

# Comparison of Knowledge Levels and Attitudes of Family Medicine Assistants About Meningococcal Infection and Vaccines Before and After Education

## Aile Hekimliği Asistanlarının Meningokok Enfeksiyonu ve Aşılıları Hakkında Bilgi Düzeyleri ve Tutumlarının Eğitim Öncesi ve Sonrası Karşılaştırılması

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### ABSTRACT

**Objective:** *Neisseria meningitidis*, which has one of the highest mortality rates without treatment, is one of the most common causes of bacterial meningitis in the world. Invasive meningococcal disease caused by this agent is one of the diseases that can be prevented by vaccination. The aim of this study was to measure and evaluate the level of knowledge and attitudes of family medicine residents about meningococcal infection and vaccines before and after the training program.

**Material and Methods:** Our descriptive cross-sectional study was conducted between 01.02.2023 and 31.03.2023 with 102 family medicine residents working in University of Health Sciences Türkiye, Adana City Training and Research Hospital, Participants were asked for sociodemographic data before and after the training program and questionnaire about their knowledge and attitudes about meningococcal infection and vaccines. The data obtained were analyzed with a statistical software package.

**Results:** The median age of the 102 participants was 31 years. Among the participants, 56.9% were women; 31.4% had encountered patients with meningococcal infection during their professional life; 29.4% had sufficient knowledge about the vaccine; 89.2% stated that they would have their own children vaccinated; 95.1% thought that it should be included in the Expanded Programme on Immunization (EPI); and 94.1% recommended that families have their children vaccinated. There was a significant difference between the pre-test and post-test mean scores of the level of knowledge about meningococcal infection and vaccines ( $p<0.05$ ).

**Conclusion:** Primary prevention is a vital aspect of family medicine. High mortality and morbidity associated with vaccine-preventable meningococcal disease, and newly developed vaccines should be emphasized in the content of the training titled "non-EPI vaccines" in the residency program.

**Keywords:** Meningococcus, vaccine, meningitis

### ÖZ

**Amaç:** Tedavisiz mortalite oranı en yüksek bulaşıcı hastalıklardan olan *Neisseria meningitidis*, dünyadaki bakteriyel menenjitin en yaygın nedenlerinden biridir. Bu etken nedeniyle ortaya çıkan invazif meningokok hastalığı aşı ile önlenilebilir hastalıklardandır. Bu çalışmadaki amacımız; düzenlenen eğitim programı öncesi ve sonrası aile hekimliği asistanlarının meningokok enfeksiyonu ve aşılıları hakkında bilgi düzeyleri ve tutumlarını ölçmek ve değerlendirilmiştir.

**Gereç ve Yöntemler:** Çalışmamız tanımlayıcı kesitsel tipte olup 01.02.2023 ile 31.03.2023 tarihleri arasında Sağlık Bilimleri Üniversitesi, Adana Şehir Eğitim ve Araştırma Hastanesi'nde çalışan 102 aile hekimliği uzmanlık öğrencisi ile gerçekleştirilmiştir. Katılımcılara eğitim programı öncesi ve sonrası sosyodemografik veriler ile meningokok enfeksiyonu ve aşılıları hakkında bilgi ve tutumlarına yönelik hazırlanmış anket soruları yöneltilmiştir. Elde edilen veriler istatistiksel paket program ile analiz edilmiştir.

**Bulgular:** Çalışmaya katılan 102 katılımcının ortanca yaş değeri 31 idi. Katılımcılardan kadınların oranı %56,9; meslek hayatı boyunca meningokok enfeksiyonlu hasta ile karşılaşmış olanların oranı %31,4; meningokok aşısıyla ilgili yeterli bilgiye sahip olanların oranı %29,4;

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kendi çocuđuna meningokok aşısı yaptıracasını belirtenlerin oranı %89,2; meningokok aşısının Genişletilmiş Bağışıklama Programı'nda (GBP) olması gerektiğini düşünenlerin oranı %95,1; ailelere çocuklarına meningokok aşısı yaptırmalarını önerenlerin oranı %94,1'dir. Meningokok enfeksiyonu ve aşıları bilgi düzeyi ön test ve son test puan ortalamaları arasında anlamlı farklılık saptandı ( $p<0,05$ ).

