

Effect of Catheter Care Maintenance Bundle on Reducing Incidence of Urinary Tract Infection among Catheterized Patients

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Abstract Background: Infection of the urinary tract attributed to the use of an indwelling urinary catheter is one of the most common infections acquired by patients at health care centers. **Aim:** The primary aim of this study was to assess effect of catheter care maintenance bundle on reducing the incidence of urinary tract infection among catheterized patients. **Setting:** The study was conducted in the neurological department, affiliated to Assiut University Hospital **Methods:** This study was designed as interventional prospective study on purposive nonprobability sixty adult patients (experimental and control) undergoing urinary catheterization were included in this study. **Results:** There was a positive correlation between catheter care maintenance bundle and occurrence of urinary tract infection ($P < 0.003$). **Conclusion:** Implementation of catheter care maintenance bundle intervention resulted in a reduction in the incidence of urinary tract infection among catheterized patients. **Recommendations:** Application of the catheter care maintenance bundle at all the settings that deal with urinary catheterization to decrease the infection rate.

Keywords: catheter care maintenance, bundle, incidence, urinary tract infection, and catheterized patients

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1. Introduction

Urinary tract infections (UTI) are the most common type of hospital infection reported to the National Safety Health Care Network (NHSN) in 2015 between the hospital there were 75 percent catheter-associated Urinary tract infections (CAUTI) [1]. The prolonged use of urinary catheters is the most important risk factor for developing UTI associated with catheters. Urinary tract infection is an infection that affects any part of the urinary system, including the urethra, bladder, ureter and kidneys [2]. Taken together, these results show that UTI associated with catheters has become a major threat to patient safety worldwide, emphasizing the importance of active infection control programs for infection control. Most importantly, it indicates that we need to develop and implement effective CAUTI prevention strategies. Several strategies have recently been proposed, such as avoiding unnecessary urinary catheters, using aseptic procedures by trained personnel, including during catheter insertion procedures, and removing the first from catheters unless otherwise indicated [3].

Urinary catheters is a common clinical procedure. While there are some advantages of catheters, there is a

risk that the device can cause the patient to develop a urinary tract infection. Catheter-associated urinary tract infections (CAUTI) have a major impact on the health care system. Those affected by CAUTI will likely have hospitalization and this is at least twice as long, and costs twice as much as those without CAUTI. Patients with CAUTI are also more likely to develop drug-resistant infections that may require treatment with more complex antimicrobial therapy [4].

Although most studies have shown that prevention of health care-related infection is a global priority. The strategy that fits this goal is patient care use packages. A bundle is defined as a set of evidence-based interventions to place the patient / population and care segment defined as when implemented together, and is a much better outcome in outcomes than when implemented individually. The four widely recognized patient care packages are targeted at the prevention of line central diseases associated with the bloodstream, respiratory-associated pneumonia, urinary tract infections accompanying the catheter and site of infection surgery [5].

1.1. Significance of the Study

CAUTIs, however, are potentially preventable by using practices which promote judicious use of urinary catheters and attention to aseptic insertion and proper catheter

maintenance practices [6]. This paper will therefore address the effectiveness of catheter care maintenance bundle on reducing the incidence of urinary tract infection among catheterized patients.

2. Aim

The aim of this study was to assess the effect of catheter care maintenance bundle on reducing the incidence of urinary tract infection among catheterized patients.

3. Patients

3.1. Research Hypothesis

The incidence of urinary tract infection will be reduced among experimental group of patients who received catheter care maintenance bundle.

3.2. Research Design

Interventional prospective study design was used to fulfill the aim of this study.

3.3. Study Variables

The independent variable in this paper was the catheter care maintenance bundle, while the dependent variable was the incidence of urinary tract infection among catheterized patients.

3.4. Setting

This study was conducted at neurology department, of neurology, psychiatry and neuroscience hospital at Assiut University Hospital.

3.5. Patients

Purposive nonprobability (60) sixty consecutive patients of either sex undergoing urinary catheterization included in the study. Thirty patients constituted the control group and thirty patients were the experimental group.

