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ORIGINAL ARTICLE

The impact of outpatient supportive oncology on cancer care cost and utilization

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Abstract

Background: Supportive oncology (SO) care reduces symptom severity, admissions, and costs in patients with advanced cancer. This study examines the impact of SO care on utilization and costs.

Methods: Retrospective analysis of utilization and costs comparing patients enrolled in SO versus three comparison cohorts who did not receive SO. Using claims, the authors estimated differences in health care utilization and cost between the treatment group and comparison cohorts. The treatment group consisting of patients treated for cancer at an National Cancer Institute-designated cancer center who received SO between January 2018 and December 2019 were compared to an asynchronous cohort that received cancer care before January 2018 ($n = 60$), a contemporaneous cohort with palliative care receiving SO care from other providers in the Southeastern Pennsylvania region during the program period ($n = 86$), and a contemporaneous cohort without palliative care consisting of patients at other cancer centers who were eligible for but did not receive SO care ($n = 393$).

Results: At 30, 60, and 90 days post-enrollment into SO, the treatment group had between 27% and 70% fewer inpatient admissions and between 16% and 54% fewer emergency department visits ($p < .05$) compared to non-SO cohorts. At 90 days following enrollment in SO care, total medical costs were between 4.4% and 24.5% lower for the treatment group across all comparisons ($p < .05$).

Conclusions: SO is associated with reduced admissions, emergency department visits, and total costs in advanced cancer patients. Developing innovative reimbursement models could be a cost-effective approach to improve care of patients with advanced cancer.

KEYWORDS
advanced cancer, cancer care, emergency department visits, health care costs, health care utilization, inpatient admissions, palliative care, supportive oncology

INTRODUCTION

In patients with cancer, interprofessional, nonhospital-based palliative care models, or supportive oncology (SO) has been shown to reduce symptom severity, hospital admissions, and total health care costs.[1–3] SO integrates social work, nutritional counseling, navigation, financial advocacy, nursing, palliative medicine, and pain management or psycho-oncology with standard oncology treatment to meet the multidimensional care needs of patients with cancer. Growing evidence on the benefits of interdisciplinary SO has facilitated efforts to fully integrate oncology and early, accessible SO.[4] Between 2009 and 2018 the proportion of US National Cancer Institute (NCI)-designated cancer centers with "supportive care" programs increased from 10% to 35%.[5,6]

However, the compositions of SO programs are heterogeneous, and evaluating their effectiveness has challenged the field.[7] Economic evaluation of SO programs is particularly complex because standard fee-for-service models do not cover costs of nonbillable services and may only cover physicians or advance practice providers (APP), leaving out the majority of SO disciplines. Thus, many SO programs offer only palliative care that can be provided and billed by a physician or APP.[8] Meta-analyses and systematic reviews indicate that the structure, quality of care, and cost outcomes associated with these programs are variable and poorly characterized.[1,9,10] A 2018 Lancet Oncology Commission states that "The absence of international agreements on the content and standards of the organization, education, and research of palliative care in oncology are major barriers to successful integration."[11]

Here, we examine the impact of interprofessional SO care on utilization and medical costs in commercially insured patients with advanced cancer. The use of three comparison cohorts is innovative and provides more robust evidence by addressing both selection bias and temporal trends, as it allows for more flexibility in making comparisons from different angles and answering different questions.

MATERIALS AND METHODS

Cohort definitions

We adopted a retrospective cohort design with three comparison cohorts. The treatment cohort consists of 138 patients enrolled in the NCI-Designated Sidney Kimmel Cancer Center (SKCC) SO program between January 2018 and December 2019 (the program period) and who were commercially insured through Independence Blue Cross (Independence). The interprofessional SO team consists of palliative care and pain management physicians and nurse practitioners, pharmacists, psychiatrists, nutritionists, social workers, lay/patient navigators, and financial counselors. The team provides symptom management, mental health support, financial counseling, practical support, and community connections based on patient-identified need. Symptomatic support encompasses pain management and addressing neuropathy, shortness of breath, fatigue, and nausea as well as assessment of medication adherence, polypharmacy, and high-risk drug identification in older adults. Emotional support involves supportive counseling, psychiatric consultation, group and educational programming and spiritual support. Financial counselors proactively connect patients with grants, foundations, patient assistance, and free drug/drug replacement programs to address the financial toxicities of cancer care. Practical support encompasses topics like transportation, housing, childcare, employment, and insurance coverage.