**Sonuç:** Meningokok aşıları henüz GBP'de yer almamaktadır. Birincil koruma aile hekimliğinin en önemli etkinlik alanıdır ve asistanlık eğitimlerinde GBP dışı aşılar başlıklı eğitim içeriğine mortalite ve morbiditesi yüksek ve aşı ile korunulabilen meningokok hastalığı ve yeni geliştirilen aşılar vurgulanmalıdır.

**Anahtar Kelimeler:** Meningokok, aşı, menenjit

## INTRODUCTION

Family physicians assume responsibility for community health as well as individual health, and immunization with vaccines, one of the primary prevention steps, is an important step in this special responsibility (1). They can monitor their registered population in terms of risk factors and exposures while they are not yet ill and before they apply to health institutions. With this lifelong follow-up and the relationship of trust established through recurring contacts, family physicians offer unique opportunities for immunization.

Meningococcal disease is a serious infectious disease caused by the bacterium *Neisseria meningitidis*. Clinical manifestations of meningococcal disease can range from asymptomatic carriage to invasive disease. *Neisseria meningitidis* causes various meningococcal disease pictures including bacteremia, meningococcemia, meningitis and chronic infection without sepsis and can also result in arthritis, pneumonia, occult bacteremia, conjunctivitis, endocarditis and endophthalmitis (2,3). Nasopharyngeal carriage is present in approximately 10% of healthy individuals, and these carriers have the main role in the spread of the agent since they do not show any signs of disease. Transmission occurs by contact with secretions or droplets (4).

Risk groups include those living in crowded living conditions, military personnel, students, those living in endemic areas in terms of meningococcus, those exposed to smoking, sickle cell patients and those with immunodeficiency.

The disease process can progress rapidly. Important non-specific findings include high fever, restlessness in the infant period, headache, nausea, vomiting and nuchal rigidity. Meningococcemia occurs in approximately half of the cases, and petechiae and purpura are not always observed (5-7). Meningococcemia is a sudden-onset, acute and rapidly progressing disease characterized by bacteremia and sepsis, high fever, and petechiae on the skin, with a high mortality rate that may lead to septic shock and multi-organ failure (8). Despite all treatment options, 10-15% of cases end in death and 10-20% of cases progress with severe morbidities such as hearing loss and limb amputations (9).

Meningitis occurs when the agent taken by direct contact or droplet into the respiratory secretions of the carrier or patient adheres to the mucosa of the nasopharynx, is carried to the deeper tissues by phagocytic vacuoles in the membrane, reaches the submucosa, invades the vessels in this area, and joins the circulation, and then reaches the meninges within

hours (10). The diagnosis is made by microscopic observation of meningococci and isolation of the agent by culture from samples obtained from sterile body fluids such as synovial fluid, blood, and cerebrospinal fluid (CSF). CSF culture is the gold standard for diagnosis. polymerase chain reaction is important for the rapid diagnosis of meningococcal infections (11,12).

Early diagnosis is very important for the successful treatment of meningococcal infection and antibiotherapy constitutes the most important step. Therefore, empirical antibiotic treatment should be initiated without waiting for the culture results (13). Beta lactams should be the first antibiotic group preferred in treatment. Alternatively, cefotaxime, ceftriaxone, or benzathine penicillin G should be started and the duration of antibiotherapy should not be less than 7 days (13,14). In meningococcal disease, the risk of infection in close contacts is increased by 500 to 800 times (15). The decision to give prophylaxis should be based on the closeness and duration of contact. Prophylaxis should be given to people who share the same house, those who stay in collective living areas, and those who come into contact with the sick person or respiratory secretions up to 7 days before the onset of symptoms (16).

Vaccination is very important in the prevention of meningococcal infections and epidemics (17). Since meningococci that cause invasive meningococcal disease (IMD) are largely encapsulated, capsule polysaccharides have been targeted in vaccine development studies (18). According to polysaccharide capsule structure, 13 serotypes have been defined, and 6 of them (A, B, C, W135, X, Y) cause IMD meningococcal vaccines are of two types based on their development technique, and these are conjugated and polysaccharide vaccines (19).

Our study aims to organize a training program increase the level of knowledge about non-EPI vaccines in the residency program, and to emphasize the issue of meningococcal disease and newly developed meningococcal vaccines, which have high mortality and morbidity and can be prevented with vaccination. Evaluation of knowledge will be made before and after the training.

