

Factors Related to the Application of Intervention Bundles by Nurses of a Portuguese Intensive Care Unit

Ana Gertrudes Felgueiras Machado^{1*}, Amâncio António de Sousa Carvalho² and Ana Paula Morais Carvalho Macedo³

¹*Nurse at the Medical Service of Centro Hospitalar Tâmega e Sousa, Unit de São Gonçalo, Amarante, Portugal*

²*Associate Professor at Universidade Trás-os-Montes e Alto Douro, Escola Superior de Saúde, Vila Real, CIEC - Centro de Investigação em Estudos da Criança, Universidade do Minho, Braga, Portugal*

³*Coordinating Professor, University of Minho, School of Nursing, Braga and Health Sciences Research Unit: Nursing, Coimbra School of Nursing, Braga, Portugal*

***Corresponding Author:** Ana Gertrudes Felgueiras Machado, Nurse at the Medical Service of Centro Hospitalar Tâmega e Sousa, Unit de São Gonçalo, Amarante, Portugal.

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Abstract

Introduction: Patients admitted to the Intensive Care Unit develop the most complications because they are submitted to invasive procedures, thus being a high-risk population for Health Care Associated Infections. Infections associated with devices such as Urinary Tract Infection (UTI), Central Venous Catheter (CVC) and Intubation Associated Pneumonia (IAP) are the most common in the Intensive Care Unit (ICU) and therefore require effective measures for their prevention, such as hand hygiene and the applicability of Intervention Beams (IF) by nurses.

Objective: To identify factors related to IF application by nurses of a Portuguese Intensive Care Unit.

Method: Descriptive-correlational, cross-sectional, quantitative approach study, with a sample of 44 nurses, from the Intensive Care Unit, of a Hospital Center located in northern Portugal, in which a questionnaire was applied.

Results and Discussion: The majority of the sample was female (72.7%), belonged to the age group between 38 - 50 years (57%), and had a degree (95.5%). In terms of professional experience, the majority (61.4%) of nurses had between 16 - 30 years of professional exercise time, and between 9 - 20 years of exercise time in the Intensive Care Unit (59.2%). The majority (80.0%) of nurses surveyed responded that they needed to address the Intervention Beams in continuous training. Regarding preventive procedures, most (79.5%) reported that the use of gloves prevents infection and does not perform audits (86.4%) for the three types of infection under study: UTI, CVC and PAI. The IF score of UTI and PAI differs significantly between the sexes (Student's T: $p < 0.047$ and $p < 0.037$); the IF of UTI and PAI and the categories of exercise time in ICU and professional exercise, respectively (Student's T: $p < 0.026$ and $p < 0.001$); and between the average of the IF score ordering of PAI and the use of gloves (Kruskal-Wallis: $p < 0.022$). The sample nurses demonstrated some knowledge about the application of IF by experience and time of professional exercise.

Conclusion: Nurses in general apply IFs to the three measures of infection under study, recommended by the Directorate General of Health. Factors related to the application of Intervention Beams are socio-demographic characteristics, time of professional exercise in the Intensive Care Unit, preventive procedures and audits.

Keywords: *Nursing Audit; Critical Care; Nurses; Prevention and Control*

Introduction

In-hospital health care can lead to the transmission of Healthcare-Associated Infections (HAIs). While patient survival is prolonged, the same patients become vulnerable to the multiple infections they may acquire in the places where care is provided, mainly due to more invasive procedures, aggressive antibiotic or immunosuppressive therapy and subsequent admissions, such as in the Intensive Care Unit.

The last century has seen a significant increase in longevity, but life is not always prolonged with the desirable quality. The periods spent in hospital are characterised by a reduction in the body's defences, that is, the defence mechanisms are annulled through diagnostic, monitoring or therapeutic techniques that depress or overcome them, generating conditions for the occurrence of infections [1]. In addition to the substantial increase in the morbidity of patients admitted to hospital, HCAI is one of the greatest causes of death worldwide.

In terms of the Program for Prevention and Control of Infections and Resistance to Antimicrobial Infections [2], although the prevalence of Central Venous Catheter (CVC) associated infection (57.1%) and PAI Intubation Associated Pneumonia (36.6%) in adult ICUs between 2008-2016 has been decreasing and there has also been a reduction in the prevalence of HCAI in hospital settings (to 7.8%), these percentages remain high. Urinary tract infections (UTI) are the most common hospital infections worldwide and are associated with increased mortality, morbidity, length of stay and health costs, with urinary catheterization being the most important risk factor for its development [3].