Patients had a combination of billable and nonbillable visits based on their highest needs. More than 60% of the patient interactions were nonbillable encounters, with an average of just over seven nonbillable touchpoints per patient. This is much different than traditional palliative care programs which are often fee-for-service and encompass billable encounters only from a physician or nurse practitioner.

Analyses compare cost and utilization outcomes between this group and three distinct comparison groups. The comparator groups were Independence members diagnosed with metastatic solid tumors getting medical, radiation or surgical cancer treatment and matched to the treatment cohort based on age, diagnoses and comorbidities. We used ICD10 codes C77, C78, and C79, and Centers for Medicare & Medicaid Services multi-level grouper 2.12 to identify patients with secondary malignancy. Although initial identification of treatment group members was done using medical records, to ensure comparability to the comparison cohorts, only treatment group members who were also identified using the administrative claims criteria were included in the analytic sample.

The Asynchronous SKCC cohort ($n = 60$) also received palliative care from Jefferson Palliative Care providers between August 2015 and July 2017, before the program began. The Contemporaneous Palliative Care Cohort ($n = 86$) received palliative care from a non-Jefferson palliative care provider in Southeastern Pennsylvania during the program period, and the Contemporaneous Non-Palliative Care Cohort ($n = 393$) received cancer care from non-Jefferson providers in Southeastern Pennsylvania between the program period but did not receive palliative care services. Receipt of palliative care services was identified using CPT and ICD10 codes and through claims associated with NPIs from palliative care providers in the geolocation of the study.

The three comparison cohort design allows us to test more hypotheses by addressing different types of confounding bias. The Asynchronous SKCC cohort holds constant health-system characteristics that could impact outcomes, including internal protocols, the physical environment, staff availability, and training, but confounds treatment assignment with time such that differences in outcomes could be impacted by factors such as changes in available treatments, recommended treatment protocols, policy changes, and environmental factors. The two contemporaneous cohorts hold the time-varying components constant but confound treatment with the hospital system. The Contemporaneous Palliative Care Cohort shows the cost-effectiveness of the SO intervention relative to other palliative care programs. Contemporaneous Non-Palliative Care

Cohort identifies the potential average treatment effect on the treated.

Outcomes

Inpatient hospital admissions capture all-cause admissions to acute inpatient facilities but exclude admissions to skilled nursing and long-term facilities. Readmissions capture all-cause inpatient admissions occurring within 30 days of discharge from an index inpatient admission. Outpatient visits include visits to outpatient clinics, and specialist and primary care visits, but exclude emergency department (ED) visits. Inpatient and ED costs reflect facility costs for ED visits but do not include professional costs from attending physicians. Professional costs include physician costs incurred in the inpatient setting, ED, and other outpatient settings. Total medical costs include inpatient, outpatient, and professional costs and costs for durable medical equipment and other ancillary services. Total medical costs do not include pharmacy costs but do include cancer-related therapeutics, including chemotherapy drugs that are covered under the medical benefit. All outcomes were identified using administrative claims.

Analytical approach

Differences in post-intervention outcomes were assessed using generalized linear models (GLM) with log-link functions. Utilization outcomes were estimated using a negative binomial distribution, and cost outcomes were estimated using a γ distribution.

GLMs with log link functions are commonly used in health outcome studies because they can handle non-normal outcomes, such as binary, count, and overdispersed count data. The log link function linearizes the relationship between the independent variables and the log odds or expected count of the outcome, stabilizes the variance, and produces interpretable results. The negative binomial distribution was our choice for estimating health care utilization because it can deal with overdispersion, count data, zero inflation, and right-skewness, which are common in administrative claims. The γ distribution is useful for estimating health care costs because it can model nonnegative data that is continuous, handle right-skewed data, and adapt to different cost distributions. Both distributions allow for the inclusion of covariates that can influence utilization and cost, such as age, gender, and chronic conditions.[12]