## MATERIALS and METHODS

### Study Type

Our descriptive cross-sectional study was conducted from 1 February to 31 March 2023 in University of Health Sciences

Türkiye, Adana City Training and Research Hospital, prior to the commencement of the study, written permissions were obtained from the administrations of the universities whose students were to be included in the study's sample. The approval of the University of Health Sciences Türkiye, Adana City Training and Research Hospital Clinical Research Ethics Committee and was obtained (decision number: 2360, date: 01.02.2023).

### Study Group

The research population consisted of 125 family medicine residents working in the ACTR Hospital. In the calculation made with the Epi-Info statistical program, the sample size was found to be 102 people with 80% power, 95% confidence interval, and 5% margin of error. Residents who agreed to participate and completed the consent form were included in the study, while those who did not agree or who later withdrew consent were excluded.

### Procedures

Before the training date, the participants were asked about sociodemographic data, knowledge, and attitudes about meningococcal infection and vaccines through both face-to-face interviews and an online questionnaire designed by the researcher.

Afterwards, a presentation titled "meningococcal infections and prevention" was made by a specialist physician through face-to-face and simultaneous video interviews in the family medicine clinic.

The content of the presentation consisted of epidemiology, prevalence, incidence, clinical features, licensed vaccines, and administration schemes according to age. After the presentation, the same questionnaire was re-administered to the participants who had taken the pretest and attended the presentation.

Structured questionnaire-data form used in our study consisted of sociodemographic data and questions created by the researcher. Cronbach's alpha value was found to be 0.75, and the questionnaire was considered valid and reliable. In the first part of the data collection form, 13 questions defined the demographic characteristics of the physicians. The questions about sociodemographic characteristics included the participant's age, gender, marital status, having children, total working time in the profession, the number of years in residency, whether the participant had a pediatric rotation, and whether the participant had ever encountered meningococcal infection. whether the physician has sufficient knowledge about meningococcal vaccines, whether he/she would have his/her own child vaccinated with the meningococcal vaccine, whether he/she wants the meningococcal vaccine to be included in the national vaccination calendar, and whether he/she recommends families to have their children vaccinated with the meningococcal vaccine. In the section assessing physician knowledge, there are twenty-six questions evaluating the

level of knowledge about meningococcal infection and vaccination. The response options "Agree", "Disagree", and "No Opinion" were used.

### Statistical Analysis

The data were analyzed with SPSS 21.0 at a 95% confidence level. The kurtosis and skewness coefficients were examined to determine the suitability of the variables to follow a normal distribution. Pre-post test change in Knowledge Level of Meningococcal Infection and Vaccines was analyzed with the dependent groups t-test. Pre-post test scores of Meningococcal Infection and Vaccines Knowledge Level were analyzed with independent groups t-test for variables with 2 groups and an ANOVA test for variables with 3 or more groups. P-value <0.05 was considered statistically significant.

## RESULTS

A total of 102 people participated in the study. Among the participants, 56.9% were women, 49.0% were 30 years of age or younger, 57.8% were married, 37.3% had children, 34.3% had been practicing medicine for 1-3 years, 68.6% were full-time residents, 27.5% were in their first year of residency, and 71.6% had received pediatric rotation (Table 1). The percentage of residents who had experienced a patient with meningococcal infection during their careers was 31.4%. The percentage of residents who had sufficient knowledge about the meningococcal vaccine was 29.4%. The percentage of residents who stated that they would have their child vaccinated with the meningococcal vaccine was 89.2%. The percentage of residents who thought that the meningococcal vaccine should be included in the national vaccination schedule was 95.1%. Finally, the percentage of residents who recommended that families have their children vaccinated with the meningococcal vaccine was 94.1% (Table 1).

