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Management commitment to safety and health in residential construction: HomeSafe spending trends 1991–1999

David P. Gilkey[a,*], Thomas J. Keefe[a], Jacob E. Hautaluoma[b], Philip L. Bigelow[c], Robert E. Herron[a] and Sheila A. Stanley[d]
[a]*Department of Environmental Health, Colorado State University, Ft. Collins, CO 80523-1676, USA*
[b]*Department of Psychology, Colorado State University, Ft. Collins, CO 80523-1876, USA*
[c]*Institute for Public Health, Florida A & M University, Science Research Center, Room 209 D, Tallahassee, FL 32307, USA*
[d]*United States Department of Labor, Occupational Safety and Health Administration, Englewood Office, 7935 E. Prentice Ave. # 209, Englewood, CO 80111-2714, USA*

Abstract. The support of good management is fundamental to the success of any safety and health program. Residential construction is a high-risk industry requiring significant commitment by management to impact day-to-day safety and health challenges. Investigators have evaluated management practices and spending trends in a cohort of 228 residential homebuilders in the Denver metro area of Colorado. Findings suggest that companies significantly increased dollars allocated to support safety and health practices between 1991 and 1999. In addition, the HomeSafe Pilot Program has positively impacted financial commitments of partner companies. Resource allocations were significantly greater for specific expense categories when comparing pre to post HomeSafe intervention. This paper presents data on the use of written safety and health programs, safety committees, and workers compensation premium cost containment certification, as well as allocations to safety incentive programs (SIP), personal protective equipment (PPE), other safety equipment (OSE), and safety training (ST).

Keywords: Resources, management practices, safety incentive programs (SIP), personal protective equipment (PPE), other safety equipment (OSE), safety training (ST)

1. Introduction

Commitment by management is paramount to the success of every company safety and health program (SHP) [11]. Management's sincerity is evidenced by their management practices, financial commitment, program design, implementation, and maintenance of the company SHP. This paper evaluates specific resource allocations, management practices, and spending trends believed to be surrogates for management commitment.

The Occupational Safety and Health Administration (OSHA) and other safety experts and organizations indicate that the first step towards effective SHP development is "management commitment" [2,14–18,23,28]. Evidence of commitment and leadership includes 1) a written policy statement with goals and objectives for protecting the health and well being of workers at all levels, 2) employee and management participation and communication in safety and health matters, 3) written safety rules and procedures, 4) annual SHP review, and 5) adequate resources to implement and maintain the program [18]. Without sincere commitment and adequate resource allocation, SHPs cannot exist or effectively control losses [14]. Regardless of the measures

*Corresponding author: Tel.: +1 970 491 7138; Fax +1 970 491 2940; E-mail: dgilkey@colostate.edu.

selected for evaluating SHPs, performance is dependent upon management commitment and adequate funding for the essential elements that drive the program. The National Association of Home Builders [14] states that there are, "five basic root causes" for SHP failure: 1) lack of management commitment and practice, 2) lack of continuous training and education, 3) lack of safe-work values, 4) lack of proper rules and procedures, and 5) lack of accountability and responsibility.

SHP development, implementation, maintenance, and evaluation consume precious company dollars. Only after company management has made the commitment and appropriately placed priority on their SHP will financial resources follow to develop, implement, and sustain a successful program. Allocations to safety incentive programs (SIPs), personal protective equipment (PPE), other safety equipment (OSE), and safety training (ST) are forms of primary prevention of workplace injury and illness [2]. Peterson [23] reports that companies should manage the SHP like any other company function by setting achievable goals by planning, organizing, and allocating to achieve the goals. It has been suggested that companies must allocate at least 2.5% of their direct labor budget to achieve effective SHP success [3].

Managing the safety and health of employees is the law [12,30], yet management often believes that safety and health procedures substantially increase the cost of doing business [11]. However, Levitt and Samuelson [13] reported that construction companies that employed management strategies that included the following elements experienced a 75% reduction in losses compared to those companies which did not:

1. Incorporation of S & H performance evaluation in promotion and salary increases for all frontline supervisors and field managers.
2. S & H priority equal to all other cost and schedule items on project.
3. Cost accounting for all S & H items as in all other items per project.
4. Requiring adequate and proper equipment for safe work practices on every project.
5. Requiring S & H training for all employees on project especially, new-hires.
6. Careful use of safety awards based on real reductions of injuries and losses.
7. Effective use of safety experts on job.