According to a European organization [4], 8.3% of patients who remained in the ICU for more than two days, presented infections such as pneumonia, blood flow infection (CVC) and urinary tract infection (UTI). Of the patients admitted to the ICU for more than two days, 6% presented pneumonia, being 98% of the cases related to intubation (PAI), 4% presented bloodstream infection, being 37% of the cases related to CVC, and 2% presented UTI and 98% of the cases related to the presence of urinary catheter.

In this respect, there are authors [5], who emphasize that the most frequent infections are the IAP, CVC and UTI, indicating to us the IFs to be implemented in ICUs to prevent each of these infections. Other authors [6] reinforce this opinion by pointing out that HAIs have an impact on the lives of patients, causing prolonged hospitalizations, increased morbidity and mortality, which result in a significant increase in costs, both for health systems and for society. They also add that IFs have been implemented to improve clinical practices, and to prevent infection.

Over time, an increasing number of interventions have emerged based on sets of measures aimed at a given objective (bundles or Intervention Beams - IF), applied in a coordinated manner and systematically monitored using checklists, involving the training of the professionals involved. This approach has had positive results, resulting in the reduction of infections. Since this is a cohesive set of measures, they must be implemented together for success to be achieved and they must be audited.

The Directorate General of Health [1] also recommends that in the implementation of IFs there should be special attention to the multi-disciplinary, aggregating and motivational nature of the work team. This team should be able to monitor the results of the implementation of IFs, namely the adherence of professionals to the implementation of IF measures, with a view to improving the indicators. This type of approach aims at reducing the incidence of target infections in inpatients. According to the Portuguese health, organization [7] auditing is a systematic, independent and documented process to obtain objective evidence and respective objective assessment in order to determine to what extent the audit criteria are met and may contribute to the application of these IFs.

Given the impact that HCAI rates have on intensive care services and on health organizations in general, our interest in studying the factors that may be related to the application of IFs by nurses, in the context of an ICU, regarding the prevention of infection arises. In this sense, the objective of this study is to identify factors related to IF application by nurses in a Portuguese ICU.

Materials and Methods

It is a descriptive-correlational, cross-sectional and quantitative approach study. The population of this study consisted of about fifty-eight nurses, who worked in the ICU of a Hospital Centre in the North of Portugal in three services: Multipurpose Intensive Care Unit of the Emergency Service (UCIPSU - 11 nurses), Multipurpose Intensive Care Unit (UCIP - 17 nurses) and Cardiology Intensive Care Unit (UCIC - 30 nurses). Inclusion criteria were as follows: i) Nurses who worked in the ICU of the Hospital Centre in the North of Portugal; ii) Nurses who were in the care area. The exclusion criteria defined as: i) Nurses who were absent from the service during the data collection period; ii) Nurses who were on sick leave during the data collection period. The sample was composed of by 44 nurses, about 75.9% of the population, who were present at the time of data collection.

The data collection was carried out by means of a self-completion questionnaire for nurses consisting of five parts: the first part for socio-demographic characterization; the second part for experience and vocational training; the third part for questions relating to prevention procedures; the fourth part for scales relating to the three IFs built by researchers; and the fifth and last part for questions relating to the performance of audits. After having been granted the authorisation by the administration of the Hospital Centre, in the North of Portugal, to carry out the study (Opinion No. 15/2019 of 1-04-2019), a date was scheduled for information gathering, which took place between May and June 2019. For the application of the questionnaire, the collaboration of the Head Nurses was requested and they were informed about the objectives of the study and procedures involved. The Head Nurses took on the task of informing their nursing team about the study and asked them to answer the questionnaire. Anonymity and confidentiality of information and voluntary participation were ensured. A questionnaire and an envelope were handed back to the nurses who voluntarily agreed to participate in the study. The Head Nurses gathered the closed envelopes and respective questionnaire and about 30 days after delivery, the researchers collected the envelopes in each of the services.