Most correct answers for the Pre-test: people in close contact with invasive meningococcal infection should receive antibiotic prophylaxis within the first 24 hours (93.1%); meningococcal vaccines are included in the routine vaccination schedule in our country (91.2%); *neisseria meningitidis* is transmitted by droplet or close contact through the nose or throat (90.2%); individuals with functional/anatomical asplenia and complement C5-C9 deficiency have an increased risk of meningococcal disease (90.2%); thirteen serotypes of meningococci have been identified, five of which (A, B, C, W135 and Y) cause the most disease (83.3%). The least correct answers for the Pre-test are: Trumenba (MenB-FHbp) and Menquadfi (MenACWY-TT) vaccines were licensed in our country in 2022 (13.7%). The only vaccine licensed for serogroup B in Türkiye is Trumenba (MenB-FHbp) (31.4%). Conjugated vaccines are not used in children under two years of age due to the weak immune response they induce (34.3%). Menveo (MenACWY-CRM) vaccine is used in children (from the 2<sup>nd</sup> month), adolescents, and adults (37.3%) Table 2. Polysaccharide meningococcal vaccines provide lifelong protection (40.2%).

**Table 1. Pre-Post Test Intragroup and Intergroup Investigation of Knowledge Level of Meningococcal Infection and Vaccines**

		Pre-educ		Post-educ		Mean average	t	p-value
		Mean±SD						
Age	<30	14.68±4.93		22.34±2.4		7.66	-12.801	0.000*
	30-34	17±3.37		23.25±1.81		6.25	-9.685	0.000*
	≥35	18.75±3.07		23.19±1.22		4.44	-5.577	0.000*
		F=6.922	p=0.002*	F=2.398	p=0.096			
Gender	Male	16.61±3.77		22.93±1.96		6.32	-10.512	0.000*
	Female	15.78±4.86		22.69±2.19		6.91	-12.593	0.000*
		t=0.947	p=0.346	t=0.579	p=0.564			
Marital status	Single	15.05±4.67		22.67±1.8		7.63	-12.03	0.000*
	Married	16.93±4.09		22.88±2.28		5.95	-11.647	0.000*
		t=-2.166	p=0.033*	t=-0.493	p=0.623			
Medical experience	<3	14.09±4.97		21.8±2.47		7.71	-10.196	0.000*
	4-7	16.59±3.92		23.33±1.78		6.74	-11.373	0.000*
	≥8	18.57±2.84		23.29±1.35		4.71	-7.584	0.000*
		F=8.217	p=0.000*	F=6.756	p=0.002*			
Residency type	Full-time	15.37±4.65		22.59±2.17		7.21	-14.943	0.000*
	Half-time	17.81±3.35		23.25±1.83		5.44	-7.706	0.000*
		t=-2.665	p=0.009*	t=-1.503	p=0.136			
Experience of patients with meningococcal infection	Yes	17.41±3.88		22.97±1.99		5.56	-8.654	0.000*
	No	15.56±4.55		22.71±2.13		7.16	-14.222	0.000*
		t=1.988	p=.049*	t=0.570	p=0.570			
Thinking that they have sufficient knowledge about meningococcal vaccine	Yes	18.63±3.08		23.3±1.82		4.67	-7.393	0.000*
	No	15.1±4.49		22.58±2.16		7.49	-15.621	0.000*
		t=4.578	p=0.000*	t=1.594	p=0.114			
Thinking that meningococcal vaccine should be included in the national vaccination schedule	Yes	16.05±4.5		22.76±2.12		6.71	-15.829	0.000*
	No	17.8±1.79		23.4±1.14		5.60	-8.257	0.001*
		t=-0.861	p=0.391	t=-0.665	p=0.508			
Recommending meningococcal vaccination to families	Yes	16.26±4.39		22.8±2.12		6.54	-15.798	0.000*
	No	14.17±4.79		22.67±1.63		8.50	-4.576	0.006*
		t=1.127	p=0.262	t=0.154	p=0.878			

\*p&lt;0.05 Paired Sample t test, independent Sample t test, ANOVA, SD: Standard deviation

**Table 2. Questions with the highest increase in correct answers**

Trumenba (MenB-FHbp) and Menquadfi (MenACWY-TT) vaccines were licensed in our country in 2022	▲49%
The only vaccine licensed for serogroup B in Türkiye is Trumenba (MenB-FHbp)	▲43%
Menveo (MenACWY-CRM) vaccine is used in children (from the 2nd month), adolescents and adults	▲42%
Menectra (MenACWY-DT) vaccine can be used between the ages of 9 months and 55 years. The vaccine is used in single doses in people older than two years of age.	▲41%
The source of meningococcal infections is mostly asymptomatic infectious carriage	▲41%

