Implementing Safe Routes to School: Application for the Socioecological Model and Issues to Consider

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The newly established national Safe Routes to School (SRTS) program has the potential to positively influence individuals, communities, and the environment regardless of race, ethnicity, or socioeconomic status. Many communities are applying their interest in physical activity promotion toward creating policies and programs to encourage active travel, though many barriers exist. SRTS legislation provides funds to address some of the barriers and improve the ability of students to safely walk and bicycle to school. SRTS requires that 70% to 90% of the funds be used for infrastructure projects (i.e., engineering treatments, such as sidewalk construction), and 10% to 30% for noninfrastructure activities, such as education, encouragement, and enforcement. The socioecological model (SEM) is widely used in public health and includes five levels of influence on behavior, from individual to public policy. Application of the SEM to SRTS provides a framework for a comprehensive approach to improve active travel to school.

Keywords: *active travel; disparities; physical activity; Safe Routes to School; socioecological model*

INTRODUCTION

Youth who engage in regular, moderately intense physical activity gain substantial positive physical and psychological health benefits (U.S. Department of Health and Social Services [USDHHS], 1996). Active travel (e.g., walking and bicycling to school) provides many benefits, one of which is an opportunity for purposeful physical activity toward the accumulation of the recommended 60 min or more of daily physical activity for children and youth (USDHHS and U.S. Department of Agriculture [USDA], 2005). Studies using objective measures have shown that children who walk to school get more physical activity per day than children who commute to school by motorized transport (Cooper, Andersen, Wedderkopp, Paige, & Froberg, 2005; Cooper, Page, Foster, & Qahwaji, 2003; Tudor-Locke, Ainsworth, Adair, & Popkin, 2003).

National travel surveys have revealed a sharp decline in the rate of active travel to school over the past 30 years. In 1969, nearly 90% of students who lived within a mile of school, and more than 40% of students at any distance, walked or biked (U.S. Department of Transportation [UDOT], 1972/2003). In 2001, about 63% of students who lived within a mile of school and about 16% of students at any distance walked or biked (*National Household Transporation Survey*; UDOT, 2001). During the same time frame, the rate of using a private automobile to commute to school increased from 16% in 1969 to 46% in 2001 (UDOT, 2001). The exact reason for the shift in modes is unknown, though it is reasonable to speculate that changes in both the social and the physical environment have promoted the use of the private automobile over more active alternatives.

Parents cite several barriers for not allowing their children to walk or bicycle to school. The most common is distance, followed by traffic-related danger and, to a

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lesser extent, weather and fear of crime (Centers for Disease Control [CDC], 2005). Though speculative, it is likely that at least some of these barriers are greater among Black and Hispanic parents than White parents, and among parents of lower socioeconomic status. In a nationally representative sample of 9- to 13-year-old children, parents with lower income and lower levels of education reported more barriers to physical activity than parents with higher income and education levels. In addition, Black and Hispanic parents reported more barriers related to physical activity than did White parents, and concerns about neighborhood safety were reported most by Hispanic parents (CDC, 2003).

Two strategies might be able to address these barriers: school siting and the Safe Routes to School (SRTS) program. Renovating rather than abandoning existing schools and locating new schools in neighborhoods can help alleviate the distance barrier. Two trends in school siting have contributed to the distance between school and home: First, in recent years, schools have been built on the edges of communities where land is less expensive and not yet developed (Beaumont & Pianca, 2002); second, although the number of students has grown, the number of schools has decreased (National Center for Education Statistics [NCES], 2003). This means that a single school serves a larger population area, with more students no longer living within walking distance. The SRTS program offers an array of strategies to overcome cited barriers and is the focus of this article.

BACKGROUND

National Transportation Health Objectives and Goals

Healthy People 2010 sets forth the nation's health goals and objectives (USDHHS, 2000). The two overarching goals of *Healthy People 2010* are to eliminate disparities and to increase quality of life. Two objectives relate directly to youths' active travel to school: Objective 22-14b aims to increase the proportion of trips to school of 1 mile or less made by walking (from 31% to 50%), while Objective 22-15b aims to increase the proportion of trips to school of 2 miles or less made by bicycling (from 2.4% to 5%). Increasing walking and bicycling are also recognized as important by the field of transportation. The USDOT *National Bicycling and Walking Study* for U.S. Congress in 1994 described two main goals: to increase trips made by bicycling and walking and to reduce the percentage of injuries and deaths to pedestrians and bicyclists (USDOT, 1994).