For data analysis and treatment a database was built in the Statistical Package for the Social Sciences (SPSS) computer software, version 25.0, where they were inserted. Descriptive statistics were then used to calculate absolute and relative frequencies for all variables and central tendency (Mean) and dispersion (Standard Deviation) measures for the ratio measurement level variables. Parametric tests (Student's t and ANOVA) were applied in the crossing of the Intervention Beam scales with the analyzed factors and alternatively, when the assumptions for their use were not guaranteed, the nonparametric Mann-Whitney and Kruskal-Wallis tests. The level of significance taken into account was 5% [8].

Results and Discussion

Most of the 44 nursing professionals in the sample was female (72.7%), belonged to the 38 - 50 age group (56.8%), was married (70.50%) and had a degree as an academic qualification (95.50%) (Table 1). The average age was 38.93 ± 5.470 years, the minimum was 26 years and the maximum was 50 years (data not shown in the table).

Variables	Fa	Fr (%)
Sex		
Male	12	27,3
Female	32	72,7
Age Group		
26 - 37 years	18	40,9
38 - 50 years	25	56,8
Non-respondent	1	2,3
Marital status		
Married	31	70,5
Single	10	22,7
Divorced	3	6,8
Academic Qualifications		
Degree	42	95,5
Master	2	4,5

Table 1: Sociodemographic characterization of the sample (n = 44).

Legend: Fa: Absolute Frequency; Fr: Relative Frequency.

The sample of nurses in this study was predominantly in the range of 16 - 30 years of professional experience (61.4%) and had between 9 - 20 years of professional exercise in the ICU (59.1%), the largest group of nurses (45.5%) had a specialty, and of these the majority (50.0%) were in the area of specialty of physician-surgical (Table 2).

Variables	Fa	Fr (%)
Time of professional exercise		
3 - 15 years	17	38,6
16 - 30 years	27	61,4
Exercise time in ICU		
1 - 8 years	18	40,9
9 - 20 years	26	59,1
Training		
Postgraduate	6	13,6
Specialty	11	25,0
The two formations	9	20,5
Non-respondent	18	40,9
Specialty (n = 20)		
Community	2	10,0
Medical-Surgical	10	50,0
Rehabilitation	7	35,0
Maternal and obstetrical Health	1	5,0

Table 2: Characterization of the experience and professional training of the sample nurses (n = 44).

Legend: Fa: Absolute Frequency; Fr: Relative Frequency.

The majority of the sample of nurses was composed of female professionals (72.7%), results that are in line with the statistical data published by the organization representing nurses in Portugal [9], which shows that in 2011 about 81% of the registered members were women. Female representativity is very similar to that found in a study conducted in Bragança (Portugal) [10], with a sample of 20 nurses, in which the objective was to identify nursing procedures in patients undergoing invasive mechanical ventilation and the development of pneumonia, in an intensive care unit, in which the majority of the sample belonged to women (75%).

For the age group, the majority of the sample was between 38-50 years old (56.8%), and this result was in accordance with data published by the organization representing nurses in Portugal [9], in which the age group between 31 and 50 years old represented the majority of nurses enrolled in this professional organization (55.9%). As for academic qualifications, in this study the majority of the sample had a degree (95.5%), which is in line with the data published by the professional organization [11], in which the majority of registered nurses had a degree (74.8%) and the results obtained in the Bragança study [10], in which the largest group (30%) also had a degree. The fact that most of the nurses in the sample fall within the 16 - 30-year range of professional experience (61.4%) and between 9 - 20 years of professional experience in the ICU (59.1%) indicates that they are professionals with a lot of professional experience, being essential for good care practice [12].

A slight majority of the sample (59.1%) had training (Post-Graduation and Specialization), demonstrating the concern of nurses in seeking professional training. This means that the work context itself is rich in continuous training experiences, generating opportunities to learn together, with others, contributing to the training of students and professionals and, finally, to the quality of health care [13].

Of the group of nurses who underwent postgraduate training, half had the medical-surgical specialty. This result corroborates that obtained in the study [10], in which the largest group (15%) had the specialty in medical- surgical, which was expected once, that these are studies performed in the context of ICU.

Most professionals had no training in Risk Management, Safety and Infection Prevention (56.8%), of those who had this training, the majority did not address the topic FI (63.1%) and reported that they feel the need to address it (80.0%).

