Report on the BIOASSURE field study for drain treatment

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Scope

The purpose of the trial is to demonstrate the efficacy of the drain treatment on the contamination of sink drains in a hospital facility.

Method

1. Statistical Drain Population

A statistical population of ten drains were selected in different patient rooms on one hospital floor. From these ten drains, three were randomly selected as a Control and seven for Testing. During the experiment, routine drain maintenance procedures were stopped for the ten drains. During the experiment, rooms F, J and T were set as "Control" and rooms G, I, L, M, O, R and Z as "Test".

2. Swabbing and Treatment Schedule

Week 1
All ten drains were swabbed on Monday and Wednesday to establish the contamination baseline of each drain.
No treatments were performed during week 1.
Weeks 2 to 5
Control drains were swabbed on Monday and Wednesday.
Test drains were treated on Monday, Wednesday and Friday.
Test drains were swabbed on Monday, and Wednesday before and after treatment.

Swabbing Procedure (applied to all sinks).
Four swabbing zones were selected on the opening of the sink drain, identified as "Left", "Right", "Wall" and "Room Side". A sterile wooden cotton swab (1cm wide) was inserted into the opening of the drain. Swabbing was performed on the left side of the drain by applying the swab's tip from the opening of the drain, working downstream for 3cm, and then back up. The cotton tips were placed in sterile tubes filled with 3mL PBS (Phosphate Buffered Saline). The tubes were then closed and placed immediately onto ice packs.

3. Treatment Procedure

Treatment consisted of one application of BIOASSURE PREPARATION diluted at 5% and one application of BIOASSURE DISINFECTANT at 2%. The following procedures were followed:

A. **BIOASSURE PREPARATION (5%)**

1. Open the water tap and let water flow into the sink for 5 seconds.
2. Perform pre-treatment swabbing on the left side of the drain-opening according to swabbing procedure.
3. Purge the air from the BIOASSURE PREPARATION nozzle by pushing on the trigger until foam appears.
4. Place the BIOASSURE PREPARATION nozzle over the drain-opening.
5. Push the trigger and let the foam go down the drain-pipe for 15 seconds.
6. Remove the nozzle and let that foam stand in the drain for 5 minutes.
7. After 5 minutes, open the water-tap and rinse the foam that is in the sink.

B. BIOASSURE DISINFECTANT (2%)

1. Purge the air from the BIOASSURE DISINFECTANT nozzle by pushing on the trigger until foam appears.
2. Place the BIOASSURE nozzle over the drain-opening.
3. Push the trigger and let the foam go down the drain-pipe for 15 seconds.
4. Remove the nozzle and let the foam stand in the drain for 5 minutes.
5. After 5 minutes, open the water tap and rinse the foam that is in the sink and in the pipe until no foam is seen from the drain opening.
6. Perform the post-treatment swabbing on the left side of the drain opening according to swabbing procedure.

4. Swab Sample Treatment

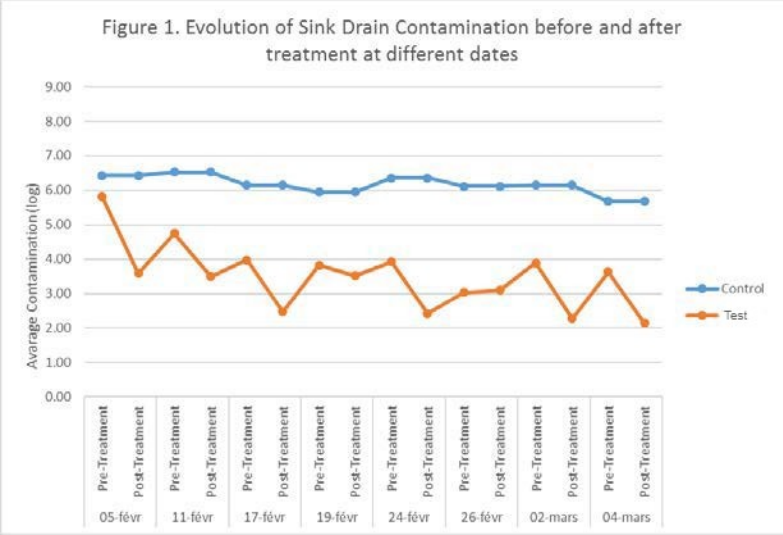
All swabs were kept cold on an icepack until delivered to the lab. For each swab tube, two serial dilutions of 1mL each were made. The serial dilutions were performed in sterile Phosphate Buffered Saline.
For Controls, dilutions from 10e4 to 10e8 were plated on TGE agar.
For Tests, dilutions from 10e1 to 10e8 were plated on TGE agar.
All plates were incubated under aerobic conditions at 37°C for 24 hours.

