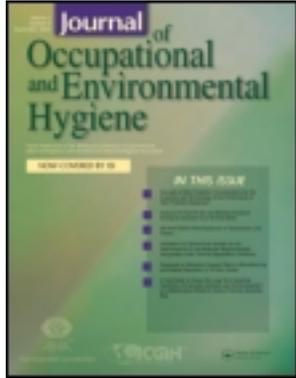


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Workplace Safety and Health Programs, Practices, and Conditions in Auto Collision Repair Businesses

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This article describes the results of a pre-intervention safety assessment conducted in 49 auto collision repair businesses and owners' commitments to specific improvements. A 92-item standardized audit tool employed interviews, record reviews, and observations to assess safety and health programs, training, and workplace conditions. Owners were asked to improve at least one-third of incorrect, deficient, or missing (not in compliance with regulations or not meeting best practice) items, of which a majority were critical or highly important for ensuring workplace safety. Two-thirds of all items were present, with the highest fraction related to electrical safety, machine safety, and lockout/tagout. One-half of shops did not have written safety programs and had not conducted recent training. Many had deficiencies in respiratory protection programs and practices. Thirteen businesses with a current or past relationship with a safety consultant had a significantly higher fraction of correct items, in particular related to safety programs, up-to-date training, paint booth and mixing room conditions, electrical safety, and respiratory protection. Owners selected an average of 58% of recommended improvements; they were most likely to select items related to employee Right-to-Know training, emergency exits, fire extinguishers, and respiratory protection. They were least likely to say they would improve written safety programs, stop routine spraying outside the booth, or provide adequate fire protection for spray areas outside the booth. These baseline results suggest that it may be possible to bring about workplace improvements using targeted assistance from occupational health and safety professionals.

[Supplementary materials are available for this article. Go to the publisher's online edition of Journal of Occupational and Environmental Hygiene for the following free supplemental resource: a business safety assessment.]

Keywords autobody collision repair, small business, workplace safety, intervention effectiveness

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INTRODUCTION

In the United States, approximately 236,000 people work in 37,600 auto collision repair businesses (NAICS code

811121). A majority of these businesses (55%) have four or fewer employees, 23% have 10 or more employees.⁽¹⁾ Collision repair technicians encounter a wide variety of physical and chemical hazards during vehicle repair, assembly, and painting. Chemical exposures to isocyanates during spray painting and the use of engineering controls and personal protective equipment (PPE) have been well documented in this industry.^(2–9)

However, other aspects of workplace safety including fire, explosion, electrical and machine-related hazards, and the programs required to manage these hazards, have not been examined in detail. Our pilot study data suggest that noise exposures could exceed occupational exposure guidelines during high production periods. In particular, air-powered tools are likely to produce noise levels exceeding 90 dBA. Airborne exposures to dusts and solvents did not exceed guidelines, but solvent exposures via skin contact could be important if no or improper gloves are worn.⁽¹⁰⁾

We conducted focus groups with owners and employees, seeking information about barriers and incentives for improving workplace health and safety.⁽¹¹⁾ Owners recognized the need for maintaining equipment, providing a clean environment, and covering the cost of personal protective equipment. However, they were unaware of the legal requirements for employee Right-to-Know training and respirator fit-testing which they thought were better managed by safety consultants or equipment suppliers. Employees were also unaware of training and fit-testing requirements.

Owners indicated they would utilize safety resources that were tailored to their needs and specific to the hazards and problems encountered in their industry. They were also in favor of working with safety consultants, in particular for preparing written programs, conducting regular audits, and training employees.

This article describes the results of baseline business safety assessments conducted as part of the Collision Auto Repair Safety (CARS) Study, which was designed to test the effectiveness of workplace safety interventions in small collision repair businesses in the Minneapolis and St. Paul metropolitan area. An intervention mapping process was followed to identify

intervention targets, change objectives, strategies for motivating workplace improvements, and outcome measures.⁽¹²⁾

Nine potential adverse health outcomes were identified following detailed job hazard analyses, ergonomic assessments, and review of pilot and published data:^(2,10,13–18) 1) respiratory sensitization from isocyanate-containing paints, 2) acute injuries from electrical hazards, 3) acute injuries from fire and explosion, 4) eye injuries from flying objects and dust, 5) hearing loss from exposure to high noise tools and equipment, 6) musculoskeletal disorders (MSDs) of the back, shoulder, and knees, 7) dermatitis and systemic effects from respiratory and skin exposure to chemicals (organic solvents), 8) slips and falls, and 9) acute injuries from knives (cuts) and frame straighteners (struck by).

