{S(t)I(t)}{N(t)}$), σ^{-1} and γ^{-1} are, respectively,

the average durations of the latent and infective periods. If $\nu = \mu$ then neither the natural increase of the population nor the loss of maternal lost of immunity of the newborns is taken into account. If $\nu > \mu$ such a lost of immunity is considered. All the above parameters are nonnegative. Note the following:

a) $\sigma > 0$ since, otherwise, the average duration of the latent period is infinity and the infectious are unrelated to the infected from; b) $\gamma > 0$ since, otherwise, the average duration of the infectious period is infinity and the whole immune population is not dynamically coupled to the infectious one; c) If $\mu = 0$ then the mortality by causes unrelated to the disease is not taken into account. If $\nu = \mu$ then neither the loss of maternal immunity of the newborns nor the natural increase of the population are considered. If $\rho = 0$ then it is assumed that there is no mortality directly caused by the disease; d) It is nonsense to eventually fix to zero the disease transmission constant β since this would decouple the infected dynamics from the susceptible one; e) Some particular modelling variants (so-called pseudo mass-action type models) fix to unity the total population $N(t)$. This modelling strategy does not consider that the disease

transmission of few susceptible and infected among large population numbers moderates the disease evolution as the SEIR- model (so called mass action – type models) does.

Assertion 1. Assume that $I(t) = \dot{I}(t) = 0; \forall t \geq t_0$. Then, $E(t) = \dot{E}(t) = 0; \forall t \geq t_0$ and $S(t) + R(t) \rightarrow N(t) \rightarrow 0$ as $t \rightarrow \infty$ and $N(t)$ is uniformly bounded for all time if $\mu > \nu$. If furthermore $\nu = \mu$ then $\lim_{t \rightarrow \infty} (S(t) + R(t)) = N = N(t_0)$. If $\gamma \rho = 0$ then, irrespective of the initial conditions, the overall population is constant if $\nu = \mu$, the overall population diverges if $\nu > \mu$ and the overall population asymptotically converges to zero if $\nu < \mu$.

The following result extend Assertion 1 to the case when I (t) vanishes asymptotically.

Assertion 2. Assume that $I(t) = \dot{I}(t) \rightarrow 0$ as $t \rightarrow \infty$. If $\sigma > 0$ then, $E(t) \rightarrow 0$ and $S(t) + R(t) \rightarrow N(t)$ as $t \rightarrow \infty$

The set of parameters parameterizing the SEIR -model is not perfectly known so that they should be estimated online to synthesize a vaccination law based on estimations.

3. Positivity and stability

The vaccination strategy has to be implemented so that the SEIR model be positive in the usual sense that none of the populations, namely, susceptible, infected, infectious and immune be negative at any time. This requirement follows directly from the nature of the problem at hand.

Theorem 1. Assume that $\min(\omega, \gamma, \sigma, \alpha - \beta) \geq 0$ and that a piecewise – continuous vaccination function is used. Then, all the solutions of the SEIR model satisfy; $S(t), E(t), I(t), R(t) \in [0, N] \forall t \in \mathbf{R}_{0+}$ if $\gamma \rho = 0$ and $\nu = \mu \geq 0$ or if $0 \leq \nu < \mu$ and $\gamma \rho \geq 0$. Furthermore, either $N(t), S(t), E(t), I(t), R(t) \rightarrow 0$ as $t \rightarrow \infty$ (i.e. the total population asymptotically extinguishes) with all the populations being uniformly bounded or all the partial and total populations are bounded and the infection does not asymptotically vanishes in the second case with $0 \leq \nu < \mu$ and $\gamma \rho > 0$.

The above property is essential to discuss the stability of the SEIR- model since all the partial populations are upper-bounded by the total population $N(t)$ for all time. It is also essential for appropriate description of the real problem through the mathematical model

Corollary 1. Assume that $\nu \leq \mu$. Then, the SEIR-model is stable.

An useful vaccination control function can be with the goal of decreasing appropriately the numbers of susceptible, infected and infectious while including the nonlinear term involving the product $S(t)I(t)$ of susceptible and infectious. One has to solve two important issues, namely, a) the parameters and partial populations of the SEIR model are not usually known precisely even if the model is considered valid for a particular study, b) the only populations being directly measurable with a certain accuracy degree at any time are the total one $N(t)$ and the infectious one $I(t)$. For the remaining populations what it can be said is that $S(t) + E(t) + R(t) = N(t) - I(t)$ at any time. It could be calculated from the model equations in the case that the model parameters and the initial conditions are fully known. Otherwise, they have to be estimated from parameter and initial condition estimated.