5. Data analysis

For each swab, the contamination level is the average of the two serial dilutions results.
All average counts were compiled for Control and Test sinks.

Results

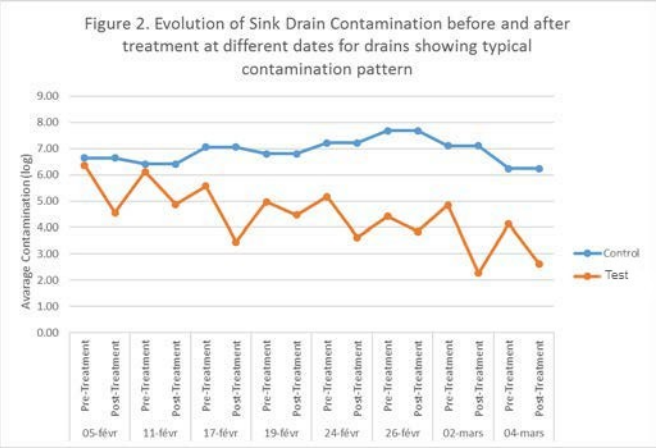
Figure 1 displays the Average Contamination of Control and Test sinks in log.

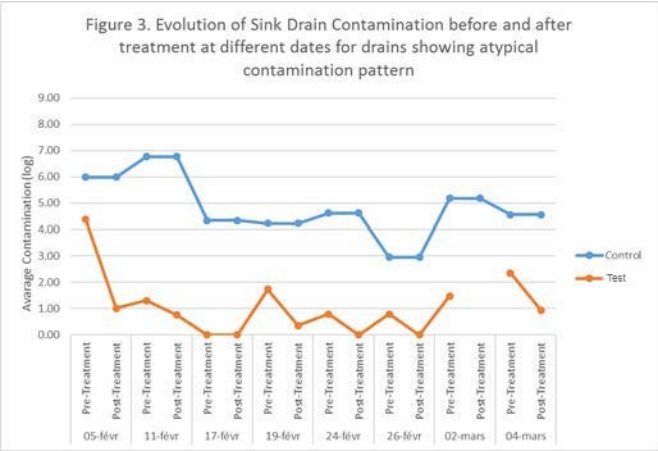


Note: No treatments were performed on Control drains. Swab results for Controls on each date are used as pre-treatment and post-treatment results. Control result is the average of counts of rooms F, J and T. Test result is the average of counts for room G, I, L, M, O, R and Z.

The results presented show that the contamination of control sinks was relatively stable ranging from 5.94 log (February 19) to 6.53 (February 11). Figure 1 also shows a higher contamination before treatment as compared to after treatment. The only exception to the efficacy of the treatment is on February 26 when pre-treatment and post-treatment were equivalent. The results also revealed that individual sinks exhibited variation from one room to another. Since we do not have any specific information that could justify discarding any rooms from the analysis, all data were split between a ***typical contamination pattern*** and an ***atypical contamination pattern***. The rooms associated to a typical contamination pattern are F, J (Controls) and G, I, M, O, Z (Tests). The rooms associated to an atypical contamination pattern are T (Control) and L, R (Tests).

Figure 2 and 3 show the evolution of the contamination pattern of drains showing typical (figure 2) and atypical (figure 3) contamination patterns.





Notes on figure 3. No Post-treatment swab was performed on sink L and R on March 2.

Figure 2 clearly demonstrates that treatment with Bio Assure is effective in lowering bacterial contamination in the Test drains. When compared to the Control drains, the Treated drain population showed a constant and significant decrease in contamination throughout the trial.

Figure 3 indicates that the control room (T) has a low contamination level and a pattern of decreasing contamination, with the exception of an increase on March 2. This increase could have been due to an unusual one-time discharge in the drain. Figure 3 also indicates that the two treated drains (rooms L and R) responded well to treatment and that the contamination level of these drains remained low for several days following treatment. This occurred in drains used frequently.