Six hazards were selected as the primary intervention targets for this study: isocyanates, solvents, fire and explosion, flying objects and dust, noise and electrical hazards. We were not able to identify cost-effective and easy-to-implement interventions for MSDs, which result from awkward postures during collision repair tasks. For similar reasons and lack of outcome measures, slips/falls and acute injury from frame straighteners were also excluded. Acute injuries from knife cuts were considered to be lower in probability and severity when compared to other health outcomes.

Businesses were enrolled in the study over a one-year period. Each business received a safety assessment and shop improvement plan at baseline, assistance with improvements over a one-year intervention period, and a follow-up safety assessment. This article describes the design of the baseline assessment tool, results of baseline measurements of business safety, and owners' commitments to specific improvements prior to intervention.

METHODS

Business Safety Assessment

Items for the business safety assessment were identified from publications, regulatory rules and guidelines, and input from consultants, suppliers, business owners, business association members, and regulators. Following review by safety professionals knowledgeable about auto collision repair workplace hazards, each item was assigned a level of severity:

- *Critical*: Items that had the potential to cause serious injury to an employee or immediate damage to the facility
- *Highly Important*: Items that might cause employee injury or long-term health issues or damage to the facility
- *Important*: Items that might cause non-serious employee injury and illness
- *Other*: Items not immediately hazardous that could be fixed relatively easily and would ensure regulatory compliance.

After preliminary testing in four representative businesses, the final business safety assessment consisted of 92 questions grouped into eight sections:

1. Safety in the shop and employee Right-to-Know (16 items) [Note: In Minnesota, the federal Occupational Safety and Health Administration (OSHA) hazard communication regulations are included in a state Employee Right-to-Know Act.]
2. Emergency planning, first aid, and fire prevention (23 items)
3. Compressed gas cylinders (3 items)
4. Paint booth and mixing room (11 items)
5. Ergonomics (4 items) (included to inform future interventions)
6. Electrical and machine safety (18 items)
7. Hearing, sight, and skin protection (7 items)
8. Respiratory protection (10 items)

Sixty-one items were applicable to all businesses; the remaining 31 items depended on responses to other questions (e.g., elements of the safety program were only applicable if a written program was present) or business conditions (e.g., a safety committee is required only for businesses with 25 or more employees). (The business safety assessment is available as a supplementary online file.)

Data on owners' years of experience, number of employees, and membership in the local business association (Alliance of Automotive Service Providers of Minnesota, AASP-MN) were also collected. A specific recommendation was developed for each incorrect, missing, or deficient (not in compliance with regulations or not meeting best practice) item or set of items, incorporated into a report and used to guide business owners' selection of improvements.

BUSINESS ELIGIBILITY AND RECRUITMENT

Businesses were eligible for this study if they met the following criteria: 1) at least 75% of revenue generated by collision repair activities; 2) in business for at least one year; 3) independently owned and operated or, if a franchise, did not have a corporate safety program; 4) at least one employee covered by workers' compensation insurance; 5) had a paint booth; and 6) not currently using consulting services of a study partner.

A data set of 273 auto collision repair businesses within a 50-mile radius of Minneapolis and St. Paul was created by combining information from the Dunn and Bradstreet database and AASP-MN membership directory. Initially, owners were recruited by telephone following a letter mailed to randomly selected businesses. If an owner agreed to participate, a visit was scheduled by the principal investigator to obtain written consent and describe the study. This recruitment method proved to be extremely time-consuming, requiring 10 to 15 calls to schedule an initial visit. Additional recruitment methods included presentations at local AASP-MN meetings, an AASP-MN magazine article, study information distribution to customers by equipment and paint suppliers, referrals from enrolled business owners, and invitations to focus group participants.

Baseline Business Safety Assessment

A baseline business safety assessment was conducted at participating businesses by one of two industrial hygienists. An owner or manager was interviewed about business demographics (e.g., length of time in business, number of employees) and safety rules and policies. Written documents (e.g., health and safety programs, policies, and training records) were examined, and current or past collaboration with a private safety consultant was noted as well (not addressed by an item on the assessment tool). Conditions (e.g., location of fire extinguishers, state of electrical panels and cords) in the repair, paint, and detail areas were observed and employees were interviewed (e.g., about equipment use) as necessary. For items present in multiples (fire extinguishers, exits, electrical panels, and electrical cords), a maximum of five items was randomly evaluated.