OSHA's Voluntary Protection Program (VPP) recognizes and encourages those 'best-practices' in SHPs on a grand scale. This nationally recognized program has existed more than a decade and experienced tremendous success with those participating companies. Across the board, reduction of lost workday cases has averaged 60% to 80% [19,25]. Key programmatic elements include "management leadership" evidenced by the following:

1. Commitment – Evidence that the company management team supports S & H through written policy, effective communication, and exemplary practice.
2. Organization – Defined methods that integrate S & H into company management structure and function.
3. Responsibility – Designated S & H responsibility at all organizational levels.
4. Accountability – Identified S & H accountability at all organizational levels.
5. Resources – Identified allocations for S & H personnel, equipment, capital investment, and training.
6. Planning – Company goals and objectives with defined integration of S & H.
7. Program Evaluation – A defined method to evaluate effectiveness of company S & H program and practices.

There exists a clear link between management structure, function, allocation of resources, and success of the company's S & H program [9,26,29]. One might even conclude that monetary allocation facilitates success and achievement of organizational goals and objective for S & H. These investigators contend that written safety and health programs (WSHPs), safety committees (SCs), workers' compensation cost containment certification and premium discounts (WCCCC), safety incentive programs (SIPs), personal protective equipment utilization (PPE), other safety equipment utilization (OSE), and safety training (ST) represent levels of management commitment, structure, function, and support for S & H. The budget process controls the existence and relative effectiveness of the entire S & H program (Fig. 1).

This paper investigates specific aspects of management practices and resource allocation among a cohort of residential homebuilders in the Denver metro area of Colorado. The HomeSafe Pilot Program is a strategic partnership between the Home Builders Association of Metropolitan Denver (HBA) and OSHA Region VIII. The HomeSafe Partners have collaborated with OSHA to reduce injuries and illness on home building sites in the Denver metro area [6]. At the core of Home-