In the Control drains, the contamination level remained between 6 and 8 log which is consistent with observations from hospital settings and many other public buildings. The variation in the control contamination levels may be the result of swabbing bias or a specific event such as one-time overuse or unusual discharge.

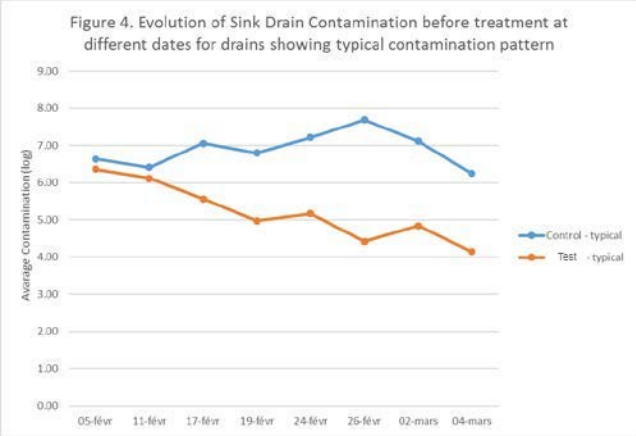
In other trials, a decrease in contamination level has been associated with the dryness of the sink and the poor bacterial nutrient supply caused by a low use of the sink.

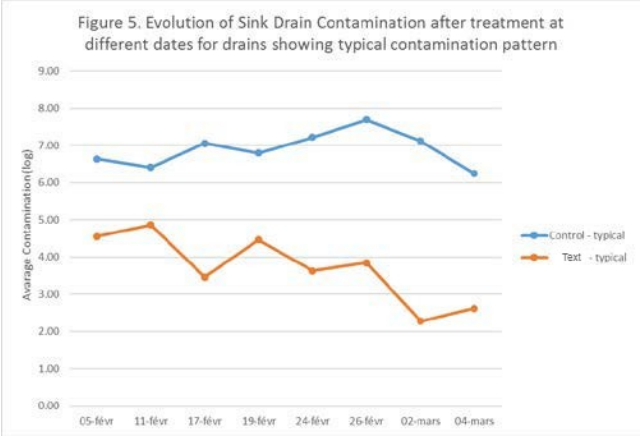
Figures 2 and 3 show the evolution of the contamination pattern of drains showing typical (figure 2) and atypical (figure 3) contamination patterns.

Discussion

Sink drains are special surfaces that must be considered as micro-environments or ecological niches. The humidity, continuous soil discharge, absence of light and the protection offered by the piping constitute an ideal environment for bacteria to grow. There is consensus that sink drains in healthcare settings can be reservoirs of pathogenic microorganisms (1), (5), (6), (7) . In fact, numerous studies and papers (2), (3), (4), (5) describe infections transmitted by pathogens that colonize sink drain reservoirs.

For Sani Marc, keeping the drain contamination at the lowest possible level is the best way to prevent patient contamination. The following graphs represent the results collected over a five-week period. Figure 4 illustrates how the contamination level in Test sinks progressively became lower than the Control sinks. This is due to BIOASSURE'S removal and destruction of bio-film and bacteria and preventing recolonization of the drains (7). In many trials, evidence of this removal is the disappearance of slimy brownish deposits inside the drain-pipe. Removing bio-film structures results in less surface area available for bacteria to adhere and grow. Following treatment, the contamination decreased over time (Figure 5), and continued to decrease after five weeks of treatment.





At the end of the trial, the average post-treatment contamination on the Test drains was 2.62 log, which is an average of 420 CFU/swab. At the end of the trial, the average post-treatment contamination on the Control drains was 6.24 log, or an average of 1,750,000 CFU/swab.

These results indicate a significant reduction of contamination which demonstrates the efficacy of the BIOASSURE treatment.

Conclusion

Given that sink drains in hospitals harbor harmful bacteria, the implementation of a method for monitoring sink use and activity during potential future trials may help better identify and study atypical drain behavior. However, the results of this trial clearly demonstrate that BIOASSURE treatment is an effective means of controlling the contamination of drains in a hospital setting, and BIOASSURE PREPARATION and BIOASSURE DISINFECTANT treatments are valuable tools for managing the risk of infection associated with bacterial drain contamination.

References

(1) Davane, M., et al. 2014. *Pseudomonas aeruginosa* from hospital environment. Journal of Microbiology and infectious Diseases/JMID. 4(1):42–43.