SRTS

The overarching goals of the SRTS program are to both enable and encourage children in grades K-8 to walk and bicycle safely to and from school. The legislation funding a national SRTS program was passed in 2005 as part of SAFETEA-LU (Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users [Public Law 109-59]; http://safety.fhwa.dot.gov/saferoutes.htm). Under this legislation, each state receives a minimum of US$1 million per year for 5 years to establish and conduct a state SRTS program. Student enrollment numbers determine the exact funding each state receives. States and the SRTS programs they support are not required to match funds, so communities with fewer resources have equal access to funding SRTS programs.

The law specifies that states may use the funds for infrastructure and noninfrastructure projects that will improve the ability of students to safely walk and bicycle to school. As of the writing of this article, 19 state SRTS programs had spent funds on either local programs or statewide activities. Thirty-eight states were actively involved in some stage of funding—this includes states whose applications are currently open;

those that have already spent at least a portion of their funds for the year and those that are about to announce funded programs. Another 11 states are preparing to open their applications. As of February 28, 2007, 394 schools in 19 states were conducting SRTS activities with support from state programs (National Center for Safe Routes to School [NCSRTS], 2007b). Additionally, 46 states, including D.C., had a permanent state SRTS coordinator in place and another 4 had interim coordinators. Eligibility for receiving SRTS funding is outlined by federal legislation guidance and further refined at the state level. Some states requested applicants to address infrastructure and noninfrastructure components within their applications whereas other states offered separate applications. Most states have established a state SRTS advisory committee, often including representatives with interest in health and physical activity, which contributes to the application selection process (NCSRTS, 2007a). Examples of such projects are presented in detail under the Intervention Applications—5Es section.

Because SRTS is relatively new, there is little information on its effectiveness. However, two recently published studies and a report indicate promising outcomes. In Marin County, CA, the SRTS program resulted in an increase in children walking, biking, and carpooling, and a decrease in the number of children arriving by private car from fall to spring (Staunton, Hubsmith, & Kallins, 2003). Boarnet and colleagues (2005) found that children who passed by a SRTS project on the way to school (e.g., construction to improve the safety of routes to school) were more likely to walk and bike than children who did not pass a project on the way to school. A report to the California Legislature described findings from a representative sample of projects funded by the state (not part of the federal funding) over a 3-year period. Direct observation of the number of walkers and bicyclists pre- and post-project rendered a 20% to 200% increase whereas parent report indicated a 10% increase. Students whose route passed by a project were more than 3 times as likely to begin walking or bicycling than students taking other routes (Orenstein, Gutierrez, Rice, Cooper, & Raglund, 2007).

INTERVENTION APPLICATIONS—THE "5Es"

Responsible use of resources requires a thoughtful, planned approach to this relatively new program and, given the dearth of data regarding the effects of SRTS programs, makes a theoretical framework all the more important to follow. The socioecological model (SEM) offers a way to consider the many possible methods and points of intervention. The SEM can also be a viewed as a way to evaluate the comprehensiveness of an SRTS plan or program.

SEM

SRTS is a broad-based initiative in that it can encompass several levels of influence and intervention strategies (see Table 1). The SEM, a widely used public health model, offers a way to view the different aspects of a comprehensive SRTS program. The ecological approach acknowledges people's interactions with their physical and sociocultural surroundings—including environmental and policy factors—and acknowledges that interventions will be most effective when they target several levels. McLeroy and colleagues define the SEM as the interaction and interdependence among multiple levels of influence to support behavior change, including individual, interpersonal, organizational (e.g., school), community, and public policy (McLeroy, Bibeau, Steckler, & Glanz, 1988).

The model is a nice fit with SRTS as it can be viewed as a school-level program or a community-level program that aims to influence the behavior of students and their parents and other school community residents. To increase active transportation, such as bicycling to school, individual factors might include bicycle ownership, personal history of bicycling, and current attitude about bicycling. Interpersonal factors might include travel needs of others in the household and having a family member, neighbor, or friend to bike with. Organizational factors might include availability, condition, and placement of a bicycle rack at school; community factors might include social norms and environmental conditions such as availability of a bike path. Finally, public policy factors might include school-level or municipality-level policy related to bicycling. Because policy can be applied at the school or community level, policy will not be explored as a fifth level, but as one of the other two (organizational or community).