3.6. Sample Size Calculation

The sample size was calculated: Using Richard Geiger equation

$$n = \frac{\left(\frac{z}{d}\right)^2 \times (0.50)^2}{1 + \frac{1}{N} \left[\left(\frac{z}{d}\right)^2 \times (0.50)^2 - 1\right]}$$

3.7. Tools

The tool of this study was created by the researcher after reviewing the related literatures and included the following sections:

Section I: Demographic data: This section comprised patient's age, sex, and medical diagnosis.

Section II: Assessment of urinary catheter: This section included date of insertion, catheter size, catheter type, catheter lumen, indications for catheterization, and duration of catheterization.

Section III: Assessment of infection: This section included: signs of urinary tract infection, and vital signs recording chart.

Section IV: Laboratory investigations: Urine analysis and urine culture results; this section was used for pre catheter care maintenance bundle assessment and post catheter care maintenance bundle evaluation.

4. Method of Data Collection

4.1. Content Validity and Reliability

Tool developed by the researcher was revised by a panel of five experts in the field of Medical-Surgical Nursing and Medicine to decide that included items are clear and suitable, applicability, and appropriateness to achieve the aim of the study & reliability were tested by using Cronbach's coefficient alpha test.

4.2. Administrative Considerations

An official permission was attained from the head of the neurology department at neurology, psychiatry and neuroscience hospital at Assiut University Hospital. The title and aim of the study have been illustrated, as well as the main items to be covered in the data collection tool in order to conduct the study.

4.3. Ethical Considerations

Research proposal becomes accepted by Ethical Committee within the College of Nursing. Oral consent was obtained from the patient (or responsible family member if unconscious patient) to ensure willingness to engage in the study after reassuring them about the confidentiality and the information will be used for the purposeful research. The researcher gave a clear and simple rationalization of the nature of the study, and the voluntary study was harmless. The patient had the full right to refuse to participate or withdraw at any point in the study.

4.4. Pilot Study

The pilot study was performed on a group of 10% of patients in July 2019 to test the feasibility and practicability of the study tools. It has also provided an estimate of the time needed to fill out the tools; no change was done in the assessment sheet, so the six patients selected for the pilot study were included in the main study.

4.5. Study Intervention

- At the first meeting, the researchers identify themselves to provoke the line of verbal communication, and gave an explanation for the nature and aim of the study.

- Patients were chosen randomly to be included in control or experimental group from the time of admission. If the patient is included as, an experimental patient the researcher follows the principles of asepsis then inserts the catheter and the catheter care bundle maintenance bundle was implemented and followed. If the patient was going to be included as, a control one the researcher just observed the catheter insertion. Then a urine sample was collected from the experimental and control group. The sample is then sent to the laboratory for culture testing

- The control group received only department routine nursing care, while the experimental group received the urinary catheter care maintenance bundle intervention by the researchers all over the week. The urinary catheter care maintenance bundle consists of 8 elements; hand hygiene, wearing gloves, catheter and tubing is free of kinks and well secured, and continuously connected to tubing, urine is draining well (i.e., no obstruction), drainage bag is below level of the bladder but mustn't touch the floor, empty the urinary bag regularly by using a patient-dedicated collection container, and perineal care should done at least once daily [7,8].

- Patients also were followed up daily by the researchers; through measurement and recording of vital signs. Assessing the patient for any manifestations of urinary tract infection. In addition, ensuring that catheter care maintenance bundle elements were applied. After that the researchers teach the relative for each patient in experimental group about how to apply the urinary catheter care maintenance bundle intervention.

4.6. Study Evaluation

After one week of follow up another urine sample is then collected and sent to the laboratory for culture testing to rule out the occurrence of urinary tract infection. This phase was emphasizing an estimation of the effect of catheter care maintenance bundle on reducing the incidence of catheter related urinary tract infection. This was reached through the result of urine culture test and comparing the result with the immediately after insertion result of the patient, and by assessing the manifestations of urinary tract infection.

4.7. Field Work

The field work lasted for 6 months (starting at July

2019 till the end of December 2019). The sessions were organized in the morning and afternoon shifts. The time required for each patient was nearly 45 minute to 1 hour.

4.8. Statistical Design

The collected data were tabulated and statistical analysis was carried out using computer program SPSS "version 20". Data expressed as "mean \pm standard deviation" "number, percent". T. test was used to compare between numeric variables and Chi- square test was used to compare non parametric variable. $p < 0.05$ was considered statistically significant.