The owner or manager received a written report listing recommendations and severity ratings for all missing (deficient or non-compliant) items, including whether an item was among the most-cited Minnesota OSHA violations for this industry. During a second visit scheduled within one month of the baseline assessment, the owner was asked to commit to improvements for at least 30% of missing items; 80% of these were expected to be in the *critical* or *highly important* categories. Owners were advised to spread the improvements over a 12-month period, with more difficult, time-consuming, or expensive improvements given longer time periods to complete. Each owner was mailed a written shop improvement plan that included detailed steps for completing each selected improvement by its target date.

Quality Control

An electronic coding manual was developed by the research team during initial testing, containing specific instructions for assigning a response for each item to ensure evaluation consistency. The first eight businesses were assessed jointly by two industrial hygienists; the coding manual was revised to include additional descriptions of specific situations and corresponding answers. Over the next eight months, six businesses (15%) were visited simultaneously but evaluated independently by the two industrial hygienists. During this same period, an external expert familiar with auto collision repair businesses served as a third evaluator who independently and simultaneously assessed three additional businesses with each of the two industrial hygienists, for a total of six external (15%) quality-control evaluations. Quality control visits were randomly selected by a statistician and distributed throughout the study period.

Data Analysis

Data were entered by research staff on printed survey instruments during the business safety assessment and then entered in Microsoft Excel spreadsheets. Safety performance was determined by calculating the fraction of correct answers for all participating businesses by item, survey section, and severity category. A "correct" answer denotes best practice or

compliance with regulatory requirements, as appropriate. Data analyses were performed with SAS (version 9.2; SAS Institute Inc., Cary, N.C.) and included computation of means, standard deviations, and Chi-squares. T-tests, ANOVA, and Pearson correlations were used to explore the relationship between the fraction of correct items, demographic variables, and previous or current use of a safety consultant. Inter-rater variability was assessed using the kappa statistic.

RESULTS

Business Recruitment and Demographics

Initially, 50 businesses were randomly selected from the 273 businesses in the original data set, sent letters, and phoned regarding willingness to participate. Of these, 15 did not meet eligibility criteria, no contact could be made with 2, 7 declined participation, and 26 agreed to participate. The two primary reasons given for not participating were "not interested" and "don't have time." An additional 31 businesses were identified from four sources: focus groups (4), AASP-MN (7), referral from a business owner (10), and suppliers (10). Four subsequently declined to participate (2) or were not eligible (2). The 23 businesses enrolled from these 4 sources included 3 focus group participants, 7 AASP-MN members, 8 owner referrals, and 9 supplier referrals. Participation rates of eligible businesses were 79% by random selection and 79% by key informant.

Forty-nine businesses received baseline evaluations between November 2009 and May 2011; one owner refused to participate beyond the baseline assessment. Establishments had been in business for an average of 32 years (SD = 13 years, range 2–60) and had an average of 7 employees (SD = 6, range 1–29). The same person had been owner or manager for an average of 14 years (SD = 11, range 1–39) and owners/managers had been in the industry for an average of 27 years (SD = 12, range 1–50). Thirty-three businesses (67%) were AASP-MN members and 13 (27%) were currently working or had worked with a safety consultant.

Quality Control

The kappa statistic ranged from 0.82 to 0.98 between the two industrial hygienists (six joint visits, all survey items) and from 0.76 to 0.96 between each industrial hygienist and an external evaluator (three visits per staff member, only *critical* and *highly important* items were considered). A kappa statistic above 0.75 is considered very good agreement.⁽¹⁹⁾

Baseline Assessment

Fraction of Correct Items

On average, 66% (SD = 7.5%) of all surveyed items were present across all participating businesses (Table I). Businesses had the highest fraction of correct items related to electrical safety, machine safety and lockout/tagout, and compressed gases (80%). The items most frequently missing, incorrect, or deficient were those related to safety programs and

TABLE I. Comparison of Safety Performance with and Without a Safety Consultant (by survey section and severity category)