(2) De Geyter, D. et al. 2017. The sink as a potential source of transmission of carbapenemase-producing Enterobacteriaceae in the intensive care unit. Antimicrobial Resistance and Infection Control. 6:24.

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(4) Kotay, S. et al. 2018. Droplet- Rather than Aerosol-Mediated Dispersion Is the Primary Mechanism of Bacterial Transmission from Contaminated Hand-Washing Sink Traps. Applied and Environmental Microbiology. AEM Accepted Manuscript Posted Online 26 October 2018. Downloaded from http://aem.asm.org

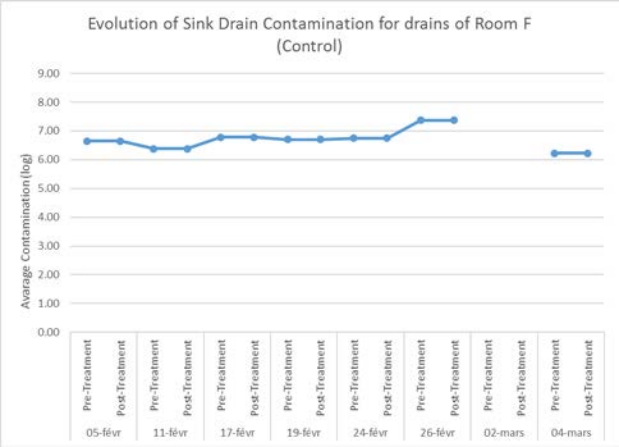
(5) Kotsanas, D. et al. 2013. "Down the drain": carbapenem-resistant bacteria in intensive care unit patients and handwashing sinks. MJA. 198(5):267–269.

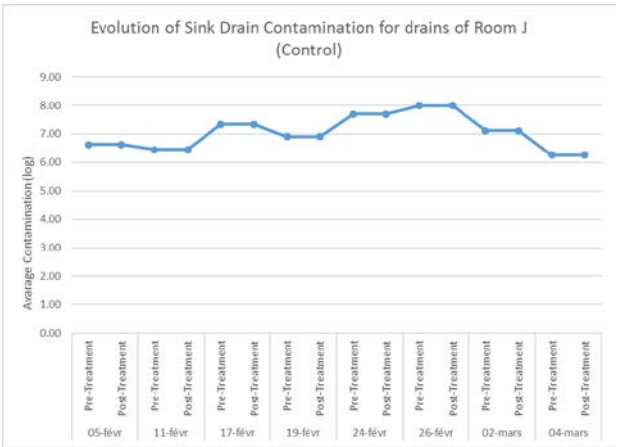
(6) Lalancette, C. et al. 2017. Hospital Drains as Reservoirs of Pseudomonas aeruginosa: Multiple-Locus Variable-Number of Tandem Repeats Analysis Genotypes Recovered from Faucets, Sink Surfaces and Patients. Pathogen. 6(36).

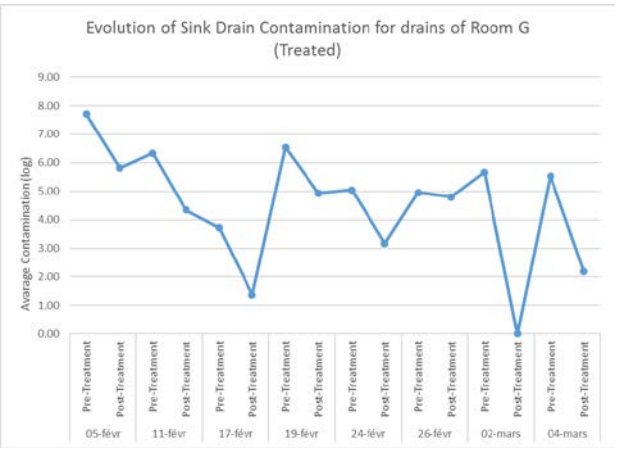
(7) Marchand, P. et al. 2017. Comparative study on the efficacy of disinfectants against bacterial contamination caused by biofilm. Canadian Journal of Infection Control. 32(4):193–198.