Limitations of the Study: This study has a number of limitations. First, the shortage of sterile supplies needed for applying perineal care. Second, the availability of an infection control unit in the hospital that have a database about the incidence and magnitude of the problem.

5. Results

Table 1: Reflects the urine culture result in which (56.7%) of patients have negative urine culture and (43.3%) positive urine culture in the experimental group versus (86.7%) positive urine culture in control group with highly significant difference ($P < 0.001$).

Table 2: Clarifies the causative organism of urine culture the highest percentage of the bundle group subjects has no growth, versus (13.3%) in the control group. While (26.7% and 33.3%) the causative organism was E. Coli and Klebseila (6.7% and 40%) in both the bundle and control group respectively. with highly significant difference ($P < 0.002$).

Figure 1: This figure shows that; A positive correlation has been found between catheter care maintenance bundle and occurrence of urinary tract infection ($P < 0.003$). Which reveals that care bundle approach was highly effective in experimental group as when compared to the group who received the routine nursing care.

Table 3 shows the mean vital signs recording in control and experimental groups. The mean vital signs in the control group was higher than those of the experimental group especially for temperature, pulse and respiration (39.37 ± 1.47 , 86.42 ± 10.23 , and 20.43 ± 2.41) respectively, with significant difference ($P < 0.05$)

Table 1. Comparison between the control and experimental group as patients regards urine culture results

Group	Control group N=30		Experimental group N=30		P. value
	No.	%	No.	%	
- Negative	4	13.3	17	56.7	** 0.001
- Positive	26	86.7	13	43.3	

**=highly statistically significant

Table 2. Comparison between the control and experimental group as patients regards isolated organisms of urine culture

Causative organism	Control group N=30		Experimental group N=30		P. value
	No.	%	No.	%	
Bacilli	1	3.3	2	6.7	0.002 **
E. Coli	10	33.3	8	26.7	
Staphylococci	3	10	1	3.3	
Klebseilla	12	40	2	6.7	
No growth	4	13.3	17	56.7	

**=highly statistically significant.

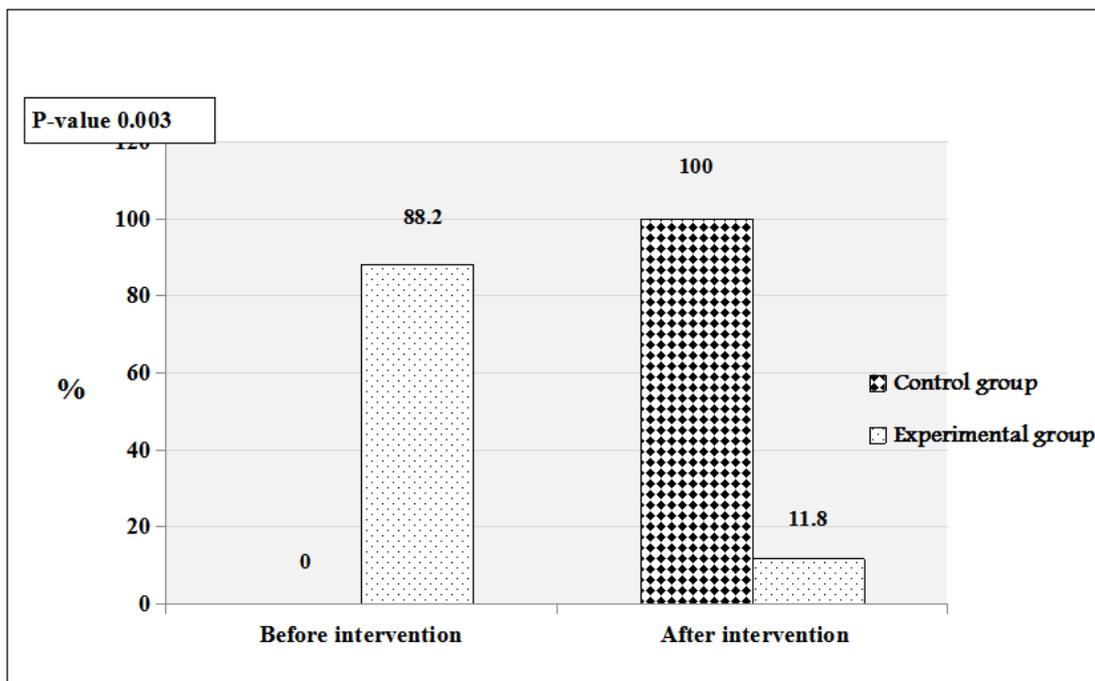


Figure 1. Correlation between catheter care maintenance bundle and occurrence of urinary tract infection obtained by control and experimental group before and after intervention

