



CHAPTER III

PROJECT EVALUATION

3.1 Introduction

The aim of this study was to implement and evaluate the results of an inventory management system designed to improve inventory procurement and inventory control system by providing training in purchasing service system and using SEANAC program, and developing work manual to inventory staff. The evaluation of the effectiveness of the project had been administered six months after the implementation of the project. The key success in this program lies in to improving knowledge and skills of inventory staff on inventory management and increasing staff's satisfaction with the inventory staff performance and new inventory system.

Data were collected using both quantitative and qualitative methods, including the use of survey, observation, and in-dept interviews.

3.2 Purpose

The purpose of this project was to evaluate the effectiveness of inventory management system. The specific objectives of the project were listed below:

1. To increase inventory staff's knowledge and skills in inventory management.

2. To reduce the office supply purchases frequency by 50 percent by 2003.
3. To reduce the number of equipment coding errors by 10 percent by 2003.
4. To increase the level of staff's satisfaction with supplies and inventory management system.

The evaluation of this project attempted to answer the following question.

1. Was there any increasing in staff's knowledge in inventory procurement?
2. Was there any increasing in staff's skills in using SENAC program?
3. Have the office supplies purchase frequency decreased by 50 percent by 2003?
4. Have the numbers of scientific equipment coding errors decreased to 10 percent by 2003?
5. Was there an increase in staff satisfaction with supply and inventory management system?

3.3 Methods

This evaluation utilizes a mixed methodology, longitudinal approach enables us to examine staff performance and to track changes in project implementation over the six months of implementation. While the quantitative data allows us to assess the relationship between program implementation and outcomes, the qualitative data will

allow us to explain quantitative findings, identify issues not captured through the quantitative approaches.

3.4 Data Collection Methods

Below we outline the data collection methods and sources of information we have used to address each evaluation question.

Evaluation question 1: Was there any increasing in staff knowledge in inventory procurement?

To answer this question, two data collection methods were used:

1. Knowledge test

This test was developed to measure knowledge of inventory staff before training and 2 months after the training workshop. The test was distributed to respondent by researcher. The test consisted of three components with a total of 33 true-false questions, with an overall ranging from 0 to 33 Score. The correct items were scored 1 and incorrect were scored 0. The component of the test included:

- a) Knowledge on general rules and regulation of the Office of Prime Minister concerning the inventory work (10 questions).
- b) Knowledge on the inventory procurement and purchasing services (14 questions).
- c) Knowledge on the scientific equipment control (9 questions)

The test was scored as the percentage of correct responses. The predefined standard was 80%, therefore the inventory staff must have more than or equal 26 scores to pass knowledge test. The test was checked the content validity by a team of DMSc's expert.

2. In-depth Interview guidelines

Interview guidelines were developed for in-depth interview with two inventory personnel 2 times after having the knowledge test back in order to get an understanding of the staff's knowledge regarding inventory procurement (Pimonpan Isarabhakdi, 2001). The interviews were designed to address four issues:

Personality: including questions about functions and responsibilities of inventory staff.

Inventory management: including questions about supply and service purchase procedure including inventory control procedure.

Technology: including questions concerning adopting new technologies into the work such as SENAC Program, etc.

Environment: including questions regarding to the amended rules and regulations about inventory and supply; and the revised working system.

Evaluation question 2: Was there any increasing in staff's skills in using SENAC program?

To measure inventory staff's skills in using SENAC program, observations were held once every other month 3 times during the study by the Researcher and the Computer Officer in order to determine whether the inventory staff was able to use SENAC program for the registration of Scientific equipment. For example, in retrieving, adding, deleting, updating, and printing out data. And addition, time spent in using the SENAC program was also recorded as an indicator of skills.

Evaluation question 3: Have the office supply purchases frequency decreased by 50 percent by 2003?

The office supply purchases frequency was counted by compiling all records from purchasing documents of RMSc CB during the fiscal year 2001 to 2003. The Head of Inventory management and the Finance Official collected the data and counted the numbers of all purchasing unit orders.

Evaluation question 4: Have the number of scientific equipment coding errors decreased to 10 percent by 2003?