	% Correct Items [mean (SD)]		
	All businesses (n = 49)	Safety consultant (n = 13)	No safety consultant (n = 36)
All items	66(7.5)	75***(5.6)	62(4.6)
Safety programs and employee Right-to-Know	53 (13)	70*** (12)	47 (6.5)
Emergency planning, fire prevention	66 (11)	72 (14)	64 (8.3)
Compressed gases	80 (27)	87 (17)	77 (29)
Paint booth and mixing room	64 (17)	73* (17)	61 (16)
Ergonomics	65 (15)	64 (16)	65 (15)
Electrical and machine safety	80 (8.9)	86** (6.9)	77 (8.3)
Hearing, eye and skin protection	71 (13)	77 (10)	69 (13)
Respiratory protection	59 (12)	76* (9.7)	54 (6.1)
		Severity Category	
Critical	84 (12)	90* (9.7)	82 (12)
Highly Important	48 (11)	67*** (8.6)	48 (5.9)
Important	63 (7.3)	69** (8.9)	61 (5.3)
Other	72 (11)	80* (10)	69 (9.8)

* p < 0.05;

** p < 0.001;

*** p < 0.0001

employee Right-to-Know training (53%) and respiratory protection (59%). No relationship was found between the fraction of correct items and number of years the owner had worked in the industry, length of time business was owned, number of employees, or membership in AASP-MN. Being a member of AASP-MN was not related to any of the demographic characteristics or overall fraction of all items present, but was significantly associated with more correct items related to the paint booth and mixing room.

The 13 businesses with a current or past relationship with a safety consultant had a significantly higher fraction (75%) of correct items, overall, when compared to the 36 businesses without such a relationship (62%; $p < 0.0001$). In particular, these 13 businesses had a significantly higher fraction of correct items for safety programs and Right-to-Know training (70% vs. 47%), paint booth and mixing room safety (73% vs. 61%), electrical and machine safety (86% vs. 77%), and respiratory protection (76% vs. 54%). The fraction of correct items was also higher for businesses with safety consultants when examined by level of severity (Table I).

Businesses utilizing safety consultants were more likely to have written safety programs, written respiratory protection programs that included procedures for selecting respirators and a schedule for changing respirator cartridges, written emergency action plans, and a policy for wearing hearing protection when using air-powered tools. These businesses were also significantly more likely to have recently conducted employee Right-to-Know training, respirator medical certification, annual fit-testing, and annual respirator training. On the other

hand, employers utilizing safety consultants did not show significant differences in most items related to the paint spray booth or mixing room and employees were not more likely to be using correct gloves, providing safety glasses, or requiring the use of respirators during all spraying operations (Table II).

Critical and Highly Important Items

For items rated *critical* or *highly important*, most businesses (at least 75%) had unobstructed emergency exits leading to a safe location; sealed, mounted, and charged fire extinguishers; open and unrestricted vents in their mixing rooms (for mixing rooms with ventilation); properly stored compressed gas cylinders; provided correct gloves, hearing protection, and safety glasses; used the correct respirator cartridge, and required employees to wear respirators during all spray operations. Conversely, more than 90% of businesses did not have a written policy describing consequences for failing to follow safety rules, written records of Right-to-Know training, and a written hearing protection policy for when air-powered tools were used, and did not conduct annual respirator training (Tables III–VIII).

Items Selected for Improvement

Owners selected improvements for an average of 84% of *critical* and *highly important* items (SD = 10%, range 60–100%). For all items, owners chose to implement an average of 58% of all recommended improvements (SD = 17%, range 31–97%). Owners with AASP-MN membership selected a significantly

TABLE II. Comparison of Selected Safety Assessment Items in Businesses with and Without a Safety Consultant