Table 3. Comparison between the control and experimental group of patient as regards vital signs recording chart (Mean)

Item	Control group	experimental group	P. value
Temperature:	39.37 ± 1.47	37.32 ± 0.44	** 0.001
Pulse:	86.42 ± 10.23	81.65 ± 8.52	* 0.05
Respiration:	20.43 ± 2.41	17.52 ± 3.26	** 0.002
Blood pressure:			
- BPs	144.59 ± 28.48	135.29 ± 22.48	0.272
- BPd	89.59 ± 15.29	85.72 ± 16.39	

6. Discussion

Infection of urinary tract among catheterized patients is one of the most common hospital acquired infections and has become a major challenge for hospital safety and health care quality [9]. A significant portion of these infections are preventable by using evidence based strategies [10]. The bundles should act as a cohesive unit to ensure that all steps of care are reliably delivered and adequately documented. This approach prevents avoidable patient morbidity and results in decreased hospital stay time and improved patient outcome [11]. The current study aimed to assess the effect of catheter care

maintenance bundle on reducing the incidence of urinary tract infection among catheterized patients.

The current study results revealed that urine culture in control group during post-test were positive for the majority of the studied patients, whereas urine culture in the experimental group during post-test, was positive for less than one half of the studied patients with highly significant difference. This finding was in line with [12], who found in their studies that in experimental group urine culture during post-test were positive for only 4 samples, whereas the other 26 samples were negative. In control group during post-test, urine culture was positive for 16 samples and 14 samples were negative. The calculated P-value ($P < 0.0009^*$) was less than 0.05 level & statistically significant at $p < 0.05$ level.

In most of the studies done in urinary tract infection until today, the most common organism isolated is E. coli [13]. However the frequency of E. coli is reduced in patients with indwelling catheters [14]. Similar finding was found in our sample where E. coli was the most common isolate followed by Klebsiella. This observation seems to agree with several other studies where the most common isolate was E. coli and its isolation rate ranged from 22% to 40.47%. On the other hand, [15] revealed contradictory results, where the most common was Enterococcus while E. coli was one of the least isolated pathogen.

According to the correlation between urinary catheter care maintenance bundle and occurrence of urinary tract infection, it was found that there was a positive correlation between catheter care maintenance bundle and occurrence of urinary tract infection ($P < 0.000$). This could be explained from the researcher's point of view that the rationale of minimizing the incidence of urinary tract infection among catheterized patients, because of the effect of the teaching sessions regarding implementation of catheter care maintenance bundle intervention. In this respect [16] stated that education is a basis for the improvement of urinary catheter care bundle practices. Among the behaviors seen in patients or responsible family members prior to the implementation, the most common noncompliance behavior was lack of complete hand hygiene prior to any manipulation of the catheter and its connections, which decreased significantly after the implementation.

Similarly, in a study by [17,18], it was reported that the highest noncompliance was associated with inattention to hand hygiene before drainage of collection bags. Cases of noncompliance with daily perineal care, keeping urine collection bag below bladder level and avoiding contamination of drainage valve and urine splash during urine drainage from drainage bag also significantly decreased after the implementation.

Furthermore, this finding is supported by prospective observational study conducted in 5 general hospitals of Kansai area of Japan reported that the perineal care was provided by only 56 percent of the nurses for the patients with urinary catheter [19]. The researcher suggests that, the lack of satisfaction found in practice of the control group of patients might be attributed to that, patients' family members are likely to remain at a patient's bedside the whole day during their hospitalization, and perform various other tasks, including providing the patient with daily catheter care which demonstrates the need for improved education about catheter care maintenance bundle elements.