4. Observer-based vaccination control strategy for the SEIR-model

It turns out that while the assumption of the knowledge of the total population N is not quite restrictive in practice, the knowledge of the individual various partial populations of susceptible, infected, infectious and immune may be considered severely restrictive. It is seen that if the partial initial populations are unknown then their evolution through time cannot be computed in a closed form from the differential system. A practical solution to circumvent the problem might be to estimate them based on percentages of the total population through time from experimental knowledge of the disease propagation. Another solution may be to estimate them online by using an on-line observer. The current manuscript focuses this solution by using a SEIR – estimation algorithm (observer) of the SEIR model which estimates through time the individual populations being involved. The vaccination strategy is obtained as a control strategy from the data supplied by the observer through time. Such a strategy does not require the knowledge of the partial populations to organize and perform the vaccination strategy. The estimates of the various individual populations are denoted by the same

notations as the real populations with hat superscripts, namely, $\hat{S}(t)$, $\hat{E}(t)$, $\hat{I}(t)$, $\hat{R}(t)$,
Thus, consider the SEIR-type observer for the SEIR- epidemic model as follows:

$$\dot{\hat{S}}(t) = -\hat{\mu}\hat{S}(t) + \hat{\omega}\hat{R}(t) - \hat{\beta}\frac{\hat{S}(t)\hat{I}(t)}{N} + \hat{\mu}N(1-V(t))$$

$$\dot{\hat{E}}(t) = \hat{\beta}\frac{\hat{S}(t)\hat{I}(t)}{N} - (\hat{\mu} + \hat{\sigma})\hat{E}(t)$$

$$\dot{\hat{I}}(t) = -(\hat{\mu} + \hat{\gamma})\hat{I}(t) + \hat{\sigma}\hat{E}(t)$$

$$\dot{\hat{R}}(t) = -(\hat{\mu} + \hat{\omega})\hat{R}(t) + \hat{\gamma}\hat{I}(t) + \hat{\mu}NV(t)$$

subject to initial conditions $\hat{S}_0 = \hat{S}(0) \geq 0$, $\hat{E}_0 = \hat{E}(0) \geq 0$, $\hat{I}_0 = \hat{I}(0) \geq 0$ and $\hat{R}_0 = \hat{R}(0) \geq 0$ under the constant population constraint

$$N = N(0) = \hat{S}(t) + \hat{E}(t) + \hat{I}(t) + \hat{R}(t) = \hat{S}(0) + \hat{E}(0) + \hat{I}(0) + \hat{R}(0)$$

equalizing its total estimated value for all time; $\forall t \in \mathbf{R}_{0+}$ and the vaccination law $V: \mathbf{R}_{0+} \rightarrow \mathbf{R}_{0+}$ generated by

$$V(t) = \frac{1}{\hat{\mu}N} (k_1 \hat{S}(t) + k_2 \hat{E}(t) + k_3 \hat{I}(t) + k_4 \hat{R}(t) + k_5 \hat{S}(t)\hat{I}(t) + gN)$$

where k_i ; $i=1,2, \dots, 5$ The estimations of the above parameters can be done, through the use of available “a priori” knowledge, to be identical to the true values if those ones are known or estimated on- line from data measurements. Through this manuscript, we assume that those estimated parameters are fixed but not necessarily identical to the true parameters and all of them are nonnegative. The pertinent substitution yield the following combined observer- controller for the SEIR model:

$$\dot{\hat{x}}(t) = \hat{A}(t)\hat{x}(t) + \hat{b}$$

$$\hat{x}(t) := (\hat{S}(t), \hat{E}(t), \hat{I}(t), \hat{R}(t))^T ; \hat{\beta}_1 := \hat{\beta}/N$$

$$\hat{b} := ((\hat{\mu} - g)N, 0, 0, gN)^T$$

$$\hat{A}(t) := \begin{bmatrix} -(\hat{\mu} + k_1 + (\hat{\beta}_1 + k_5)\hat{I}(t)) & -k_2 & -k_3 & \hat{\omega} - k_4 \\ \hat{\beta}_1 \hat{I}(t) & -(\hat{\mu} + \hat{\sigma}) & 0 & 0 \\ 0 & \hat{\sigma} & -(\hat{\mu} + \hat{\gamma}) & 0 \\ k_1 + k_5 \hat{I}(t) & k_2 & \hat{\gamma} + k_3 & -(\hat{\mu} + \hat{\omega} - k_4) \end{bmatrix}$$

The substitution of the above equations yields the following compacted SEIR observer-based vaccination controlled SEIR- model

$$\dot{\hat{x}}(t) = A(t)x(t) + B(t)\hat{x}(t) + b$$

which is used for positivity and stability analysis.