Two surveys were conducted to check the coding numbers of scientific equipment. The first one was took place after the project had been implemented for 2 months. The Head of Inventory Section, Quality assurance officer and the Researcher

randomly selected 25 percent of all equipment (65 out of 257) for checking. The second survey was held after 6 months of the implementation all 257 existing scientific equipment. A working team comprising of the supervisor of inventory section, inventory staff, inventory staff assistant, quality assurance official and the researcher.

Two indicators were used for determining a correct coding of scientific equipment: (1) There had to be a number labeled right at the equipment, and (2) such number had to match with the number registered in the inventory record of scientific equipment basing on SEANAC standard numbering system. The equipment that was not labeled with a number or the ones that their labeled numbers did not match with the SENAC system was considered as having a coding error.

Evaluation question 5. Was there an increase in staff's satisfaction with supply and inventory management system?

A questionnaire was used to measure the satisfaction of 21 persons who work related to the inventory management unit, before and after the implementation of the project. The questionnaire consisted of 27 questions and covered the following areas: personality (9 questions), procurement (9 questions), and inventory control (9 questions).

The questionnaire were distributed for completing satisfaction score on the five scoring scales as follow: Very unsatisfied = 1, Unsatisfied = 2, Neutral = 3, Satisfied = 4, and Very satisfied = 5.

The satisfaction was scored as the average of 27 items. Average scores of 3.5 and higher were indicative of a higher satisfaction with the inventory unit. Cronbach's alpha coefficient for total scale was 0.95.

The data collection methods for each evaluation question outlined above are summarized in Table 3.1.

Table 3.1: Summary of data collection methods

Evaluation question	Data collection method	Sources of information
1. Was there any increasing in staff's knowledge in inventory procurement?	- Questionnaires 33 true-false items - In-depth Interviews	2 inventory staff (Inventory Officer and the Assistant)
2. Was there any increasing in staff's skills in using SENAC program?	- Observation	2 inventory staff
3. Have the purchase frequency decreased by 50% by 2003?	- Review of records	Inventory Procurement Data Record for fiscal year 2001-2003
4. Have the numbers of scientific equipment coding errors decreased to 10 % in 2003?	- Review of equipment records	257 scientific equipment
5. Was there an increase in staff's satisfaction with supply and inventory management system?	- Questionnaire Likert scale 1-5, 27 items	21 RMSc CB staff

3.5 Data Analysis

For this study, data management and results of all quantitative analyses were processed with the SPSS (Statistical Package for Social Science) version 11.0 for Windows. Descriptive analysis was done based on frequencies, percentages, means and standard deviation. To analyze the significant differences on outcome variables, pretest and follow up paired t-test was used for continuous variables. For all analyses, statistical significance was set at $P < 0.05$.

3.6 Results

The results of each evaluation question are as below:

Evaluation question 1: Was there any increasing in staff's knowledge in inventory procurement?

Survey Results Table 3.2 presents the marks obtained by the inventory management personnel by percentage in knowledge testing before and after the training. In the pretest, the inventory officer obtained more than 70 percent of the total marks, while the inventory assistant got less than 50 percent. However, in the posttest, both of them improved and got more than 90 percent of the total marks and their percentage in marks of the test increased in all areas.

The survey findings indicate that, after the training, the knowledge of both personnel have increased by a portion set in the criteria, which was to be increased by

80 percent in all areas. For the area of inventory procurement and inventory control in particular, they both got 100 percent of the total marks of the test.

In-dept Interview Results

Regarding the result of the interview, at posttest, both personnel have better knowledge than the pretest, corresponding with the results obtained from the survey. However, there was an exception about the knowledge on inventory control regarding the item about the registration of scientific equipment before handling them to persons who request for the purchase. The inventory officer gave incorrect answers both in pre-test and post-test. From the interview, we found that she knew the correct process but intended to give incorrect answer because she did not perform the work in accordant with the rules and work manual. The following is an excerpt from an inventory staff interview.

Interviewer: Did you know the approach of scientific equipment registration according to Regulations about the inventory control item?"

Inventory Staff: "I knew that the equipment must be registered first before handling out but I didn't have enough time to do so. Therefore, I sent the equipment first and think that I could register and assign a number on a later date."

Most of other items that the inventory assistant giving incorrect answers were the questions about information relevant to the inventory such as rules and regulations about the supply and inventory management. Reasoning for not giving correct answer

was that there are too many rules and regulations that made a difficulty in remembering. And in addition, the rules and regulation can be referred anytime she wants. Therefore, the inventory staff does not want to remember. The following excerpt is an example of this.