As well as, [20], they found in their studies that a catheter associated urinary tract infection bundle has a significant effect on reducing catheter associated urinary tract infection. Additionally, [21] they observed in their study that bundles confirmed reduction in the incidence of hospital care associated infections, when applied during the care of patients. This study finding is inconsistent with the study of [22] who stated that the rates of catheter associated urinary tract infection in ICUs did not change after the implementation of a national prevention program in the US. These findings may indicate different impacts of catheter associated urinary tract infection bundles on the rate of catheter associated urinary tract infection in different settings.

About vital signs recording chart post implementation of catheter care maintenance bundle elements, the results of the present study demonstrated that, the mean vital signs in the control group was higher than those of the experimental group particularly for temperature, pulse and respiration. It means that applying catheter care maintenance bundle has to even a degree achieved the intended goal and decreased the incidence of urinary tract infection among catheterized patients of the experimental group.

7. Conclusion & Recommendations

The findings of this study showed that implementation of catheter care maintenance bundle resulted in a reduction in the incidence of urinary tract infection among catheterized patients, this reduction was statistically significant. In light of the above, the following recommendations were suggested that, application of catheter care maintenance bundle in all settings dealing with urinary catheters to reduce the incidence. Alternative urine collection strategies may be appropriate in certain groups of patients. Specifically, condom catheters should be considered in men who are likely to adhere to this urine collection method, supra-pubic catheters should be considered in patients who need long-term residential drainage. Nurses should be encouraged to attend specific meetings, workshops and seminars held to prevent urinary tract infection to familiarize themselves with aspects of progress and modern skills in this field.

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Disclosure

The author reports no conflicts of interest in this work

References

- [1] Dudeck, M. A., Edwards, J. R., Allen-Bridson, K., Gross, C., Malpiedi, P. J., Peterson, K. D., Pollock, D. A., Weiner, L. M., and Sievert, D. M., *National Healthcare Safety Network report, data summary for 2013, Device-associated Module. American journal of infection control*, 43(3), 206-221. Jan 6. 2015.
- [2] Gould, C.V., Umscheid, C.A., Agarwal, R.K., Kuntz, G., and Pegues, D. A., *Healthcare Infection Control Practices. Advisory Committee. Guideline for prevention of catheter-associated urinary tract infections 2009. Infection Control and Hospital Epidemiology*, 31(4), 319-26. June. 2017.
- [3] Lo, E., Nicolle, L.E., Mph, S.E.C., Gould, C., Mph, L.L. M., Meddings, J., and Gould, C., *Strategies to prevent catheter-associated urinary tract infections in acute care hospitals: Infection Control & Hospital Epidemiology*, 35(5), 464-479. Mar.2016.
- [4] Loveday, H.P., Wilsona, J.A., Pratta, R.J., Golsorkhia, M., Tinglea, A., Baka, A., Brownea, J., Prietob, J., and Wilcox, M., *epic3: National evidence-based guidelines for preventing healthcare-associated infections in NHS hospitals in England. Journal of Hospital Infection*; 86(1): s1-s7. Jan. 2014.
- [5] Chenoweth, C.E., C.V. Gould, and S. Saint, *Diagnosis, management, and prevention of catheter-associated urinary tract infections. Infect Dis Clin N Am*, 28(1): 105-119. Mar. 2014.