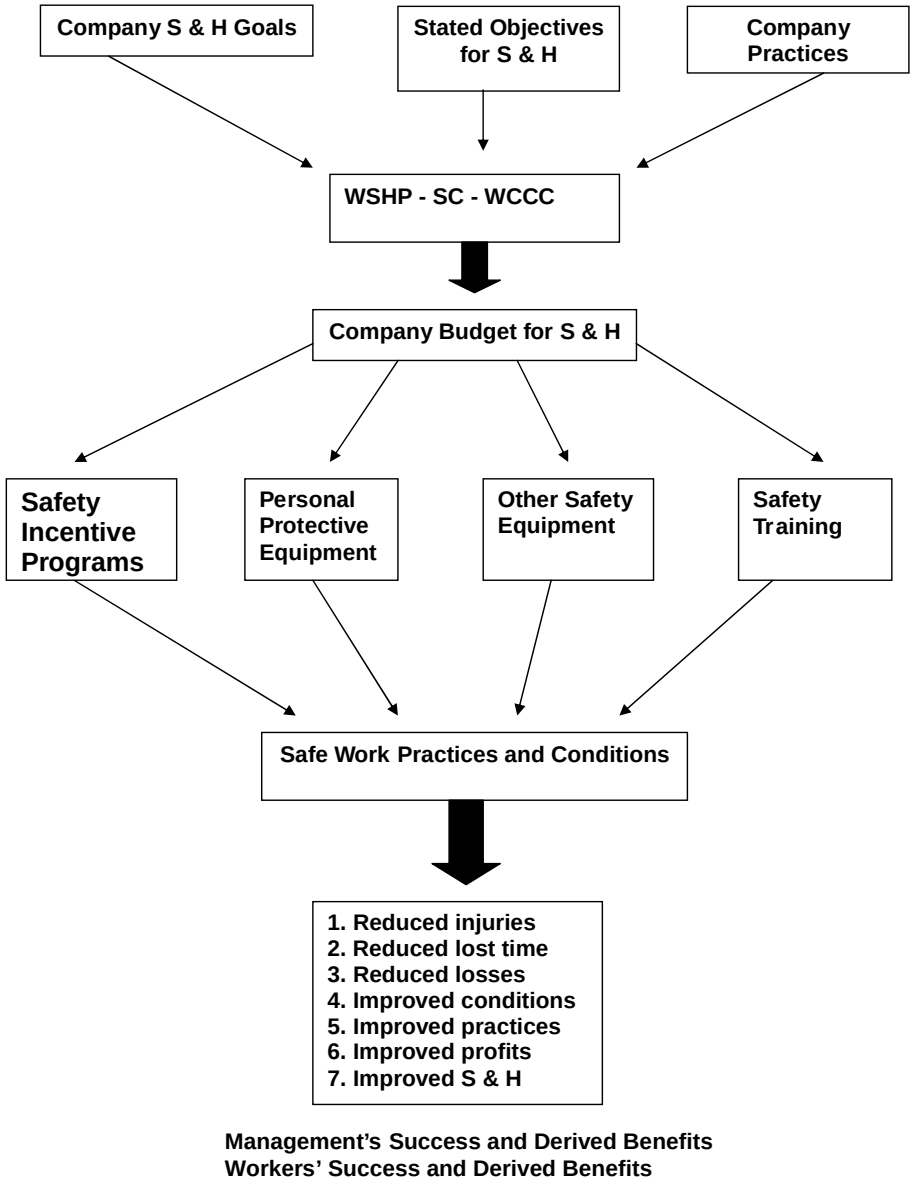

Fig. 1. The management commitment process.

Safe is a specifically designed 10-point SHP tailored to reduce the real risks and hazards known to injure and kill residential construction workers [4]: 1) safety policy – the company written safety policy establishing a commitment to a safe and healthy workplace, 2) personal protective equipment – the proper PPE made available with appropriate training on selection, maintenance, use, and disposal, 3) scaffolding – the proper equipment made available with training on assembly and use, 4) ladders – the proper equipment made available with training on safe use, 5) construction electrical power and power cords - the proper electrical power requirements, equipment, and cords with training on use as well as recognition of hazards, 6) access and housekeeping – the importance of proper ingress and egress and cleanliness on sites, 7) open holes and unprotected sides and edges – the importance of fall prevention and protective measure as hazards are created, 8) fall protection – the importance of proper equipment made available with appropriate training on selection, maintenance, and use of fall arrest systems, 9) excavations and trenching – the importance of proper grading,

sloping, and equipment used to prevent cave-ins, and 10) power tools and motorized equipment – the proper equipment made available with appropriate training on maintenance and use as well as recognition of hazards.

This pilot program was launched in January 1997 and was officially recognized April 24, 1998 with the signing of a contract between Home Builders Associations of Metropolitan Denver (HBA) representatives and OSHA officials, and today it remains one of the original strategic partnerships under the TED 8-0.2 OSHA Directive [21].

2. Methods

Data on management practices and resource allocation for safety and health were collected during two phases of this four-year prospective study. The first phase was carried out during the partner's initial exposure to the HomeSafe Pilot Program. HomeSafe Pilot Program membership requires that partners attend a three-hour "training and orientation" session provided by HBA and OSHA. This session included a program introduction, history of injury and illness in Colorado's residential construction industry, research strategies, hazard identification and control training on the 10-points of HomeSafe. The HBA, OSHA, and CSU provided faculty for the "training and orientation" session. Each of the 10-points of HomeSafe were covered in detail including examples of appropriate and inappropriate work practices, equipment and conditions by a qualified safety and health expert. An emphasis was placed on using local residential safety and health individuals who were known within industry. Attendees were not assessed for competency but encouraged to take the program back to their companies and incorporate content appropriately. Additional training was advocated through OSHA and the HBA which included field testing of workers for performance competency of workers receiving HomeSafe training.

The HBA and OSHA conducted 19 training and orientation sessions between January 1997 and June 2000. During this time they introduced HomeSafe to over 1,500 individuals from 450 companies representing approximately 37,000 residential construction workers in the Denver metro area. At the beginning of each initial session the senior management representative from each attending company was identified and asked to complete a survey regarding company characteristics, management practices, and expenditures of their company for safety and health from 1991 to 1995. During the session, investigators were introduced to provide explanations and encouragement about data collection. Completed surveys were collected at the end of each session. The program is voluntary and partners are not required to complete surveys. Since the first session in January 1997 over 200 companies have returned surveys. The return rate was 51% based upon 228 companies returning surveys of the 450 companies attending sessions.