Propensity score matching[13] (PSM) was conducted using a greedy 1:1 match without replacement to identify a comparison group from the Contemporaneous Non-Palliative Care population. The algorithm pairs each treated individual with the closest untreated individual based on their propensity score that is generated based on demographic characteristics, risk score, chronic/complicating conditions, days between treatments, and the most common diagnosis and procedure codes observed in the sample during the 6 months before the index date. PSM covariate balance was assessed using absolute standardized mean differences. The matched comparison cohort did not differ from the treatment group on any of the variables in Table 1. The same index date from the treatment cohort was assigned to the corresponding matched comparison member. PSM was not used for comparisons using the Asynchronous SKCC and Contemporaneous Palliative Care cohorts due to small sample sizes. Regression analyses comparing the Asynchronous SKCC and Contemporaneous Palliative Care cohorts to the treatment group included variables from Table 1 as covariates on which the treatment and comparison cohorts differed.

RESULTS

Table 2 shows that the treatment cohort had significantly fewer inpatient admissions and readmissions across all time periods and fewer ED visits in the first 30 days following the first palliative encounter compared to the asynchronous comparison cohort. Specifically, in the 0- to 30-day period post-treatment, the treatment group had 43% lower odds of any inpatient hospitalization (IP) admission, 67% lower odds of any IP readmission, and 51% lower odds of any ED visit. In the 31- to 60-day period post-treatment, the treatment group had 47% lower odds of any IP admission and 69% lower odds of any IP readmission. In the 61- to 90-day period post-treatment, the treatment group had 61% lower odds of any IP admission and 71% lower odds of any IP readmission. The lower medical costs in the treatment group were mainly due to reductions in inpatient costs, which were driven by both lower admission rates and lower readmission rates.

As seen in Table 3, comparisons between the treatment group and the contemporaneous cohort with palliative care showed lower inpatient admission rates across all time periods and lower readmission rates in the first 30 days. The treatment group also had lower ED admission rates through the first 60 days post the first SO encounter and lower inpatient costs and total medical costs in the first 90 days following initiation of SO. In particular, during the first 30 days after treatment, the treatment group was 39% less likely to have any inpatient admission and 54% less likely to have any emergency department visit. During the 60 days after treatment, the treatment group was 61% less likely to have any inpatient admission. In the 90 days after treatment, the treatment group was 70% less likely to have any inpatient admission.

According to Table 4, the treatment group had less inpatient admission, readmission, and ED visit rates and less total medical costs than the cohort that was eligible for but did not get palliative care, over the whole 90-day period after treatment. The treatment group also had fewer outpatient visits in the last 30 days of the post-treatment period. More specifically, in the 0- to 30-day period post-treatment, the treatment group had 33% lower odds of any IP admission and 44% lower odds of any ED visit. In the 31- to 60-day period post-treatment, the treatment group had 57% lower odds of any IP admission. In the 61- to 90-day period post-treatment, the treatment group had 75% lower odds of any IP admission.

In summary, at 30, 60, and 90 days post enrollment into SO, the treatment group had between 27% and 70% fewer inpatient admissions and between 16% and 54% fewer ED visits ($p < .05$) than all non-SO comparison cohorts. Total medical costs were significantly

TABLE 1 Demographics characteristics of treatment cohort participants and three control cohorts.

Characteristic	Treatment (n = 138)	Asynchronous cohort (n = 60)	Contemporaneous cohort with palliative care (n = 86)	Matched contemporaneous cohort with no palliative care (n = 138)
Sociodemographic variables				
Age, years	58.5	63.2	61.5	59.8
Male	44.6%	51.7%	48.8%	46.3%
DxCG risk score[a]	7.2	7.9	7.5	7.1
Pre-period medical costs (SE) (12 month look back)	$11,094 (973)	$11,285 (1049)	$12,416 (1082)	$10,372 (1136)
Diagnosis variables				
Encounter for antineoplastic chemotherapy (Z51.11)	55.1%	61.7%11	51.2%	54.3%
Neoplasm-related pain (G89.3)	47.1%	48.3%	44.2%	46.3%
Nausea (R11.0)	41.3%	43.3%	40.7%	42.0%
Gastro-esophageal reflux without esophagitis (K21.9)	26.1%	23.3%	28.7%	26.1%
Anemia (D64.9)	26.8%	25.7%	29.1%	27.5%
Hypertension	42.0%	46.7%	36.1%	40.5%
Diabetes	16.7%	18.3%	19.8%	17.4%
Chronic kidney disease	14.5%	11.7%	10.5%	15.9%
Depression	18.8%	15.0%	15.1%	18.8%
Anxiety	34.1%	38.3%	33.7%	36.3%
Procedures variables				
Evaluation and management of patient (99,214)	93.5%	86.7%	90.6%	92.7%
Blood count (85,025)	86.9%	83.3%	89.5%	84.7%
Comprehensive metabolic panel (800053)	84.7%	88.3%	82.5%	83.3%
Collection of venous blood (36,415)	75.4%	78.3%	79.1%	73.9%
Chemotherapy administration (96413)	51.4%	53.3%	54.6%	52.2%
Days between diagnosis and first palliative care consult	182	205	193	182