In addition to the levels of influence on behavior as represented by the SEM, the federal guidance for SRTS recommends that programs address five activities—the "5Es"—within two domains (i.e., infrastructure and noninfrastructure; http://safety.fhwa.dot.gov/saferoutes/srtsguidance.htm). Infrastructure activities focus on engineering. Examples include sidewalk improvements, traffic calming and speed-reduction improvements, pedestrian and bicycle crossing improvements, on-street bicycle facilities, off-street bicycle and pedestrian facilities, secure bicycle parking facilities, and traffic-diversion improvements in the vicinity of schools. These activities can be implemented on any public road or any bicycle or pedestrian pathway or trail within 2 miles of a school (http://safety.fhwa.dot.gov/saferoutes/ srtsguidance.htm). Noninfrastructure activities involve enforcement, education, and encouragement. Examples include public awareness

TABLE 1
Safe Routes to School Applied to the Socioecological Model[a]

	Evaluation			
		Noninfrastructure		
Level	*Infrastructure Engineering*	*Enforcement*	*Education*	*Encouragement*
Community	Street-scale urban design and land-use policies and practices	Speed limits within school zone Volunteer reporting of traffic violations within school zone	Pedestrian and bicycle safety messages Signage such as school zone and speed limit (also engineering)	Community-level partnerships to support active travel
Organization (school)	Altered school grounds to foster safe walking and bicycling	School policy, such as different arrival and dismissal times for walkers than bus riders	School-based pedestrian and bicycle safety education	Official "Walk to School" days, promoted at the school; schoolwide contests; mileage clubs
Interpersonal	Neighbors keep sidewalks clear	Safety patrol	Parents teaching children pedestrian and bicycle skills	Walking school bus
Individual	Access though individual's property	Following rules, wearing a bicycle helmet	Pedestrian and bicycle skills development; knowledge of route to school	Individually earned incentives for walking and/or bicycling

a. The public policy level of the socioecological model is subsumed under the community level and the organizational level.

campaigns and outreach to press and community leaders; traffic education and enforcement near schools; student sessions on bicycle and pedestrian safety, health, and environment; and funding for training, volunteers, and managers of SRTS programs. The fifth "E" is evaluation, which cuts across all the other Es (engineering, enforcement, education, and encouragement; http://safety.fhwa.dot.gov/ saferoutes/srtsguidance.htm). Examples of how the 5Es can be applied to the SEM are summarized in Table 1.

There are situations when not all Es need to be implemented. For example, in a school where virtually all children already walk, encouragement strategies are unnecessary, but safety concerns may exist that require extra attention. As the "4Es" are discussed below, "promising practices" are revealed. Unfortunately, the SRTS field is not at a point where many evidence-based, proven effective strategies are available. We urge the field to consider using the SEM for a comprehensive approach and to carefully evaluate their programs to uncover the "best practices" for SRTS.

Engineering

Community. At the community level, policy and engineering interventions to increase physical activity are widely promoted (Brownson, Baker, Housemann, Brennan, & Bacak, 2001; King, Stokols, Talen, Brassington, & Killingsworth, 2002; Sallis et al., 2006). Most recently, street-scale and community-scale urban design and land-use policies were recognized as effective strategies by the Task Force on Community Preventive Services (Heath et al., 2006). Most applicable to SRTS are street-scale changes on one or more of the streets surrounding the school. Recommended tactics include introducing or enhancing traffic-calming measures such as center islands

or raised crosswalks, improving street lighting, and enhancing the aesthetics of the street (Heath et al., 2006). The implementation of such tactics requires the coordination of urban planners, architects, engineers, developers, and public health professionals (Heath et al., 2006).