The survey instrument included 10 questions which identify the industry type according to their Standard Industrial Classification (SIC) code, percent of business in home building, size range of company, and estimates of expenditures for: safety incentive programs (SIP), personal protective equipment (PPE), other safety equipment (OSE), and safety training (ST). The survey also inquired whether the company had used: a written safety and health program (WSHP), safety committee (SC), and Workers' Compensation Cost Containment Certification (WCCCC). The initial sampling requested information regarding the 1991–1995 time-frame. All of these are key items believed to represent management commitment to safety and health.

The second phase of data collection on resource allocation took place during "re-orientation" of participating company members approximately two years later. The HBA Safety Committee mandated "Re-Certification" of HomeSafe partners to assure participation and adherence to the 10-point program. This session consisted of an additional three-hours of information including feedback on preliminary program results and practices followed by training on hazard identification and control for residential construction. Again, the emphasis was placed on those hazards identified in the HomeSafe 10-point Pocket Guide [10]. The additional data were collected by identifying the senior management representative at each of the three re-certification sessions and providing another survey asking for management information and estimates of expenditures from 1996–1999. Completed surveys were returned to the Department of Environmental Health at Colorado State University.

3. Analysis and results

Those subjects submitting survey responses were predominantly male (89.8%) and management representatives, 73% being either owners or construction managers, or equivalent. Females represented only six

Table 1
a. Subject profile

Gender	
Male	94%
Female	6%
Job Title	
Owner	34%
Manager	39%
Other	27%
Mean Age	40 yrs.
Percent Homebuilding	
1–39%	6.50%
40–79%	10.70%
$>$ 80%	89.30%
Number of Employees	
$<$ 10	52.50%
11–25	25.50%
$>$ 26	22%

b. Trade distribution of subjects

SIC	% of Total	Trade description
1521	54.8	Single Family General Contractor
1711	4.8	Plumbing and HVAC
1721	3.1	Painting and papering
1731	4.8	Electrical work
1742	2.4	Plastering, drywall, masonry and insulation
1751	9.3	Carpentry
1761	3.5	Roofing, siding and sheeting
1771	2.6	Concrete work
1793	1.9	Glass work
1794	1.9	Excavation work
1799	10.9	Special trades not otherwise classified

Table 2
Total expenses per category 1991–1999

Expense category	Dollars spent
Safety Incentive Programs (SIP)	$1,009,081
Personal Protective Equipment (PPE)	$704,451
Other Safety Equipment (OSE)	$489,766
Safety Training (ST)	$1,009,529
Total spent 1991–1999	$3,212,827

percent of attendees. Nearly 90% of respondents reported that residential homebuilding constituted more than 80% of their total business. Fifty-two percent reported their company employed less than 10 persons, while only 22% reported greater than 26 employees. The single largest SIC code represented was the single-family construction general contractor. Over half of those submitting data reported their SIC as 1521 or 1522 (Table 1a, b).

The 228 HomeSafe partners reported spending a combined $ 3,212,827 between 1991 and 1999 (Table 2). The largest expense allocations were for ST followed by SIP, PPE, and OSE.

Total safety and health expenditures pre-HomeSafe years, 1991–1996 averaged $341,842 per annum which increased to $387,257 per year during the post-HomeSafe years, 1997–1999 (Table 3). The total increase in safety and health (S & H) expenses represents a modest eight percent rise from pre to post-HomeSafe periods. Mean annual company expenses for S & H were significantly greater (25%) ($p < 0.001$, Table 4). Over time the distribution of dollars to expense categories did change noticeably (Table 4). For example, the largest portion of expenses for SIP was accrued in the pre-HomeSafe years. Conversely, ST expenses increased markedly by (55%) in post HomeSafe years. OSE and PPE expenses also increased substantially by 32%. The average HomeSafe company spent increasing resources over the nine years (p-value < 0.001, Table 4). ST was the largest allocation category at $16,900 followed by PPE at $10,262.