- [6] Meddings, J., Rogers, M.A., and Krein, S.L., *Reducing unnecessary urinary catheter use and other strategies to prevent catheter-associated urinary tract infection: an integrative review*. *BMJ Qual Saf*; 23: 277-89. Apr. 2014.
- [7] Saskatchewan Infection Control Program, *Sample best practice checklist*. 2015. Available at: <https://www.ehealthsask.ca/services/resources/Resources/Sample%20Urinary%20Catheter%20Bundle%20Checklists.pdf> (Accessed date August 2015).
- [8] National health services (NHS), *Bundle for preventing urinary tract infections in community sittings when inserting and maintaining a urinary catheter*. 2014. Available at: <http://www.documents.hps.scot.nhs.uk/hai/infection-control/bundles/cauti/uc-community-v1.pdf> (accessed date May 2015).
- [9] Amine, A. E., Helal, M. O., and Bakr, W. M., *Evaluation of an intervention program to prevent hospital-acquired catheter-associated urinary tract infections in an ICU in a rural Egypt hospital*. *GMS hygiene and infection control*, 9(2), 15. Aug. 2014.
- [10] Septimus, E.J., and Moody, J., *Prevention of Device-Related Healthcare-Associated Infections* [version 1; referees: 2 approved] *F1000Research* 5(F1000 Faculty Rev). Jan. 2016; 65.
- [11] Prakash, S. S., Rajshekar, D., Cherian, A., and Sastry, A. S., *Care bundle approach to reduce device-associated infections in a tertiary care teaching hospital, South India*. *Journal of laboratory physicians*, 9(4), 273-278. Oct-Dec. 2017.
- [12] Mahesh, Angeline, K., and Renuka, *Effectiveness of Nursing Care Bundle on Catheter Associated Urinary Tract Infection (CAUTI) among Patients with Indwelling Catheter in Selected Wards of Mgmcri, Kasturba Gandhi Nursing College, udcherry India - An Experimental Study* *Archives of Pulmonology and Respiratory Medicine*. ISSN: 2639-362X. 1(2), 10-17. 2018.
- [13] Shah, L.J., Vaghela, G.M., and Mahida, H., *Urinary tract infection: Bacteriological profile and its antibiotic susceptibility in Western India*. *National Journal of Medical Research*. 5(1): 71-74. Oct. 2015.
- [14] de Siqueira e Silva, M.F., de Sena, F.C.R., Agostinho, F., Almeida Medeiros, K.K., and Miguel, C.B., *Urinary tract infection related to hospitalized patients :A Review*. *Arch Urol*1(1): 001-004. Oct. 2017.
- [15] Duszyńska, W., Rosenthal, V.D., Szczepny, A., Woźnica, E., Ulfik, K., Ostrowska, E., Litwin, A., and Kubler, A., *Urinary tract infections in intensive care unit patients— a single-centre, 3-year observational study according to the INICC project*. *Anaesthesiology Intensive Therapy* 48(1): 1-6. Mar. 2016.
- [16] Abdel-Hakeim, E. H., and Hamza, M. F., *The Effect of Implementing Urinary Catheter Care Bundle on The Prevention of Catheter-Associated Urinary Tract Infections*. *IOSR Journal of Nursing and Health Science (IOSR-JNHS)* e-ISSN: 2320-1959. p- ISSN: 2320-1940. 7, (1), 37-46. Jan.- Feb .2018.
- [17] Taleschian-Tabriz, i N., Farhadi, F., Madani, N., Mokhtarkhani, M., Kolahdouzan, K., and Hajebrahimi, S., *Compliance with guideline statements for urethral catheterization in an Iranian teaching hospital*. *International journal of health policy and management*. 4(12): 805. Dec. 2015.
- [18] Dehghanrad, F., Nobakht-e-Ghalati, Z., Zand F., Gholamzadeh, S., Ghorbani, M., and Rosenthal, V., *Effect of instruction and implementation of a preventive urinary tract infection bundle on the incidence of catheter associated urinary tract infection in intensive care unit patients*. *Electron J Gen Med*. 16(2), 2019. Pem131.
- [19] Tsuchida, T., Makimoto, K., Ohsako, S., Fujino, M., Kaneda, M., and Miyazaki, T., *Relationship Between Catheter Care And Catheter-Associated Urinary Tract Infection At Japanese General Hospitals: A Prospective Observational Study*. *Int J Nurs Stud*, 45(3): 352-36. Dec. 2008.
- [20] Leblebicioglu, H., Ersoz, G., Rosenthal, V.D., Yalcin, A.N., Akan, O.A., and Sirmatel, F., *Impact of a multidimensional infection control approach on catheter-associated urinary tract infection rates in adult intensive care units in 10 cities of Turkey: International Nosocomial Infection Control Consortium findings (INICC)*. *Am J Infect Control*. May. 2013, 41: 885e91.
- [21] Andreessen, L., Wilde, M.H., and Herendeen, P., *Preventing catheter associated urinary tract infections in acute care: the bundle approach*. *J Nurs Care Qual*. 27(3): 209-17. Jul-Sep. 2012.
- [22] Saint, S., Greene, M.T., Krein, S.L., Rogers, M.A., Ratz, D., and Fowler, K.E., *A program to prevent catheter-associated urinary tract infection in acute care*. *N Engl J Med*. Jun. 2016, 374: 2111-2119.