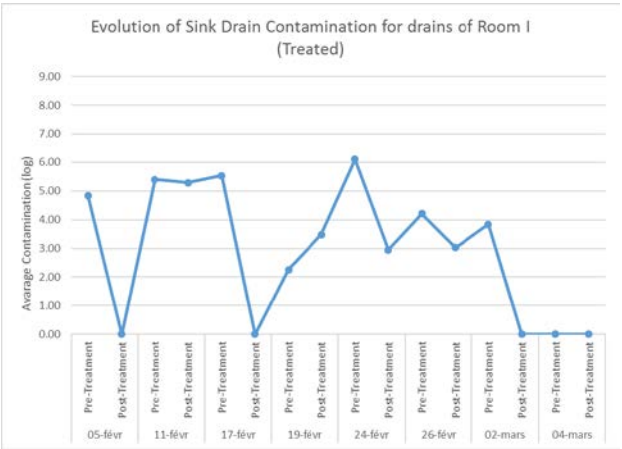
(8) Mc Bain, A.J., et al. 2003. Microbial Characterization of Biofilms in Domestic Drains and the Establishment of Stable Biofilm Microcosms. Applied and Environmental Microbiology. 69(1):177–185.

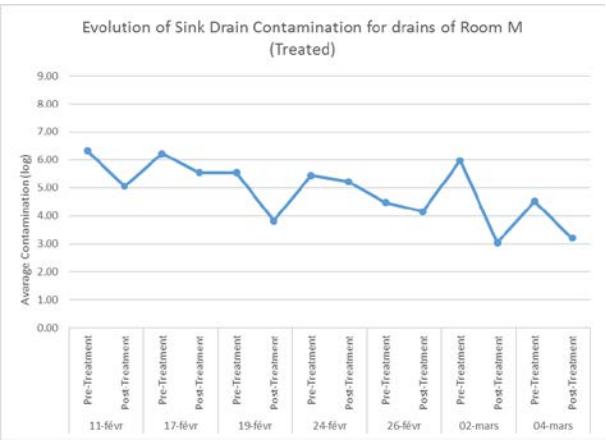
Annex A, Results for Typical rooms

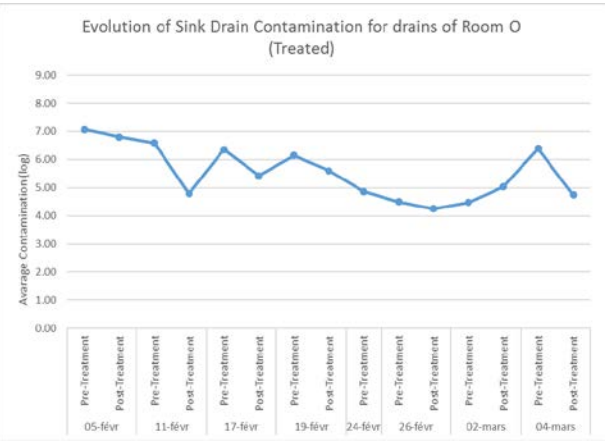


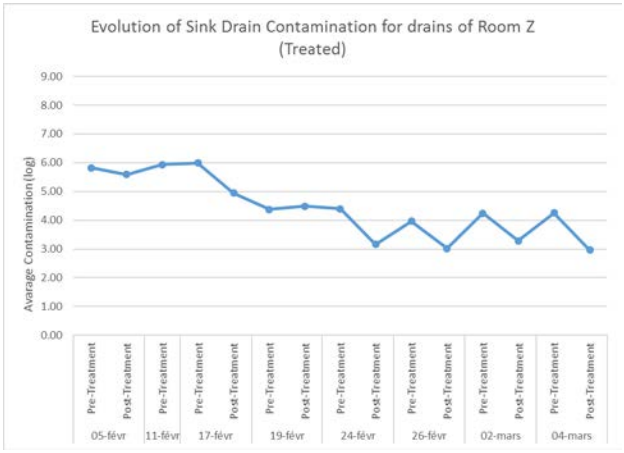




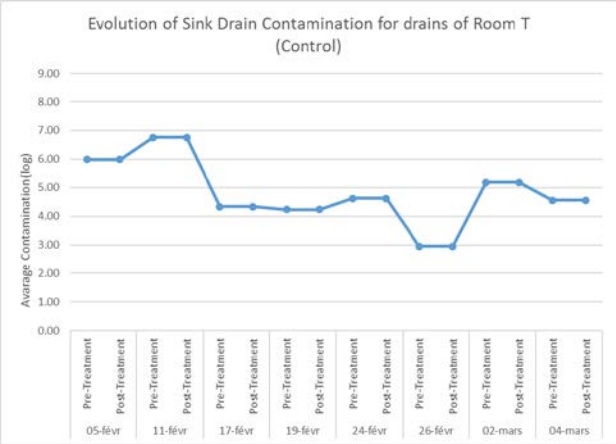


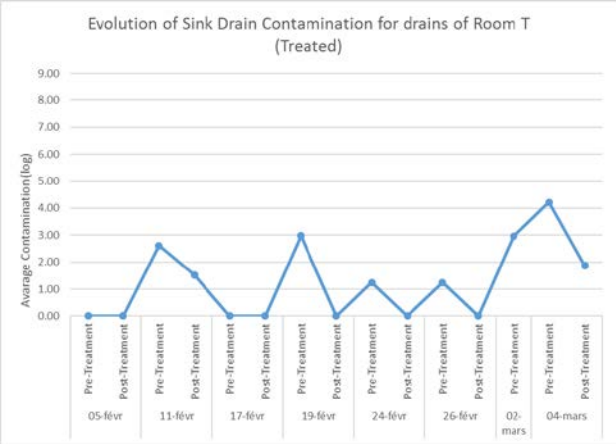


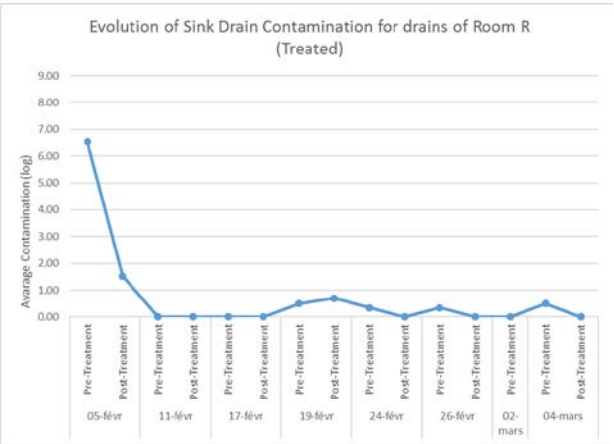



Evolution of Sink Drain Contamination for drains of Room Z
(Treated)
Avarage Contamination (log)
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Pre-Treatment
Post-Treatment
05-févr
11-févr
17-févr
19-févr
24-févr
26-févr
02-mars
04-mars

Annex B, Results for Atypical rooms







Annex C, Average Counts per Swab (CFU/swab)

	F	G	I	J	L	M	O	R	T	Z
05-févr										
1. Pre-Treatment	5000000	52500000	70000	4550000	0		12300000	3700000	1160000	690000
2. Post-Treatment	5000000	660000	0	4550000	0		6450000	38	1160000	405000
11-févr										