The structural alterations include numerous traffic engineering strategies that have demonstrated success in improving safety and active travel. A recent study reported that speed humps were associated with a 53% to 60% reduction in the odds of injury or death among children struck by an automobile in their neighborhood (Tester, Rutherford, Wald, & Rutherford, 2004). Cities can also prioritize how non-SRTS funds are spent. For example, in Phoenix, AZ, access to schools is considered when prioritizing sidewalk construction (City of Phoenix Street Transportation Department, 2004). In California, the construction of a sidewalk and the addition of a traffic control was associated with an increase in walking or bicycling to school (Boarnet, Anderson, Day, McMillan, & Alfonzo, 2005). In Sweden, traffic-calming measures (e.g., roundabouts) and bicycle and pedestrian accommodations (e.g, central refuge islands, pedestrian walkways) were added to a busy street, resulting in a decline in the number of children driven to school (from 37% to 21%) and an increase in the number of children bicycling to school (from 29% to 51%; Leden, Wikstrom, Garder, & Rosander, 2006).

Organizational (school). A school may install a well-located, good-condition bicycle rack as an engineering tactic to potentially increase bicycling to school. Schools can also separate entrances for walkers and bicyclists from those for buses and vehicles to improve safety.

Interpersonal. Neighbors can get together for sidewalk cleanups. Removing trash, trimming hedges, and keeping parked cars and trash cans off of the sidewalks are simple examples of no-cost engineering tactics.

Individual. Sometimes plans for a new path to school can be blocked by someone with a "not in my backyard" attitude. Conversely, when people are willing to cooperate by, for example, allowing an easement through their yard to shorten the route, they promote safe and active travel to school.

Enforcement

Community. Community members can aid public officials with enforcement of traffic laws by reporting violations in the school zone. Some communities offer a hotline for reporting these violations. In addition, a community member can volunteer to serve as a crossing guard to help enforce the traffic laws at crosswalks where they exist. Community members can be role models by obeying speed limits when they drive near the school, thereby forcing vehicles behind them to travel at the same speed.

School zones often have reduced speed limits, though these limits are not often obeyed. One study found that two thirds of drivers exceeded the posted speed limit in school zones during the 30-min period before and after school (National Safe Kids Campaign, 2002). A national observational survey found that many motorists at intersections in school zones and residential neighborhoods violated stop signs by not coming to a complete stop (45%), rolling through (27%), or not even slowing down (7%; National Safe Kids Campaign, 2004).

Enforcement strategies at the community level have been somewhat successful. In Sweden, a new code specified that drivers must yield to pedestrians entering or crossing in marked crosswalks; this resulted in cars giving way to 72% of children after the code change (in addition to a new roundabout), compared with 32% before the new code and roundabout. For child bicyclists, the rate went from 6% to 84% (Leden et al., 2006).

Organization (school). A member of the school faculty or staff can volunteer as a crossing guard to help enforce the traffic laws at crosswalks or to oversee student safety patrol. In addition, the school can implement and enforce an arrival and dismissal schedule that makes it safe and desirable to walk or bicycle, such as by dismissing walkers and bicyclists before car and bus riders. Schools can also require the use of helmets by bicycle riders and enforce that rule.

Interpersonal. Student participation in safety patrol is an example of enforcement at the interpersonal level. These students help enforce student drop-off and pick-up rules on the school grounds, and they, as well as other peers, can encourage fellow students to follow bicycling and pedestrian rules.

Individual. People are more inclined to choose safe behavior when it is formally mandated. For example, helmet use among children increases when a helmet law is enacted (Rodgers, 2002).

Education

Community. Media can be used to influence behavior at the community level. Media can inform and build support for SRTS among the public. They can also be used to educate the public about safe driving practices and pedestrian and bicycle safety.

Various community groups may offer traffic safety classes or pedestrian and bicycle safety classes. For example, driver education lessons could focus on issues related to safe travel in school zones. A recent survey of the National Association of County and City Health Officials showed that 13% offer pedestrian safety education, and a recent survey of the American Planning Association showed that 64% offer such education (unpublished survey results). Community groups, such as bicycle clubs, can also offer bicycle skills training for children and adults.

Organization (school). Pedestrian and bicycle safety skills can be taught in the classroom and practiced during class time or as a special event before, during, or after school. One popular example for promoting bicycle safety at the organizational level is a school-sponsored bicycle rodeo that consists of bicycle handling drills and practice in a simulated setting.