[a]The risk score is a measure used to predict or explain the utilization of health care services, health care efficiency, or health care cost.

lower for the treatment group across all comparisons, including between 4.4% and 24.5% lower at 90 days post-enrollment into SO, with the largest reductions seen in inpatient spending: between 16.6% and 31.2% lower ($p < .05$).

In Table 5, we summarize the regression-adjusted results from the entire 90 days post-treatment from the treatment cohort and all three comparison cohorts. Overall, these results suggest that the treatment was associated with a shift in health care utilization patterns, with a decrease in hospitalizations, readmissions, and ED. This shift in utilization patterns led to significantly lower total medical costs in the treatment group compared to the comparison group.

DISCUSSION

The treatment group had lower costs and inpatient admissions in comparison to the contemporaneous palliative care cohort. Although costs, ED visits, and inpatient admissions were reduced, the composition of palliative care at other cancer centers is uncertain and likely only reflects inpatient palliative care.

This study provides important new evidence on the comparative effectiveness and cost-effectiveness of SO care in patients with advanced cancer. Across three distinct comparison groups, we demonstrate that a comprehensive SO program comprised of both billable (physician and nurse practitioner) visits and nonbillable encounters (nurse, social work, navigation, nutrition) is associated with fewer inpatient hospital admissions, ED visits, and lower total medical costs for patients with advanced cancer.[14–17]

Our findings suggest that SO programs can improve the quality and efficiency of care for patients with advanced cancer. By providing patients with comprehensive and coordinated care, SO programs can help to reduce the burden of hospitalizations and ED visits, which are often associated with high costs and poor patient outcomes. Health plans and providers should jointly consider ways to facilitate the adoption, implementation, of SO services and programs for their patient and member populations. This may include developing

TABLE 2 Regression-adjusted results for treatment versus asynchronous comparison cohort.

	0–30 Days post-treatment		31–60 Days post-treatment		61–90 Days post-treatment	
Outcome	**Treatment (*n* = 138)**	**Comparison (*n* = 60)**	**Treatment (*n* = 138)**	**Comparison (*n* = 60)**	**Treatment (*n* = 138)**	**Comparison (*n* = 60)**
Any IP admission	30.4% (42)	53.3% (32)	13.1% (18)	25% (15)	7.9% (11)	20.0% (12)
Any IP readmission	6.5% (9)	20.0% (12)	3.6% (5)	11.7% (7)	2.9% (4)	10.0% (6)
Any OP visit	91.3% (126)	85.0% (51)	81.2% (112)	70.0% (42)	65.2% (90)	56.7% (34)
Any professional visit	86.2% (119)	78.3% (47)	73.2% (101)	60.0% (36)	63.7% (88)	51.7% (31)
Any ED visit	20.3% (28)	41.7% (25)	17.4% (24)	16.7% (10)	20.2% (28)	23.3% (14)
No. of IP admissions	43	39	19	16	11	12
No. of IP readmissions	9	12	5	7	4	6
No. of OP visits	400	179	410	174	401	146
No. of professional visits	352	159	314	160	368	125
No. of ED visits	42	40	28	12	31	17
IP cost diff.	$(1512)		$(1297)		$(1402)	
OP cost diff.	$239		$376		$185	
Professional cost diff.	$382		$415		$327	
Total cost diff.	$(3273)		$(2315)		$(2632)	

Note: Total costs are total medical costs, excluding pharmacy costs.