1. Pre-Treatment	2400000	2150000	265000	2800000	425	2100000	3950000	0	8600000	915000
2. Post-Treatment	2400000	22000	195000	2800000	60	117000	62500	0	8600000	
17-févr										
1. Pre-Treatment	6000000	5300	345000	22000000	0	1700000	2300000	0	21500	975000
2. Post-Treatment	6000000	58	0	22000000	0	355000	275000	0	21500	91000
19-févr										
1. Pre-Treatment	5000000	4400000	185	8050000	940	355000	1400000	5	17000	24000
2. Post-Treatment	5000000	85000	3050	8050000	0	6600	400000	5	17000	33000
24-févr										
1. Pre-Treatment	5700000	115000	1250000	49500000	18	295000	77500	3	42000	25000
2. Post-Treatment	5700000	1500	900	49500000	0	165000		0	42000	1450
26-févr										
1. Pre-Treatment	23500000	91000	16000	100500000	18	31500	32500	3	900	11050
2. Post-Treatment	23500000	67500	1100	100500000	0	14500	18000	0	900	1060
02-mars										
1. Pre-Treatment		465000	7050	13000000	905	980000	30000	0	150000	17500
2. Post-Treatment		0	0	13000000		1120	109000		150000	1950
04-mars										
1. Pre-Treatment	1700000	340000	0	1800000	16500	33000	2450000	5	35500	18000
2. Post-Treatment	1700000	155	0	1800000	75	1650	56000	0	35500	925