Interviewer: "Can you explain the approach of inventory purchasing supply according to Regulations about the inventory management item?"

Inventory assistant: "I cannot remember them all there are so many rules and regulations about the inventory management and they keep issuing new regulations every now and I must refer to the regulation document when I have a problem or a question about the purchase"

Table 3.2: Comparison of percentage marks in knowledge testing before and after training

Knowledge test	Inventory officer		Inventory assistant	
	Pre-test	Post-test	Pre-test	Post-test
Information about the inventory	90%	100%	40%	80%
Supply and inventory management is a task	✓	✓	✓	✓
According to the Regulation of the Office of	✓	✓	✗	✓
Purchasing through the agreed-price	✓	✓	✗	✓
Purchasing through the price-checking	✓	✓	✗	✗
Purchasing through bidding is the purchase	✓	✓	✗	✗
For all kinds of purchases, there must be a	✓	✓	✓	✓
For the purchase through bidding, three	✓	✓	✗	✓
For the purchase through price-checking	✓	✓	✓	✓
For the purchase through agreed-price	✗	✓	✗	✓
Each committee consists of 1 chairperson	✓	✓	✓	✓
Inventory procurement	64%	100%	36%	100%
For every purchase of goods and services,.....	✓	✓	✗	✓
The objective of the purchase is to buy goods	✓	✓	✗	✓
Inventory management officer must have a	✗	✓	✗	✓
Heads of work units must work together with	✓	✓	✓	✓
Only the supply and inventory management.....	✗	✓	✗	✓
Personnel must receive continuous training so	✗	✓	✓	✓
The persons eligible for defining the	✗	✓	✗	✓
Persons who want to use the supplies are	✓	✓	✗	✓
The Inspection and Acceptance Committee	✓	✓	✗	✓
The Inspection and Acceptance Committee	✓	✓	✓	✓
Inventory officer is responsible for compiling.....	✓	✓	✓	✓
In the case that the director does not approve	✓	✓	✓	✓
After the Inspection and Acceptance	✓	✓	✗	✓
For the purchase of durable articles, the	✗	✓	✗	✓

Table 3.2: (Cont.) Comparison of percentage marks in knowledge testing before and after training

Knowledge test	Inventory officer		Inventory assistant	
	Pre-test	Post-test	Pre-test	Post-test
Inventory control	67%	89%	44%	90%
For the purchase of durable articles, the	✗	✗	✗	✓
The criteria used for assigning a code for	✓	✓	✓	✓
In the registration of durable articles, the	✓	✓	✓	✓
The classification of scientific equipment in	✗	✓	✗	✓
In labeling a number of scientific equipment,	✓	✓	✓	✓
If there is a modification of an equipment, the	✓	✓	✗	✓
For any equipment set that comes with 2	✓	✓	✗	✓
For new items of durable articles, equipment	✓	✓	✓	✓
For equipment transferred from other offices,	✗	✓	✗	✓

✓ Indicate the item of respondent giving correct answers

✗ Indicate the item of respondent giving incorrect answers

Evaluation question 2: Was there any increasing in staff's skills in using SENAC program?

Two inventory management personnel were assessed 3 times about their skills in using SENAC program for the registration of durable articles.

On the first observation, the inventory officer was able to use SENAC Program to register durable articles but she needed to refer to the manual all the time. She also had to occasionally ask the computer officer of how to do. It took her about 30 minutes to register a single item of the equipment. For the inventory assistant officer, she was able to use the SENAC Program well and only referred to the manual occasionally when she was not sure of something. It took her about 20 minutes for registering each equipment.

At the second assessment, the inventory officer still referred to the manual occasionally but she was able to register faster than before. She took 20 minutes this time to register one item of equipment. While the assistant was able to do the registration without referring to the manual and took only 15 minutes for the registration of each item.

During the third observation, the inventory officer was able to use SENAC program without consulting the manual. She was able to retrieve data very quickly and took only 15 minutes to register one item. Whereas the assistant was able to do much faster than before without referring to the manual. She took only 8 minutes for registering one item.

These findings indicate that the staff's skills of the inventory officer and the assistant in using SENAC program had increased. They were able to work more quickly and spent lesser amount of time to perform (Nataphong Phanmanee, 1999).