Abbreviations: diff., difference; ED, emergency department; IP, inpatient hospitalization, excluding skilled nursing facilities; OP, outpatient visits, excluding ED visits.

TABLE 3 Regression-adjusted results for treatment versus contemporaneous cohort comparison with no palliative care.

	0–30 Days post-treatment		31–60 Days post-treatment		61–90 Days post-treatment	
Outcome	**Treatment (*n* = 138)**	**Comparison (*n* = 138)**	**Treatment (*n* = 138)**	**Comparison (*n* = 138)**	**Treatment (*n* = 138)**	**Comparison (*n* = 138)**
Any IP admission	30.4% (42)	45.6% (63)	13.1% (18)	30.4% (42)	7.9% (11)	31.2% (43)
Any IP readmission	6.5% (9)	12.3% (17)	3.6% (5)	11.6% (16)	2.8% (4)	8.7% (12)
Any OP visit	91.3% (126)	87.7% (121)	81.3% (112)	77.5% (107)	65.2% (90)	76.8% (106)
Any professional visit	86.2% (119)	84.1% (116)	73.2% (101)	73.9% (102)	63.7% (88)	57.2% (79)
Any ED visit	20.3% (28)	36.2% (50)	17.4% (24)	30.4% (42)	20.3% (28)	31.1% (43)
No. of IP admissions	43	63	19	42	11	43
No. of IP readmissions	9	18	5	16	4	12
No. of OP visits	400	388	410	387	401	369
No. of professional visits	352	341	314	368	368	340
No. of ED visits	42	79	28	43	31	48
IP cost diff.	$(2249)		$(1738)		$(2046)	
OP cost diff.	$306		$269		$(241)	
Professional cost diff.	$257		$53		$101	
Total cost diff.	$(4152)		$(3963)		$(4311)	

Note: Total costs are total medical costs, excluding pharmacy costs.

Abbreviations: diff., difference; ED, emergency department; IP, inpatient hospitalization, excluding skilled nursing facilities; OP, outpatient visits, excluding ED visits.

TABLE 4 Regression adjusted results for treatment versus contemporaneous comparison cohort with palliative care.

	0–30 Days post-treatment		31–60 Days post-treatment		61–90 Days post-treatment	
Outcome	**Treatment (*n* = 138)**	**Comparison (*n* = 86)**	**Treatment (*n* = 138)**	**Comparison (*n* = 86)**	**Treatment (*n* = 138)**	**Comparison (*n* = 86)**
Any IP admission	30.4% (42)	50% (43)	13.1% (18)	33.7% (29)	7.9% (11)	26.7% (23)
Any IP readmission	6.5% (9)	12.8% (11)	3.6% (5)	9.3% (8)	2.9% (4)	5.8% (5)
Any OP visit	91.3% (126)	88.4% (76)	81.1% (112)	77.9% (67)	65.2% (90)	60.4% (52)
Any professional visit	86.2% (119)	79.1% (68)	73.2% (101)	68.6% (59)	63.7% (88)	56.9% (49)
Any ED visit	20.3% (28)	44.1% (38)	17.4% (24)	25.6% (22)	20.3% (28)	22.1% (19)
No. of IP admissions	43	45	19	30	11	24
No. of IP readmissions	9	12	5	9	4	6
No. of OP visits	400	241	410	241	401	229
No. of professional visits	352	212	314	229	368	211
No. of ED visits	42	49	28	25	31	23
IP cost diff.	$(1381)		$(972)		$(759)	
OP cost diff.	$193		$217		$128	
Professional cost diff.	$237		$285		$113	
Total cost diff.	$(2504)		$(1889)		$(1675)	

Note: Total costs are total medical costs, excluding pharmacy costs.

Abbreviations: diff., difference; ED, emergency department; IP, inpatient hospitalization, excluding skilled nursing facilities; OP, outpatient visits, excluding ED visits.

TABLE 5 Regression-adjusted results 90-days post-treatment.