Interpersonal. Parents can educate their children about proper bicycling and pedestrian travel. Peers can also influence one another with regard to active travel, such as staying on sidewalks instead of walking in the street on the way to school.

Individual. Children can actively engage in the learning process to build skills and knowledge related to pedestrian and bicycle safety.

Encouragement

Community. Media can help motivate the public to support SRTS by spreading positive messages about active travel, such as reduced traffic congestion and increased physical activity, and its association with positive health outcomes.

Community members can play an active part in encouraging activities of SRTS. It takes an array of partners at the community level to implement SRTS, such as students, parents, school staff, and community activists. Together, they develop encouraging plans to increase walking and bicycling to school. "Walk to School Day," a day in October when families around the world are encouraged to walk to school, is one concrete activity requiring the involvement of community and school members. Data from the 2005 Walk to School Coordinator Survey reveal that 24% of coordinators are parents from the community, 12% are community activists or members of a community organization, and 8% are local government employees.

Organization (school). Classroom activities can promote SRTS; the 2005 Walk to School Coordinator Survey revealed that 44% of coordinators are teachers, school administrators, or staff. Numerous examples can be drawn from schools around the world that have celebrated International Walk to School Day (see www.iwalktoschool.org). Common themes include mapping the distance walked to teach geography lessons and providing incentives for active travel. Classroom lessons are available on the Internet (see Go for Green, http://www.saferoutestoschool.ca/).

Interpersonal. Social support is a known strategy to increase physical activity among adults (Kahn et al., 2002); it may be important for youth as well. Parents and children can travel to school in groups called walking school buses or bike trains as a means of encouragement. Walking school buses can be found around the globe in Australia, New Zealand, the United Kingdom, Canada, Japan, and the United States. Parents describe social and physical benefits of walking school buses both for their children and for themselves (Mackett, Lucas, Pasking, & Turbin, 2005).

Individual. Incentives administered at the organizational level work at the individual level as well, by reinforcing the behavior.

Though we have described the relationship between the levels of SEM and the 4 Es in one direction, there is an interplay between them, especially as it relates to the individual. For example, education focused on benefits may raise the desire of students to engage in active travel by improving their attitude. Furthermore, engineering alterations, such as a new trail or bike path, have been shown to influence people. Two studies found similar results that suggest that access to trails would improve rates of walking; and, although these studies were of adults, the results may be applicable to walking to school. One showed that availability of trails differs by socioeconomic status (SES) of neighborhoods, with lower-SES areas having substantially fewer trails than higher-SES areas. This study found that having a trail was associated with being physically active among low- but not high-SES residents (Wilson, Kirtland, Ainsworth, & Addy, 2004). The second study examined SES indicators of people (not places) and found similar results; that is, lower-income people and those with high school education or less had less access to trails, but were more likely to walk when they had them than those with higher income and education (Brownson et al., 2000).

DISCUSSION

This article has summarized the broad nature of SRTS and application of the SEM to explore all the possible

avenues for intervention. The SRTS movement began in the 1970s in Denmark in response to high pedestrian injury rates; it has grown into a worldwide movement—to address not only safety issues but also physical inactivity, childhood obesity, and air-quality concerns. The expansiveness of SRTS also aligns it with the *Healthy People 2010* goals to eliminate health disparities and increase quality of life.

SRTS has positive implications for individuals, communities, and the environment without regard to race, ethnicity, or SES. The intervention strategies can be applied equally across any sociodemographic factor at the individual level, but the question remains, can they be applied equally across any sociodemographic factor at the neighborhood level?

Poor neighborhoods are more likely than other neighborhoods to have factors that are negatively associated with physical activity (Taylor, Carlos Poston, Jones, & Kraft, 2006). Communities with higher proportions of minority racial or ethnic populations have fewer physical activity settings (Powell, Slater, & Chaloupka, 2004). Low-SES and racial or ethnic minority communities are often plagued with highway construction (Bullard & Johnson, 1997) and with physical and social disorder such as abandoned windows, litter, graffiti, loitering, and street disrepair (Molnar, Gortmaker, Bull, & Buka, 2004). As such, the built environment in these areas is often not pedestrian- or bicycle-friendly (King et al., 2002; Taylor et al., 2006). Not surprising, then, is the finding that school zones in low-income areas often have higher than average child pedestrian injury rates (Nantulya & Reich, 2003).