This need is understandable, if we take into account what refers to the representative organization of nurses in Portugal [14], when we say that the need for training results from the individual experience of each experience, regarding the training process.

As for prevention procedures, the majority of nurses used gloves in care (61.4%), considered that the use of gloves prevents infection of the patient and health professional (79.5%), the entire sample considered that proper hand hygiene prevents infection (100%), and most reported hand hygiene with SABA or soap and water (88.6%).

The Program for Prevention and Control of Infections and Resistance to Antimicrobial Agents [2] indicates that in 2016, monitoring of the use of gloves by health professionals obtained an overall quality index of 80.7%, percentage much higher than in the present study, meaning that there is still a need to insist that this behaviour is consolidated in the practice of these nurses.

With regard to audits on the implementation of IFs, it can be seen that in the case of ITU, CVC and PAI, respectively, most nurses reported that the service was audited (94.7%; 100%; 52.6%), in relation to the frequency in which the monitoring of Intervention Beams adherence was carried out, the majority reported that it was sometimes carried out (57.9%), with audits being carried out in computer support (73.1%).

About audits, a study carried out in Minas Gerais (Brazil) [15] on the evaluation of nursing records in hemotherapy of a general hospital, revealed that only 65.5% of the items evaluated in the prescriptions in compliance, a percentage slightly higher than the implementation of monitoring of IF adherence, in this study, which exposes the difference between technical guidelines and what is actually implemented.

Regarding the relationship between IF application and socio-demographic variables, the ITU average IF score does not differ significantly among nurses with different age groups (t of Student: $p \geq 0,490$). The IF score differs between male and female nurses (Student’s t: $p < 0.047$) and female nurses had a higher average (8.84 > 7.17), i.e. they reported better procedures in this area.

The mean score of the CVC IF did not differ between nurses of different genders (Student’s t: $p \geq 0.069$) and age groups (Student’s t: $p \geq 0.313$).

The IAP IF score is significantly different among nurses of both sexes (Student’s t: $p < 0.037$) and age groups (Student’s t: $p < 0.005$). Male nurses had a higher mean (22.83 > 19.69), which means that they reported having better practices in this IF, as well as older nurses, who had a higher mean, than younger nurses (22.40 > 18.44) (Table 3).

Variables	Categories	n	Mean/OM	Test value	gl	p
ITU x sex Intervention Bundles Scale	Male	12	7,17	t = -2,048	42	0,047
	Female	32	8,84			
ITU x Age Group Intervention Bundles Scale	26 - 37 years	18	8,67	t = 0,696	41	0,490
	38 - 50 years	25	8,12			
Scale of the Intervention Bundles CVC x gender	Male	12	13,25	t = 1,867	42	0,069
	Female	32	16,41			
Score of Intervention Bundles CVC x Age Group	26 - 37 years	18	16,56	t = 1,021	41	0,313
	38 - 50 years	25	14,92			
PAI x sex Intervention Bundles Scale	Male	12	22,83	t = 2,156	42	0,037
	Female	32	19,69			
Intervention Bundles scale score PAI x Age group	26 - 37 years	18	18,44	t = 2,982	41	0,005
	38 - 50 years	25	22,40			

Table 3: Relationship between the application of intervention bundles with the sociodemographic variables.

Legend: gl: Degrees of Freedom; OM - Average Ordering; MW - Mann-Whitney; KW - Kruskal-Wallis; t- Student t- Test.

Regarding the relationship between the application of IFs and the variables of professional experience and professional training, the average ITU IF score does not differ between nurses with different time of professional exercise (t for Student: $p \geq 0,768$), nor between nurses with and without training (t for Student: $p \geq 0,274$). But significant statistical differences were found between the mean score of this IF for nurses with different time of professional exercise in the ICU (Student’s t: $p < 0.026$), with nurses with less years of experience in the ICU obtaining a higher mean (9.39 > 7.69), meaning that their procedures were more appropriate.

The mean CVC IF score does not differ among nurses with different time of professional exercise (Student’s t: $p \geq 0.063$), as well as among nurses with different time of professional exercise in the ICU (Student’s t: $p \geq 0.311$) and with different formative condition (Student’s t: $p \geq 0.293$).