Most correct answers for the final test; with the introduction of conjugated pneumococcal and Hib vaccines into routine vaccination schedules world-wide, *neisseria meningitidis* is now the leading cause of meningitis, accounting for 99.0% of cases. People in close contact with invasive meningococcal infection should receive antibiotic prophylaxis within the first 24 hours. Individuals with functional/anatomical asplenia and complement C5-C9 deficiency have an increased risk of meningococcal disease, meningococcal vaccines are included in the routine vaccination schedule in our country, *neisseria meningitidis* is transmitted through close contact or droplets from the nose or throat, accounting for 97.1% of transmissions. The least correct answers in the post-test; trumenba (MenB-FHbp) and Menquadfi (MenACWY-TT) vaccines were licensed in our country in 2022, polysaccharide meningococcal vaccines provide substantial protection, with an efficacy of 69.6%, over a lifetime, conjugated vaccines are not used in children under two years of age due to the weak immune response they induce. The only vaccine licensed for serogroup B in Türkiye is Trumenba (MenB-FHbp), which has an effectiveness of 74.5%, meningococcal infection is more common in children under 2 years of age in developing countries, and over 10 years of age in developed countries.

## DISCUSSION

The rate of those who had experienced a patient with meningococcal infection during their professional life was 31.4% in our study, and this rate was 51.9% in a study conducted by Kapar (20) with pediatric specialists and assistants. In a study conducted by Aycanoğlu (21) with 193 physicians-120 family physicians, 39 family medicine residents, and 34 family medicine physicians-it was found that 32.1% of the participants had experience with meningococcal infection. Since meningitis infections usually have an acute onset, rapidly and noisily progressing clinical picture; the first presentation is mostly to secondary and tertiary healthcare institutions rather than primary care, and therefore pediatricians are more likely to encounter these cases than family physicians. The result of our study confirms this situation.

In our study, the rate of those who thought they had sufficient knowledge about meningococcal vaccine was 29.4% before the training and 80.3% after the training; in Kolcu (22), in which a total of 236 physicians (143 family GPs, 70 family medicine residents, 20 family medicine specialists) participated, the

rate of participants who considered themselves sufficiently knowledgeable about meningococcal vaccines was 12.7%. In a study conducted by Avcı (23) with 377 family physicians on vaccines other than the national vaccination schedule, 26% of the participants considered themselves knowledgeable about special vaccines, while 56.5% stated that they had partial knowledge. In the same study, 88.7% of those who thought they did not have sufficient knowledge about special vaccines suggested in-service training as a method of obtaining information.

The rate of those who thought that meningococcal vaccine should be included in the national vaccination schedule was 95.1% in our study. In Avcı (23), 69.4% of the participants stated a positive opinion. In Kolcu (22), 70.4% of the participants answered yes to the same question, while 26.9% were undecided. In the study conducted by Özdemir et al. (24) with pediatricians, this rate was 81.8%. Participants who responded negatively cited the high cost of vaccination (56.6%), the idea that it was not a priority (42.3%), side effects (15.4%), and not finding it effective (7.7%) as reasons. In the Aycanoğlu (21), 82.9% of the participants selected the option "I think that meningitis vaccine should be included in the routine vaccination schedule due to the high mortality and morbidity rates of meningococcal meningitis." The rate of those who think that meningococcal vaccines should be included in the national calendar was found to be higher than in other studies.

The correct response rate to the statement that there are two types of meningococcal vaccines, polysaccharide and conjugated, was 77.5% in the Pre-test and 87.3% in the post-test in our study. 61.53% of the participants in Kapar (20) stated that there are two types of vaccines. In the Özdemir et al. (24) study conducted with pediatricians, 87.6% of the participants answered the same question correctly, and in the Avcı (23) study, 72.9% of the participants answered the same question correctly. The correct response rate to another statement that meningococcal vaccines have vaccine forms containing a single serotype and vaccine forms containing multiple serotypes was 71.6% in the Pre-test and 95.1% in the post-test in our study, while the correct response rate for the same statement was 68.9% in Aycanoğlu (21) Again, while the correct response rate of the false statement "polysaccharide meningococcal vaccines provide permanent immunity" was 40.2%, 35.8% of the participants in Aycanoğlu (21) chose the option of disagreeing with the statement

“polysaccharide meningococcal vaccines provide lifelong protection.” In general, it was observed that participants' knowledge of meningococcal infection was higher than that of meningococcal vaccines. This shows that more emphasis should be placed on vaccination in the training sessions to be organized.