The SEIR model is described by the following parameters taken from an influenza outbreak in an English college, also used

$$\frac{1}{\mu} = 255 \text{ days}, \frac{1}{\sigma} = 2.2 \text{ days}, \frac{1}{\omega} = 15 \text{ days} \quad \beta = 1.66 \text{ days}^{-1}$$

while it is taken $\gamma = \sigma$. The initial conditions are given by, $S(0) = 400$, $E(0) = 150$, $I(0) = 250$ and $R(0) = 200$ individuals so that the total population is $N = N(0) = N(t) = 1000$ individuals. The initial estimates of each population are $\hat{S}(0) = 250$, $\hat{E}(0) = 150$, $\hat{I}(0) = 150$, $\hat{R}(0) = 450$ individuals.

$$\frac{1}{\hat{\mu}} = 235 \text{ days}, \frac{1}{\hat{\sigma}} = 2 \text{ days}, \frac{1}{\hat{\omega}} = 14 \text{ days} \quad \hat{\beta} = 1.46 \text{ days}^{-1}$$

while $\hat{\gamma} = \hat{\sigma}$. Thus, Figure 1 displays a non-zero observation error between the real and observed states in the steady-state.

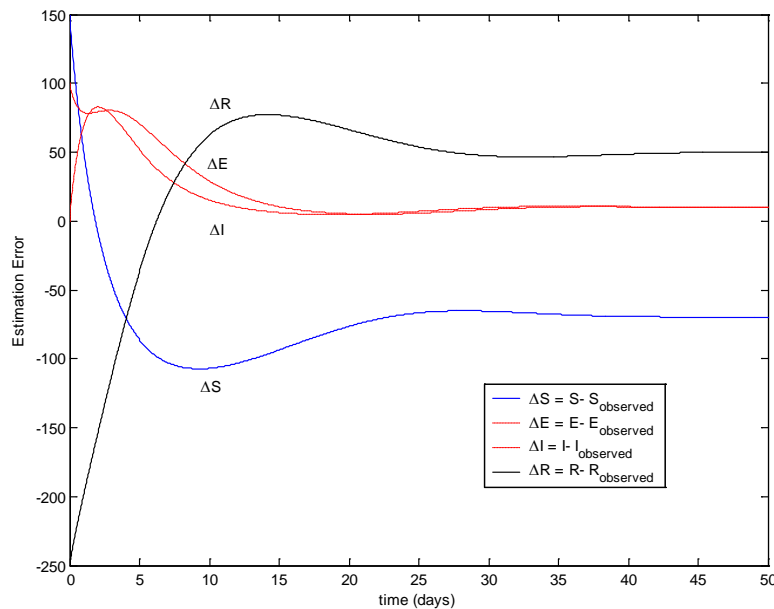


Figure 1. Observation error in the vaccination-free case and unknown model parameters Nevertheless, the observer-based control law still works in the presence of this estimation error. Under an observed-based procedure, we take

$k_1 = 1, k_2 = -0.1 < 0, k_3 = -\hat{\gamma}, k_4 = 0.95\hat{\omega}, k_5 = -\hat{\beta}_1, g = \hat{\mu}$. Figure 2 shows the time-evolution of the populations.

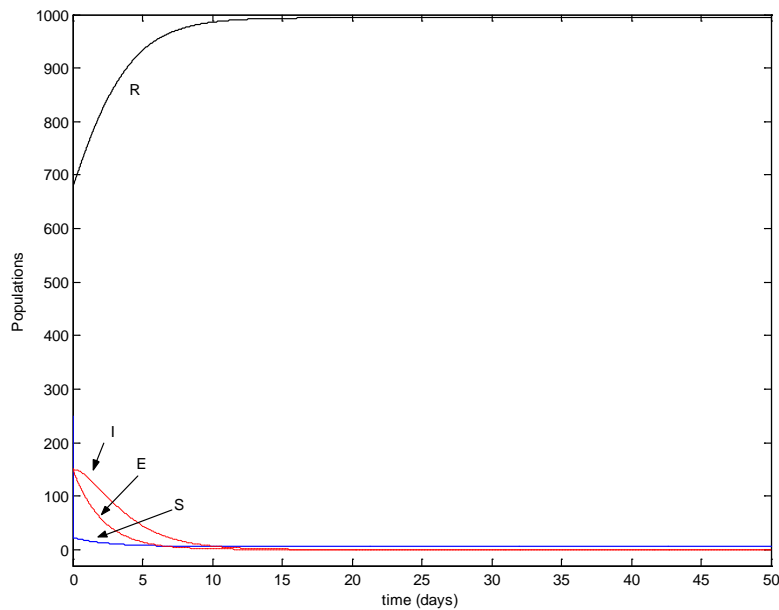


Figure 2. Evolution of the populations with vaccination and unknown parameters

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