A recent study examining income at the neighborhood level found that schools and public physical activity facilities (e.g., tennis courts, recreation centers) were significantly more likely to be in higher-SES and low-minority neighborhoods (Gordon-Larsen, Nelson, Page, & Popkin, 2006). This has implications for an SRTS program insofar as some students from these poor communities may not be able to walk or bicycle directly from their home to their school because it is too far away. It is interesting to note that, at the individual level, having a single parent (Fulton, Shisler, Yore, & Caspersen, 2005), having indicators of lower SES (Carlin et al., 1997), and being non-White (Evenson, Huston, McMillen, Bors, & Ward, 2003) are positively associated with active transportation to school. It is plausible that students with these characteristics who live within a mile or two of school walk to school out of necessity (e.g., lack of access to buses or cars) even though the environment is not conducive to physical activity.

Addressing known barriers is important because 5- to 18-year-old children with no reported barriers are 6 times more likely to walk or bike to school than their peers with one or more barriers (CDC, 2002). One of the core principles of the SRTS program is to make communities safe for children to walk and bike to school, thus empowering communities to play a central role. As such, as mentioned by the Federal Highway Administration's guidance, the SRTS program can serve as a mechanism to address equity and environmental justice issues in diverse neighborhoods (http://safety.fhwa.dot.gov/saferoutes.htm). Indeed, it has been noted that the modern civil rights movement has its roots in transportation-related issues (Bullard & Johnson, 1997). Capacity building is a critical step in supporting an infrastructure to develop, implement, and maintain an SRTS program in diverse neighborhoods. Indeed, the Federal Highway Administration's guidance for the SRTS program calls for state Departments of Transportation to provide targeted outreach and technical assistance, such as assistance with capacity development, to ensure that low-income communities in urban or rural areas are considered fairly for funding, and there is no matching funds requirement.

Barriers may differ along racial or ethnic and SES lines. For example, fear of crime may be higher among minority populations. Concern over neighborhood safety and its influence on physical activity is much more pronounced among Black women than White women (Henderson & Ainsworth, 2000; King et al., 2000; Wilbur, Chandler, Dancy, & Lee, 2003). Data from the nationally representative Youth Media Campaign Survey indicate concerns about neighborhood safety were reported more frequently by Hispanic parents (41.2%), followed by non-Hispanic Black (13.3%) and non-Hispanic White (8.5%) parents. These data may reflect homicide victimization and crime rates. In 1996, Blacks had the highest rate (29.8 per 100,000) followed by Hispanics (12.4), American Indians (9.8), Asians (4.6), and non-Hispanic Whites (3.5; Council of Economic Advisors for the President's Initiative on Race [CEA], 1998). While 6% of Whites reported that crime was a problem in their neighborhood, 7% of Asians, 8% of American Indians, 12% of Hispanics, and 15% of non-Hispanic Blacks cited this problem (CEA, 1998). In these neighborhoods, addressing the barrier of neighborhood safety seems to be highly important.

Because SRTS is implemented at the local level, understanding the characteristics of neighborhoods is essential. A key feature of neighborhoods across the United States is that they are segregated mainly along racial or ethnic lines and, to a lesser extent, along socioeconomic (i.e., income, education, and occupation) lines (Acevedo-Garcia, Lochner, Osypuk, & Subramanian, 2003; Williams & Collins, 2001). It is striking to note the extent to which racial or ethnic minority youth are disproportionately represented among residents of poor neighborhoods as well as

among those living in poor households. In 1999, 8% of White, non-Hispanic children lived in poor neighborhoods, compared with 17% of Asian or Pacific Islander children, 42% of Latino children, 45% of American Indian or Alaska Native children, and 48% of African American children (Mather & Rivers, 2006). SRTS funds may be needed to address safety concerns for active travel to school for students in these neighborhoods.

CONCLUSION

SRTS is an example of a program that promotes active travel (i.e., walking or bicycling to school) among children and adolescents, and holds promise for including those who are traditionally underserved. The SEM offers guidance on the intervention possibilities, particularly at this early stage of SRTS program use when little direct evidence about what works is available. Because most children and adolescents attend school, schools are an ideal setting to promote physical activity among the diverse student body in the United States.

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