The same was true for the average score of the IAP IF, which did not differ between the group of nurses who had and those who had no training (Student’s t: $p \geq 0.746$). The mean score of the IF of the PAI distinguishes between the nurses in the categories of time of professional exercise (t of Student: $p < 0.001$), and those with more experience obtained a higher mean, i.e. the his procedure in this IF was more appropriate. The same happened regarding the average score of the IAP IF among the nurses in the ICU professional exercise time categories (t of Student: $p < 0.009$) and those with more experience also obtained the highest average, which means better procedure in this IF (Table 4).

Variables	Categories	n	Mean/OM	Test value	gl	p
ITU Intervention Bundles Scale x professional exercise time	3 - 15 years	17	8,53	t = 0,297	42	0,768
	16 - 20 years	27	8,30			
Score of the Intervention Bundles ITU x exercise time in ICU	1 - 8 years	18	9,39	t = 2,316	42	0,026
	9 - 20 years	26	7,69			
ITU Intervention Bundles Scale x Training	Trained	18	8,89	t = 1,404	42	0,274
	Untrained	26	8,04			
Score of the Intervention Bundles CVC x time of professional exercise	3 - 15 years	17	17,35	t = 1,908	42	0,063
	16 - 20 years	27	14,41			
Score of the Intervention Bundles CVC x exercise time in ICU	1 - 8 years	18	16,50	t = 1,026	42	0,311
	9 - 20 years	26	14,88			
Scale of the Intervention Bundles CVC x training	Trained	18	14,56	t = -1,065	42	0,293
	Untrained	26	16,23			
Score of the Intervention Bundles PAI x time of professional exercise	3 - 15 years	17	17,82	t = -3,610	42	0,001
	16 - 20 years	27	22,26			
Score of the PAI Intervention Bundles x exercise time in ICU	1 - 8 years	18	18,61	t = -2,732	41,72	0,009
	9 - 20 years	26	21,88			
PAI x training Intervention Bundles scale score	Trained	18	20,28	t = 0,326	42	0,746
	Untrained	26	20,73			

Table 4: Relationship between the application of intervention beams and the variables professional experience and training.

Legend: gl: Degrees of Freedom; OM: Average Order; t- Student’s t Test.

Regarding the relationship between the application of IFs and preventive procedures, the ITU average IF ordering does not differ significantly among nurses with different glove usage procedures (KW: $p \geq 0,064$).

The same was the case for the CVC IF, where the average ordering does not differ significantly among nurses with different glove procedures (KW: $p \geq 0,294$). In the IAP IF, the mean sorting order of this bundle is significantly different among nurses with different glove

use procedures (KW: $p < 0.022$) and those nurses who indicated that they always use the gloves obtained the highest mean sorting order (26.50 > 14.71), meaning that they have more adequate procedures in this area.

Regarding the relationship between IF scores and audit procedures, in the ITU IF, the average sorting of scores does not differ significantly among nurses with different audit conditions (Yes/No) (MW: $p \geq 0.519$). The same was true for the CVC IF, where the average scoring did not differ significantly between nurses with different audit conditions (MW: $p \geq 0.345$), and for the PAI IF, where no statistically significant differences were found between the average scoring of nurses with different audit procedures (MW: $p \geq 0.232$).

In the present study, there is a relationship between the application of the IAP IF and the time of professional exercise and exercise in the ICU, in these two cases the nurses with the most professional experience (16 - 20 and 9 - 20 years of experience) were those with the most appropriate procedures in this field. These results may be explained using the statements of one author [12], who states that nurses with more professional exercise time demonstrate more competence in their area of care. However, there is an exception to this trend in the relationship between the application of the ITU IF and the time of professional exercise, in which it was the nurses with less time of professional exercise in the ICU (1 - 8 years), who reported to have more appropriate procedures. This result may be due to the fact that during graduation the UTI theme was deepened in several contexts, being a measure of infection more used, thus being more present in their short professional experience.

There was also a relationship between the application of the IAP IF and the use of gloves by nurses, as a preventive procedure for infections, in which the nurses who reported using gloves reported more appropriate procedures. This can be explained by the DGS recommendations [16], in which the recommendation for the use of gloves as a preventive procedure is included.