The Meningococcal Infection and Vaccines Knowledge Level Pretest score shows a statistically significant difference according to age ( $p < 0.05$ ). Those under 30 years of age have a mean score of 14.68; those between 30-34 years of age have a mean score of 17.00; and those 35 years of age and older have a mean score of 18.75. Accordingly, the average income of those aged 35 years and over is the highest. Again, Meningococcal Infection and Vaccines Knowledge Level Pretest score shows a statistically significant difference based on the length of practice ( $p < 0.05$ ).

The mean of those who have been practicing for 1-3 years is 14.09; the mean of those who have been practicing for 4-7 years is 16.59; and the mean of those who have been practicing for 8 years or more is 18.57. Accordingly, the average of those who have been practicing for 8 years or more is the highest. Similarly, the post-test score of Knowledge Level of Meningococcal Infection and Vaccines showed a statistically significant difference according to the duration of practice ( $p < 0.05$ ). The mean score is 21.80 for those who have been practicing for 1-3 years; 23.33 for those who have been practicing for 4-7 years; and 23.29 for those who have been practicing for 8 years or more. Accordingly, the average of those who have been practicing for 4-7 years is the highest.

In Aycanoğlu (21), it was observed that the level of knowledge of meningococcal infection was higher in employees working for 20 years or more compared to the others. It may be thought that age and years spent in the profession, and thus experience, may have led to this result. Primary care/family medicine forms the basis of preventive medicine practices. Vaccination studies are one of the most important parts of the research. In addition, family medicine involves managing conditions with low prevalence. Therefore, always being prepared is required for any disease, no matter how rare it is in the community. Meningococcal vaccines are not yet included in the national vaccination schedule in Türkiye. Therefore, physicians do not have as much practice with meningococcal vaccines as with other vaccines on the schedule. This causes the information acquired over time to be forgotten or not kept up to date. As a matter of fact, most of the physicians who answered “no” to the question posed by Kolcu (22) about recommending that families have their children vaccinated with the meningococcal vaccine claimed that they did not have sufficient knowledge to provide education about the vaccine.

### Study Limitation

This study was conducted in a single center as a survey. With a multicenter design, it is possible to define the state of knowledge about Meningococcal Infection and Vaccines in Family Medicine education both in other centers and nationally in a more inclusive manner. The strength of our study is that it was conducted among family medicine residents who will actively assume immunization responsibility in primary care. In addition, the provision of opportunistic education was provided indirectly and the simultaneous assessment of knowledge and attitudes regarding infections, clinical practices, and vaccines is one of the strengths of our study.

### CONCLUSION

Family physicians serve individuals seeking medical care irrespective of age, gender and disease. Vaccination is undoubtedly a fundamental task for family physicians. Meningococcal disease, a vaccine-preventable disease with high mortality and morbidity despite treatment, can be considered critical in this respect.

The data obtained in our study showed that family physicians may be hesitant about non-EPI vaccines and that they are more knowledgeable about the disease related to these vaccines than about meningococcal vaccination. Awareness and knowledge increased after the education program. Preventive medicine, involving physicians who will be more motivated towards taking measures before individuals get sick, will prevent congestion in the health system in the future. In addition, the feedback mechanism will provide guidance for future education programs. This will also provide reference information for family medicine trainers.

### Ethics

**Ethics Committee Approval:** The approval of the University of Health Sciences Türkiye, Adana City Training and Research Hospital Clinical Research Ethics Committee and was obtained (decision number: 2360, date: 01.02.2023).

**Informed Consent:** Residents who agreed to participate and completed the consent form were included in the study.

### Footnotes

#### Authorship Contributions

Surgical and Medical Practices: A.T., H.V.T., Concept: A.T., M.T., H.V.T., Data Collection or Processing: A.T., H.V.T., Analysis or Interpretation: A.T., M.T., H.V.T., Literature Search: A.T., M.T., Writing: A.T., M.T., H.V.T.

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