Evaluation question 3: Have the frequency of purchase decreased by 50% in 2003?

Changes in annual office supply purchases frequency are displayed in Figure 3.1. The frequency of purchases declined between 2001 and 2003. In 2001, there were 514 frequencies of purchases; in 2002, there were 375; and in 2003, there were 257, percentage decrease of 27% and 50 % from 2001 respectively. The results show

that the dropped of annual frequency of office supply purchases in 2003 reached the target of the decrease of 50% from 2001.

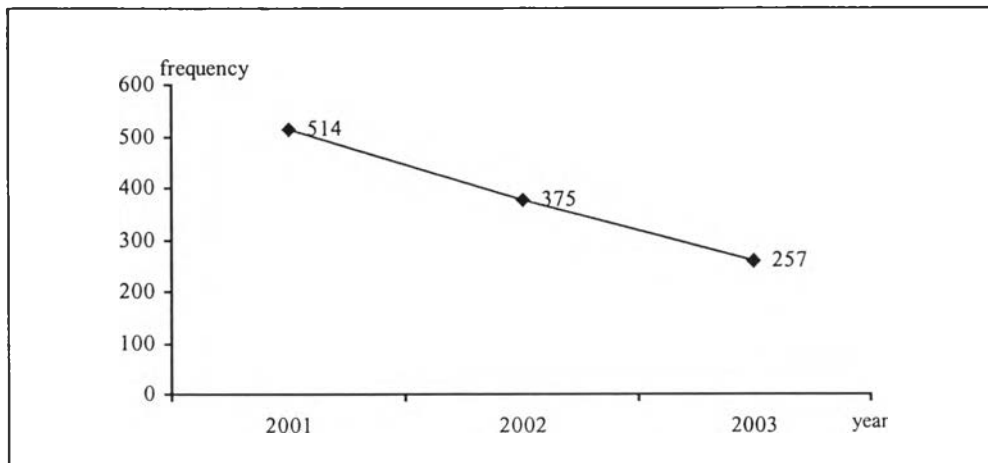


Figure 3.1: Total frequency of office supply purchases during 2001-2003 displaying changes in numbers of office supplies distributed by budget sources

The decrease of purchase frequency may partially be explained by having of annual purchase plan. The annual purchase plan had been launched since 2002 according to researcher recommendation. To make the annual purchase plan, Inventory Unit distributed a form to each unit for filling the list of supplies needed with the quantity and a date needed. The forms were then collected serving as input for making the purchasing plan. And in line with the purchase plan, purchase will be made for every 3 months.

Another possible explanation for the dropped of purchase frequency is that the stock checking was carried out every 3 months by the Inventory Officer to ensure sufficient stock for use. In the past, there was neither purchase plan nor the stock checking. Each unit defined each time of purchase independently. As a result, the Inventory Officer had to conduct a purchase every day. No specific times or periods

were set for the purchases. For some items of supplies in particular, the Inventory Officer had to go out and buy office supplies herself. Therefore she spent most of her times for purchasing and did not have time for a periodic stock checking. The stock was checked the only once a year by the stock checking committee. Therefore the updated data about quantity of supplies in stock was not usually available. When a purchase of some supplies took some times to process, there were no buffer stocks of such supplies for using during the interim.

The results indicate that this project had enhanced the performance of the inventory officer. As the purchase plan was developed and the stock checking had been carried out regularly, the purchases frequency had reduced. Although there have been new urgent projects under government's policy coming to all government organizations including RMsC CB in additional to the existing plan, such as One Tambon One Product (OTOP) and Thai Herbal Medicine and Foods Safety. According to the government policy, RMsC CB was provided 14 millions Baht each year for the purchases in the project government policy since 2002 (Table 3.3). Lower purchase frequency allowed more time for the Inventory Officer to undertake some other activities such as handling the coding number system for inventory control of scientific equipment.