Company size dramatically influenced the amount of money allocated for S & H (Table 5a). Small employers on average spent much less in every category of expense compared to larger employers ($p = 0.07$). There clearly exists a trend of increasing allocation with size. The disparity in SIP expenses is 20 times greater for companies with more than 25 employees. In most categories, the disparity is at least two-fold. When looking at pre vs. post comparisons, the disparities are lacking (Table 5b). SIP was the only category with significant increases noted ($p = 0.006$, Table 5).

Based on an examination of mean company dollars, significant increases were seen for SIP and OSE expenses only (p $<$ 0.001 and 0.019 respectively), from 1991 through 1999 (Fig. 2 a–d). Trends are likewise positive when comparing pre to post HomeSafe mean dollar allocations. SIP expenditures were slightly increased by 7% while ST allocations were greatly increased by 36%. Although the trends are positive, no statistically significant differences were seen on a per company basis.

The general contractors (SIC 1521) as a trade far out-spent all other trades identified with a total of $1,693,093 (Table 6). The next largest allocation was a mere 20% of the GC's expenditure and came from the electrical trade (SIC 1731) at $306,978. Weakest contributors included landscapers (SIC 1623), glasswork (SIC 1793), and painting (SIC 1721) that reported spending less than $50,000 total between 1991 through 1999 [22].

Data was limited on the following SHP-related management practices: 1) the presence of a written safety and health program other than HomeSafe (WSHP), 2) Safety Committee (SC), and 3) Workers' Compensation Cost Containment Certification (WCCCC) (Ta-

Table 3
Pre vs. post HomeSafe expense category difference

Category of expense for safety & health	Pre-HomeSafe Vs. Post-HomeSafe				Percent difference in mean spending
	1991–1996	Mean 1 yr.	1997–1999	Mean 1 yr.	
SIP	$756,261	$126,043	$252,820	$84,273	34% Decrease
PPE	$532,057	$88,676	$172,394	$57,465	36% Decrease
OSE	$282,748	$47,125	$207,018	$69,006	32% Increase
ST	$479,991	$79,998	$529,538	$176,513	55% Increase
Total Mean		$341,842		$387,257	8% Increase

Table 4
Mean total annual expense per company for safety and health 1991–1999

Years	1991	1992	1993	1994	1995	1996	1997	1998	1999
SIP	$280	$371	$258	$517	$678	$1,431	$1,566	$1,511	$1,832
PPE	$949	$1,645	$940	$1,117	$1,155	$881	$1,051	$1,219	$1,305
OSE	$667	$893	$889	$830	$678	$936	$1,203	$1,474	$1,401
ST	$1,619	$1,579	$1,703	$1,636	$1,785	$721	$1,179	$2,694	$3,984
Totals	$3,515	$4,488	$3,790	$4,100	$4,296	$3,969	$4,999	$6,898	$8,522

Significant increases from 1991–1999 p-value < 0.0001.

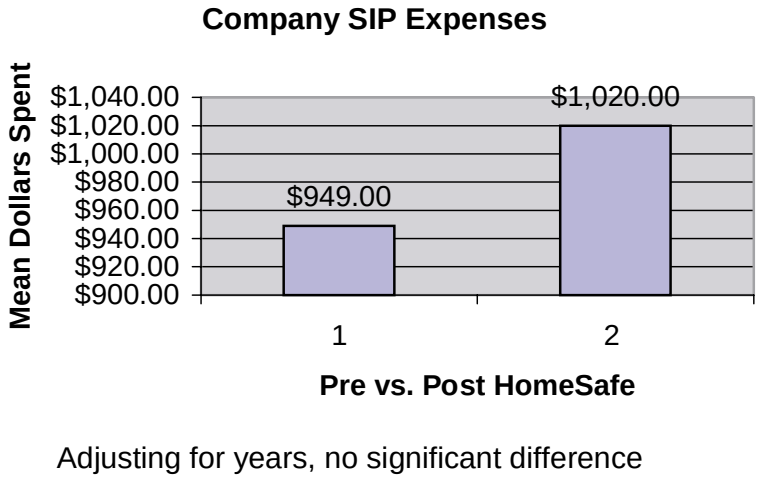

Fig. 2. Comparing expences for safety incentive programs pre vs post HomeSafe.

ble 7). Only 25% of the total number of companies reported using a WSHP, and only 11% took advantage of the Colorado's WCCCC discount program by 1999. However, the comparison of the number of WSHPs, SCs, and WCCCCs reported by employers in 1991 to 1999 yields impressive increases of 43%, 63%, and 64% respectively in frequency of use.