Outcome	**Treatment (*n* = 138), % (*n*)**	**Asynchronous cohort (*n* = 60), % (*n*)**	**Contemporaneous cohort with palliative care (*n* = 86), % (*n*)**	**Matched contemporaneous cohort w/o palliative care (*n* = 138), % (*n*)**
Any IP admission	39.1 (54)	63.3 (38)	55.8 (48)	49.3 (68)
Any IP readmission	10.1 (14)	21.7 (13)	18.6 (16)	17.4 (24)
Any OP visit	93.5 (129)	88.3 (53)	91.9 (79)	90.6 (125)
Any professional visit	88.4 (122)	81.7 (49)	84.9 (73)	87.7 (121)
Any ED visit	30.4 (42)	48.3 (29)	46.5 (40)	41.3 (57)
No. of IP admissions	131	84	119	178
No. of IP readmissions	29	25	32	51
No. of OP visits	1017	429	623	992
No. of professional visits	951	401	565	826
No. of ED visits	156	98	132	221
IP cost diff.	—	$(1474)	$(1120)	$(2112)
OP cost diff.	—	$280	$184	$217
Professional cost diff.	—	$393	$229	$276
Total cost diff.	—	$(2877)	$(2184)	$(4349)

Note: Total costs are total medical costs, excluding pharmacy costs.

Abbreviations: diff., difference; ED, emergency department; IP, inpatient hospitalizations, excluding skilled nursing facilities; OP, outpatient visits, excluding ED visits.

payment models that reimburse for the full range of SO services, providing training and education to clinicians on the benefits of SO care, and integrating SO programs into existing cancer care pathways. By investing in SO care, health plans and providers can improve the quality of life for patients with advanced cancer, reduce health care costs, and promote a more patient-centered approach to care.

We acknowledge that our study, like other retrospective cohort studies, is not immune to unobserved confounding bias. We cannot rule out the possibility that there are unobserved factors that are associated with both the treatment exposure and the health care utilization outcomes. Because of the observational nature of our study, we cannot control for all potential confounders, and our results may be biased if there are important unobserved confounders. Another limitation of our study is that there were some differences in the characteristics of the two comparison populations, despite our efforts to control for these differences using regression analyses. To minimize the risk of bias, we used propensity score matching to create comparison groups that were similar to the treatment group on observed characteristics. However, propensity score matching cannot fully eliminate the risk of bias due to unobserved confounding.

Additionally, retrospective studies are inherently limited by the quality and completeness of the data available, which may introduce bias into the analysis. Our study population was limited to commercially insured patients in Southeastern Pennsylvania limiting the generalizability of our findings to other populations, such as uninsured or Medicaid populations, or to patients in other regions. Although our sample is relatively small, we were able to detect significant differences between groups. Studies with larger sample sizes may be able to detect smaller, more nuanced effects. The comparison groups were identified using ICD10 codes on administrative claims. To the extent that palliative care and cancer are accurately or completely coded on administrative claims data, we may misidentify certain members used in our comparison groups. Also, administrative claims do not accurately capture the cancer stage at diagnosis and mortality, so we were unable to match on or adjust for cancer stage and include mortality as an outcome in our models.

Despite these limitations, the consistency of the results across three distinct comparison groups provides valuable insights into the potential benefits of SO in reducing health care utilization and costs among commercially insured cancer patients. Further research with larger sample sizes and more diverse populations is needed to confirm our findings and to determine the generalizability of our results to other settings.

AUTHOR CONTRIBUTIONS

Brooke Worster: Conceptualization, investigation, writing– original draft, methodology, writing–review and editing, project administration, data curation, supervision, and resources. **Yifan Zhu:** Conceptualization, methodology, validation, formal analysis, data curation, writing–review and editing, and writing–original draft. **Gregory Garber:** Conceptualization, writing–original draft, writing–review and editing, and project administration. **Sawyer Kieffer:** Writing–original draft, writing–review and editing, and resources. **Aaron Smith-McLallen:** Conceptualization, writing–original draft, methodology, validation, visualization, writing–review and editing, formal analysis, and data curation. Aaron Smith-McLallen had full access to the data and can take responsibility for the integrity of the data and the accuracy of the data analysis. Brooke Worster affirms that the manuscript is an honest, accurate, and transparent account of the study being reported and no important aspects of the study have been omitted.

CONFLICT OF INTEREST STATEMENT

Brooke Worster reports consulting fees from Ethos Cannabis, Pax, and eo Care for medical cannabis consultation work. The other authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author on reasonable request.

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