Table 3.3: Displaying expenditure plan for 2001-2003 fiscal years

Source of budget	2001			2002			2003		
	Office supply	Scientific supply	total	Office supply	Scientific supply	total	Office supply	Scientific supply	total
Plan									
Budgets allocated			14,082,618.42			14,510,110.42			16,601,423.71
Actual expenditures	1,976,534.42	2,584,765.58	4,561,300.00	3,251,300.00	2,674,900.00	5,723,870.19	2,256,653.24	3,767,216.95	6,023,870.19
Number of items purchased	1132	398	1530	690	379	379	765	334	1033
Frequency of the purchases	514	128	642	375	138	138	257	121	344
Project									
Budgets allocated						1,433,560.00			1,858,400.00
Actual expenditures				352,754.83	1,080,600.00	1,433,354.83	449,916.54	1,430,484.42	1,880,400.96
Number of items purchased				-	95	268		381	447
Frequency of the purchases				-	28	108		125	159
Total									
Budgets allocated			14,082,618.42			15,943,670.42			18,459,823.71
Actual expenditures	1,976,534.42	2,584,765.58	4,561,300.00	3,604,054.83	3,755,500.00	7,157,225.02	2,706,569.78	5,197,701.37	7,904,271.15
Number of items purchased	1132	398	1530	690	474	1164	765	715	1480
Frequency of the purchases	514	128	642	375	166	541	257	246	503

Source: Annual Report for 2001-2003 Fiscal Years, Regional Medical Science Center- Chonburi, Department of Medical Science, Ministry of Public Health

Evaluation question 4: Have the number of scientific equipment coding errors decreased by 10 % in 2003?

During the first survey of the 65 equipments, only 6 (9%) were found having error code. The coding numbers of 2 equipments did not match with the registration control system and 4 equipments were not labeled with the numbers. After a thorough check, the two equipments with the coding numbers not matching to the control system were the ones that had been used for more than 10 years. With reference to this fact, the rest of equipments having been used for more than 10 years, 80 in total, were then surveyed again. Of these, 36 (45%) did not have the correct coding numbers. It implied that the number of equipment improperly controlled by coding numbers on the first found of sampling was 42 out of 145 (29 %). For the equipment having been used for more than 10 years in particular, as high as 45 percent was improperly controlled by the coding numbers.

On the second survey of a total of 257 equipments, all equipment's were found having the correct code.

As the number of equipment improperly controlled by coding numbers obtained from the first survey was quite high, the following factor might be the reason behind this. Previously, when the inventory control system for scientific equipment had not been yet implemented, the inventory officer documented all related data in a registration book for scientific equipment and did not put a label of registration number on the equipment immediately. When the coding number system was changed to a new

one, she just did some changes of the coding numbers in the book for some equipment only, but not all. Besides, she did not replace the old labels of the assigned coding numbers (attached directly to the equipment) with the new ones. As this was not carried out following steps defined for inventory control, therefore, the data on coding numbers of scientific equipment were not updated.

After the computer system and the SENAC Program were adopted for the inventory control, the results of the second survey showed no errors in coding numbers assigned to scientific equipment. The officer was able to enter the data of equipment and print out the labels of the assigned codes for putting onto the equipment right away. Also, the assigning of such coding numbers would be double-checked by the Supervisor of Inventory Subsection within the same week. The prevention of errors was then quite assured. Apart from ensuring the precise system of inventory control for scientific equipment, using SENAC Program also help to reduced working steps of the inventory officer herself and those of other sections and subsections (Nataphong Phanmanee, 1999). Overall work process was streamlined because all sections and subsections could retrieve the data on coding numbers directly without request to the Inventory Management Unit.

Evaluation question Q5. Was there an increase in staff's satisfaction with supply and inventory management system?

Personnel of RMSc CB were asked about their satisfaction with the supply and inventory management system. Not all of the personnel in the total sample completed the survey every time it was administered (n= 18 to 21).

At baseline, mean satisfaction marks for personnel on overall and all subscales were low and did not reach maximum satisfaction criterion (3.5 = satisfied). The mean score for overall satisfaction was 2.39 ± 0.28 ; performance of supply & inventory management subscale was 2.49 ± 0.43 ; inventory procurement subscale was 2.72 ± 0.17 ; and inventory control subscale was 1.98 ± 0.24 . When considering each item, it found that the only mean score of interpersonal relationship item was high (3.2 ± 0.76), while the rest were low (Table 3.4).

After 6 months of implementation, statistically significant changes were found between the baseline and follow-up for overall and all subscales (Table 3.5). Changes in mean satisfaction scores for overall and subscales were:

- Overall satisfaction results increased from 2.39 (SD= 0.28) to 2.88 (SD =0.23);
- Mean satisfaction marks with personnel performance increased from 2.49 (SD=0.43) to 2.71 (SD =0.28);
- Inventory procurement increased from 2.72 (SD= 0.17) to 2.99 (SD= 0.14); and Inventory control increased from 1.98 (SD =0.24) to 2.92 (SD=0.38).