4. Discussion

HomeSafe was the first strategic partnership to be developed between industry and OSHA. This program preceded OSHA policy and was the inspiration to develop OSHA Directive TED 8.02 outlining the requirements for all strategic partnerships to follow. At the core of the strategic partnership program was an intention to reduce injuries, accidents, and fatalities in workplaces throughout America. This unique program provides an opportunity for industry to organize and develop their own solutions to safety and health implementation, management, monitoring, and evaluation and report progress to OSHA thereby relieving OSHA to focus on non-organized industries. The popularity of such programs has resulted in over 60 partnerships nationwide.

One major limitation within this industry is company size [11]. Seventy-eight percent of HomeSafe partners employ less than 26 individuals and spent one-half to a twentieth of larger companies. Data support the lim-

Table 5
a. Mean company expenses by size 1991–1999

Category of expense	Number of employees			P Values
	< 10	11–25	> 25	
SIP	$156.00	$625.00	$3,638.00	< 0.001
PPE	$329.00	$1,511.00	$1,433.00	< 0.001
OSE	$285.00	$878.00	$1,735.00	< 0.001
ST	$540.00	$1,132.00	$1,236.00	0.027

b. Comparing mean company expenses Pre vs. post HomeSafe

Category of Expense	Number of employees			P Value
	< 10	11–25	> 25	
SIP	$1,045.00	$987.00	$1,448.00	0.006
PPE	$1,133.00	$1,262.00	$699.00	0.668
OSE	$628.00	$600.00	$951.00	0.062
ST	$925.00	$932.00	$937.00	0.088

Adjusted for years.

Table 6
Comparison of resource allocation by trade

Trade	Spent 1991–1999
1521	$1,693,093
1623	$0
1711	$145,724
1721	$47,600
1731	$306,978
1742	$146,650
1751	$126,819
1761	$301,204
1771	$62,600
1793	$16,250
1794	$251,901
1799	$213,008
Total	$3,212,827

iting effect of company size. The disparity was significant for every category of expense in our study. The company size makeup of the industry is likely to continue to be a problem in construction. General contractors do not wish to have employees and incur the related expenses. Small employers often prefer the independence afforded by subcontractor status.

Despite the limitations related to company size, the HomeSafe partners reported that they are committed to safety and health [1]. Organizational size is directly linked to design, functional capability, resource allocation, and reporting and documentation requirements under OSHA [24]. Fifty-two percent of companies in this study reported less than 10 employees and therefore, are not required to keep OSHA 200 logs. Many of the companies operate as "work-groups" of subcontactors that operate in unison but maintain separate business identities. In essence, many employers are a one-person company.

The use of a written safety and health policy is recommended by many experts and serves to codify procedures within companies. The use of the WSHP, SC, and WCCCC practices were sparse in 1991 although the study data clearly show improving trends. These practices underpin the expense categories evaluated: safety incentive programs (SIP), personal protective equipment (PPE), other safety equipment (OSE), and safety training (ST). Only 22% of partner companies employed more than 26 individuals, yet 25% of companies had WSHPs. Small companies have traditionally not used written operating procedures for S & H but relied on verbal communication. Company size is a major limitation of this group. In Colorado, the Workers' Compensation Premium Cost Containment Board has required a written plan and evidence of its effectiveness to grant premium discounts. The HomeSafe 10-point booklet provides the basic framework on which to build a comprehensive S & H program, yet there exists a paucity of WSHPs within the HomeSafe partnership. In addition, the National Association of Home Builders has produced a template model S & H program for the home building industry available through the local HBA. Incredibly, the majority of small employers choose not to acquire and use a WSHP.