Conclusion

The analysis of the results and its discussion allows the identification of the relationship between the application of IF by nurses of a Portuguese ICU and the socio-demographic characteristics, regarding the application of the IF of the UTI the sex factor and the application of the IF of the PAI the sex factor and age group. When the relationship in question is between the application of IFs and professional experience and training, the emerging factors were in the case of the UTI IF the time of professional exercise in the ICU and in relation to the ICU IF the overall time of professional exercise and in the ICU. Finally, regarding the relationship between IFs and preventive procedures, the only factor identified was the use of gloves, regarding the IF of the PAI. It should be noted that in the application of the IF of the CVC no factor was identified.

It can be concluded that training in Risk Management, Safety and Infection Prevention reaches less than half of the sample and will have to be more offered by the responsible entities, so that it can cover all professionals.

The use of gloves in nursing care, in the procedures in which it is recommended, may not yet be fulfilled, by all professionals, which may constitute a risk of spreading HCAI. Given that audits of ITU, CVC and PAI IF application procedures are not a widespread reality and their frequency is low, it can be assumed that generalising this process to all IFs and increasing their frequency could be a measure to be applied to minimise that gap and even to increase the application of these IFs and the quality of the procedures.

Therefore, the implementation of these strategies for health organizations is urgent. This objective to be achieved depends not only on the directives and audit systems that are part of the organizational structure, but above all on the responsibility of health professionals, in the application of good practices, so that we can all benefit from quality care.

The main limitations of this study are the small sample size and the fact that it is a non-random sample, which has limited the security of inference of the sample results for the population.

This study may have implications in professional practice, in the area of Nursing of the Person in a Critical Situation, since its implementation and the dissemination of the results will make Nursing professionals aware of the importance of adopting these measures and for training in the prevention and control of infections. It is already being envisaged in the short term to organise training in the different services, where we carry out the study and in other services in the same hospital centre, on this subject, in which we would like to be the driving force.

Bibliography

1. Direção-Geral da Saúde. Diário da República, 2ª série Nº102 (2015).
2. Direção-Geral da Saúde. “Programa de Prevenção e Controlo de Infeções e de Resistências aos Antimicrobianos (2017).
3. AlKhawaja S., *et al.* “Catheter-Associated Urinary Tract Infections at Intensive Care Unit in Bahrain”. *EC Microbiology* 8.2 (2017): 71-79.
4. European Centre for Disease Prevention and Control. Healthcare-associated infections in intensive care units - Annual Epidemiological (2017).
5. Gao F., *et al.* “Impact of a bundle on prevention and control of healthcare associated infections in intensive care unit”. *Journal of Huazhong University of Science and Technology - Medical Science* 35.2 (2015): 283-290.
6. McAlearney AS., *et al.* “Searching for management approaches to reduce HAI transmission (SMART): A study protocol”. *Implementation Science* 12.1 (2017): 82.
7. Direção-Geral da Saúde. “Orientação nº 002/2017 de 20/01/2017. Preparação e Condução de Auditorias da Qualidade e Segurança da Prestação de Cuidados de Saúde, Documento de apoio (2017).
8. Marôco J. “Análise Estatística com o SPSS Statistics (7th edition) (2018).
9. Ordem dos Enfermeiros. Dados Estatísticos 2000-2011 (2012).
10. Cruz JRM and Martins MDS. “Pneumonia associada à ventilação mecânica invasiva: cuidados de enfermagem. Bragança, Portugal”. *Revista de Enfermagem Referência –IV* nº20 (2019).
11. Ordem dos Enfermeiros. Estatísticas de Enfermeiros (2018).
12. Benner P. “De Iniciado a Perito: Excelência e Poder na Prática Clínica de Enfermagem (2001).
13. Macedo APMC., *et al.* “Professional practices of education/training of nurses in an intensive care unit”. *Revista Brasileira de Enfermagem-REBEn* 72.2 (2019): 321-328.
14. Ordem dos Enfermeiros, lei nº156/2015, de 16 de setembro. Regulamento do Exercício Profissional dos Enfermeiros (2015).

15. Santos SP, *et al.* "Avaliação dos registros de enfermagem em hemoterapia de um hospital geral". *Avances en Enfermería* 31.1 (2013): 103-112.
16. Direção-Geral da Saúde. "Norma nº 013/2014 de 25/08/2014 atualizada a 07/08/2015 Uso e Gestão de Luvas nas Unidades de Saúde (2015).

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