Even with the fact that satisfaction levels among staff increased significantly, however, comparing to the set target, not any of the mean scores had reached 3.5, which indicated that the staff were still not satisfied with the supply and inventory management system.

Though the overall satisfaction score of personnel was not high, however, when it was reviewed individually for each person, 4 of them (19%) had the satisfaction scores that increased to 3.5 at posttest. And after looking into deeper details, all these 4 persons were working in a supervisory level: Finance Officer, Quality Assurance Officer, and Laboratory Analysts. The level of satisfaction increased from 2.0 to 3.6 for the Finance Officer; from 2.9 to 3.7 for the Quality Assurance Officer; and from 3.1 to 3.9 and 2.4 to 3.5 respectively for other 2 Laboratory Analysts. Basing on the interviews, the satisfaction of personnel increased because, after they realigned their work process to be in line with the new established system, they could work more conveniently and more rapidly. For example, after the purchase plan was developed, it was more convenient for the Finance Officer, as s/he was able to set up a system for rendering requesting-disbursement services with a more streamlining. The Quality Assurance Officer was able to handle scientific equipment control system with compliance with the QA system. The Laboratory Analysts were able to perform analytic tasks faster and issue the results of analyses on time. The analysis results were also accurate and reliable because the Analysts were supported with materials and equipment that met their needs. Also, the equipment were well calibrated and maintained in compliance with the Quality System.

Table 3.4: Satisfaction with the inventory management before and after implementing the program

Type of satisfaction	Before		After		p-value
	mean	SD	mean	SD	
Performance of supply & inventory manage	2.49	0.43	2.71	0.28	.011
Enthusiasms in performing duties.....	2.52	0.45	2.80	0.28	.010
Being disciplinary.....	2.62	0.51	2.95	0.24	.015
Good interpersonal relationship.....	3.15	0.33	3.25	0.29	.042
Being responsible for duties.....	2.65	0.48	2.95	0.36	.005
Ability in solving contingent problems.....	2.10	0.39	2.42	0.23	.015
Regularly updating one's self with knowledge.....	1.86	0.43	2.53	0.26	.004
Adopting technology in work performance.....	1.95	0.36	2.71	0.25	.000
Extending cooperation in solving problems.....	2.71	0.42	2.90	0.25	.009
Maintaining good relationship between work.....	2.81	0.45	3.14	0.32	.001
Functioning in the procurement of goods and	2.72	0.17	2.99	0.14	.044
Conducting procurement in line with the.....	2.79	0.12	3.06	0.15	.015
Knowledge and understanding of inventory.....	2.50	0.33	2.94	0.53	.001
Appropriateness of the forms used for.....	2.81	0.27	3.10	0.27	.002
Opportunity for users in participating and.....	2.86	0.06	3.10	0.13	.004
Purchases are made in time to meet the needs.....	2.67	0.16	2.89	0.43	.268
The purchased items are matched to what.....	2.90	0.19	3.14	0.15	.005
The quality of purchased items meets the.....	2.86	0.15	3.14	0.27	.042
The acceptance process for purchased items is.....	2.60	0.10	2.89	0.39	.056
Perform procurement activities according to.....	2.45	0.13	2.94	0.21	.003
Inventory control of scientific equipment	1.98	0.24	2.92	0.38	.004
Procedural steps for registration of the.....	2.19	0.25	2.63	0.29	.004
Searching for the registration number of.....	1.81	0.15	2.60	0.08	.001
Searching for maintenance history of scientific.....	1.86	0.25	2.55	0.60	.004
All scientific equipment are assigned with.....	2.00	0.38	3.05	0.179	.001
Using computer program to search data on.....	1.81	0.29	2.50	0.16	.002
Making requests for and distributing supplies.....	1.90	0.21	3.27	0.59	.000
Processing a request for equipment repair.....	2.52	0.13	3.05	0.29	.008
Processing a request for discharging the.....	1.95	0.24	2.91	0.02	.015
Convenience in annual inventory check at the.....	1.81	0.29	3.68	0.39	.001
Total	2.39	0.28	2.88	0.23	.019