The temporal variation in the pattern of utilization of WSHPs may not truly represent actual level of program use among HomeSafe partners. Data were collected from two different groups of partners two years apart as cross-sectional samples and do not represent a longitudinal practice of the original subjects. Many of the companies that were sampled initially had been involved with the HBA and the development of HomeSafe for a prolonged period and represented a company with a higher level of commitment to S & H. The second sample represented younger companies that may not have yet recognized the benefits of a comprehensive WSHP and only used the HomeSafe booklet as their program. In every case, the expenditures given were believed to be accurate, but the data provided may have been estimates and not actual amounts. Although every effort was made to identify the senior management representatives, it is possible that misinformation was given.

The use of a 'safety committee' has also been the practice of larger companies with greater numbers of personnel and resources compared to smaller companies. Only 14% of companies reported using SCs in 1999. However, again it should be noted that 78% of partners employ less than 26 individuals. It is not likely that smaller companies will typically engage the use of SCs due to limited manpower and operational resources. A similar temporal trend of declining use

Table 7
Written S & H program, safety committee, and workers' compensation cost containment certification

Mgt. practice	Years 91–99									Total percent
	1991	1992	1993	1994	1995	1996	1997	1998	1999	
WSHP	35	45	55	75	90	43	55	65	65	25%
SC	15	20	29	36	49	23	31	34	41	14%
WCCCC	11	16	24	31	39	16	22	28	31	11%

was seen in 1996 for SC followed by an upward trend to 1999. This, again, is unexplainable and likely due in part to comparing our two cross-sectional samples.

WCCCC guarantees a 5% discount within the State of Colorado with any workers' compensation insurance carrier; however, despite the cost savings incentive, most employers, nearly 90%, have not taken advantage of the program due to the application process, programmatic demands, and required documentation of effectiveness. The peak year of participation was seen in 1995 where 17% reported participation WCCCC. The decline in participation seen in this study may be an artifact of data collection due to the two cross-sectional samples. Most companies do not allow WCCCC to lapse, but in fact become more committed to sound S & H practices and glean additional discounts and dividends directly from carriers secondary to reduced losses. Thus, the numbers of participating companies was expected to increase not decline.

SIPs have taken many forms among HomeSafe partners. Companies reported financial incentives provided as salary bonuses, safety equipment, company attire with logos, vacation trips, meal vouchers, vehicle allowances, and promotions. Several safety equipment suppliers in the Denver metro area have large product lines advocated as "incentives" for reducing accidents. Product selections are very diverse and personalized for each consumer company. Large companies may use these strategies whereas the smaller company doesn't typically consider these methods.

General contractors (GCs) far out-spent all other SIC codes in the SIP category and represent greater than 50% of those returning surveys. Many of the larger GCs rely on SIPs to motivate subcontractors. For example, the GCs safety director may make a safety inspection at a jobsite and supply hardhats and safety glasses to workers not equipped with proper PPE. However, if all subcontractors are 'in-compliance', he may supply lunch vouchers for the entire work crew or provide new stylish safety glasses for everyone on-site.

One roofing company provided a complete all-expense-paid trip for employees and families to Las Vegas for one weekend to celebrate a full year of no lost-time accidents [7]. The use of SIPs appeared to increase over the nine years evaluated in this study. While the total dollars decreased 34% comparing pre to post HomeSafe periods, the average allocations for SIPs increased by 85% from 1991 to 1999 ($p < 0.001$).

PPE typically included items such as hardhats, safety glasses, work boots, respirators, sun block, and protective clothing and uniforms. Under OSHA regulations 29 CFR 1910.132–1910.140, employers must provide necessary PPE to workers exposed to hazards requiring protection where other controls are not feasible. The standard practice in residential construction in the Denver metro area of Colorado is for the employer to provide the initial issue of PPE and then charge employees for replacement items thereafter at discounted rates. Larger companies whose resources permit bulk purchases and storage may choose to supply their employees with the necessary PPE at no charge to employees. Each employee is expected to use PPE on a worksite at all times. Proper PPE is described in the HomeSafe 10-point booklet. The use of PPE increased dramatically by 36% comparing pre to post HomeSafe and by 16%

comparing 1991 to 1999 expenses. Looking more closely at mean company distributions, there was no significant increase in allocations for PPE over time.

Other safety equipment included fall prevention systems, proper ladders, scaffolds, ground cords, tools and equipment. OSE allocations increased by 32% when comparing pre to post HomeSafe ($p = 0.052$) and by 26% on a per company basis over time. The use of other safety equipment has dramatically increased in Colorado residential construction over the past decade. For example, the use of aluminum pump-jack scaffolds and personal fall arrest systems is the current standard of practice in residential construction in the Denver metro area. It is believed that OSE allocations have been under reported. One HomeSafe partner, a roofing company, indicated that it had invested over $100,000 in fall arrest equipment alone between 1994 and 1997 [7]. With increasing pressure from OSHA during this time, companies were investing in improved and safer equipment. We believe that respondents were not categorizing all appropriate allocations to this category; thus,

the findings may well underestimate the actual OSE allocations.

Construction is replete with risks and hazards that require specialized safety training in order to work safely [12,19,27]. Previous studies have shown that as much as 50% of construction-related injuries are due to high turnover and lack of training [11]. Safety training programs within this cohort were typically focused on hazard identification and control but also included safe work practices, equipment use, and reporting procedures. Higher-level training may have been obtained at the OSHA Institute located in a local community college and focused on comprehensive S & H management. Additional structured training was available through OSHA and the HBA. At least 400 participants attended the OSHA 10-hour course at a cost of nearly $90 following the initiation of the HomeSafe Pilot Program. This course was structured to focus training on the 10-points of HomeSafe. HomeSafe booklets were also available for use in field training and greater than 20,000 were sold at a cost of $4 initially increasing to $8 each by 2001. The HBA safety committee produced a field-training manual costing $40 that included appropriate topics and tests for construction workers. This was highly recommended to all HomeSafe partners. Despite the 55% increase in the use of safety training pre to post HomeSafe, the per-company assessment was not significantly different from before 1997. Employers on the average spent nearly $17,000 on ST over the nine years evaluated. Safety training has increased in popularity this past decade. Training is also associated to company size; increasing company size results in increased training for employees [5]. We also believe that the cross-sectional data collection methods impacted our assessment of training allocations. Our data may represent underestimates of actual allocations; for example, a greater number of larger employers now employ full-time safety directors who train employees and subcontractors. their salary is not likely reflected in cost estimates.

Beginning in 1991 OSHA has applied continued pressure on this industry in the Denver metro area resulting in positive changes in safety and health in residential construction [6]. A prominent response has been to increase the amount of training provided. Other data from HomeSafe suggests that the average construction worker has received at least five hours of safety training in recent years from a variety of sources [8]. Training has been available through the foreman, GC safety director, workers' compensation (W.C.) insurance carrier, HBA and OSHA representatives, or safety consultants. It is highly likely that workers were exposed to more than one source of training, which could not be accounted for in present estimates.

One major goal of this strategic partnership was to obtain a cultural shift toward embracing safe work practices in residential construction in the Denver metro area of Colorado. The collaborative project was born of adversity but culminated in synergy. The HomeSafe Pilot Program has transformed S & H in the Denver metro area and continues today due to its positive affects. The HomeSafe strategic partnership lives beyond it's planned sunset of April 2001 and with additional research, investigators will explore the relationship between exposure to HomeSafe and impacts on injury and illness rates of partner companies.

5. Conclusion

This study demonstrates that sizable investments have been made to support safety and health practices in a cohort of residential homebuilders in the Denver metro area of Colorado. Although the data are limited, the trends are encouraging. The resource allocations made by the builders of all sizes and trades are impressive. However, it is clear that general contractors far outspend all trades in this industry for safety and health management. It is also clear that larger companies have greater resources to support loss control practices. The trend over time is one of progressive improvement. HomeSafe has positively impacted this industry in many ways including the creation of the OSHA strategic partnership program and focus of resources on real risks and hazards that take lives in residential construction. Companies must commit sound management practices and resources to appreciate S & H controls of the known risks and hazards inherent to this industry. The HomeSafe Pilot Program has had a positive and profound affect on the residential homebuilding industry both in Denver Colorado and across the nation. The safe work practices advocated by HomeSafe have become more commonplace in the Denver metro area. It is believed that work conditions and work practices are improved due to HomeSafe. The cross-sectional sampling methods used in this study weakened our findings but they are still meaningful and encouraging. Future research may yield additional data on the relationship of costs to effectiveness of injury prevention and control in residential construction.

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