Item	All businesses		With safety consultant N = 13		Without safety consultant N = 36	
	# correct ÷ # applicable	%	# correct ÷ # applicable	%	# correct ÷ # applicable	%
Written safety program	15/49	31	12/13	92***	3/36	8
Written safety policy	11/49	6	3/13	15	1/36	3
Discuss safety at least twice a year	15/49	31	8/13	62**	7/36	19
Right-to-Know training in past year	4/49	8	4/13	31***	0/36	0
Written emergency plan	7/49	14	6/13	46***	1/36	3
Employees trained to use fire extinguishers	10/49	20	4/13	31	6/36	17
Monitor flow in paint booth	30/49	61	10/13	77	20/36	56
Routinely spray outside booth	14/49	29	8/13	4	8/36	22
Spray area has explosion-proof wiring ^A	5/40	12	2/9	22	3/31	10
Spray area has explosion-proof lighting ^A	7/41	17	3/10	30	4/31	32
Spray area has ventilation with explosion-proof fan ^A	14/38	37	5/10	50	9/28	32
Spray area has fire suppression system ^A	16/41	39	6/10	60	10/31	32
Mixing room has working ventilation system ^B	31/43	72	9/12	75	22/31	71
Mixing room has open and unobstructed vents ^B	33/38	87	12/12	100	21/26	81
Mixing room door blocked open ^B	22/43	51	6/13	46	16/36	44
If applicable, have a LOTO program	4/11	36	4/5	80**	0/6	0
Hearing protection policy	5/49	10	4/13	31**	1/36	3
Wear correct type of gloves ^C	27/49	55	6/13	46	21/36	58
Provide safety glasses	42/49	86	13/13	100	29/36	81
Safety glasses required ^D	11/49	22	5/13	38	6/36	17
Written respiratory protection program	11/49	22	10/13	77***	1/36	3
Procedures for selecting respirators	13/49	27	8/13	62***	5/36	14
Medical certification for respirators	7/49	14	7/13	54***	0/36	0
Annual fit-testing	6/49	12	5/13	38***	1/36	3
Annual respirator training	5/49	10	5/13	38***	0/36	0
Schedule for changing cartridges	4/49	8	3/13	23*	1/36	3
Required to wear respirators every time spray	41/49	84	13/13	100	28/36	78
Dust mask not worn when paint spraying	0/49	100	13/13	100	36/36	100
Organic vapor cartridges with pre-filter used ^E	48/48	100	13/13	100	36/36	100
Monitor carbon monoxide ^F	6/13	46	3/5	60	3/8	38

*** p < 0.001; ** p < 0.01; * p < 0.05

^Afor companies where paint spraying is routinely performed outside of the paint booth

^Bfor companies with a mixing room

^Ccorrect responses include thick latex, nitrile, butyl, and silver shield gloves; incorrect responses include no or thin latex gloves.

^Dwhen grinding, working under car or cleaning with compressed air; asked as three separate questions; coded "no" if any response = "no."

^E when wearing an air purifying respirator during paint spraying

^F when wearing an airline respirator during paint spraying

higher fraction of recommended improvements (63% vs. 46%; p = 0.009). Industry experience, number of years owning the business, shop size, and having a current or a past relationship with a safety consultant were not associated with the number of improvements selected.

For businesses missing or with deficiencies in *critical* and *highly important* items, owners were most likely (>75% of businesses) to select improvements related to:

- Right-to-Know training
- Ensuring that emergency exits were not locked from the inside
- Updating and properly locating fire extinguishers
- Training employees to use extinguishers
- Chaining compressed gas cylinders
- Ensuring that cars were properly supported when employees are working underneath

TABLE III. Shops with Correct Items and Selecting Items for Improvements in Safety Programs and Right-to-Know Training (sorted by severity and percent correct)

Item	Severity ^A	Evaluation method, health hazard ^B	Responses ^C	Shops with correct response N = 49		Shops selecting item for improvement N = 48	
				# correct ÷ # applicable	%	# selecting ÷ # missing	%
Employees informed about programs and policies	3	OI, A	Written copy, At orientation, Safety meetings, Bulletin board, <u>Not informed,</u> <u>None of above</u>	26/49	53	5/23	22
Discuss safety at least twice a year	3	OI, A	<u>Y/N</u>	15/49	31	8/34	24
Written safety programs and policies	3	RO, A	<u>Y/N</u>	15/49	31	11/33	33
Shop specific programs and policies (if written program)	3	RO, A	<u>Y/N/NA</u>	11/49	22	9/37	24
Single person with safety oversight (if written program)	3	RO, A	<u>Y/N/NA</u>	7/49	14	14/41	34
New employee Right-to-Know training	3	OI, I, S, D, N	<u>Y/N</u>	5/49	10	30/43	70
Right-to-Know training in past year	3	RO, A	<u>Y/N</u>	4/49	8	41/44	93
Right-to-Know training record (if training conducted)	3	RO, I, S, D, N	<u>Y/N/NA</u>	4/49	8	41/44	93
Right-to-Know training roster (if training conducted)	3	RO, I, S, D, N	<u>Y/N/NA</u>	4/49	8	40/44	91
Written policy with consequences for not following safety rules	3	OI, I, S, D, N	<u>Y/N</u>	3/49	6	11/45	24
Someone designated to oversee safety	2	OI, A	Owner, Manager, <u>Safety consultant,</u> Office personnel, <i>No one designated</i>	49/49	100	—	—
Safety committee ^D	2	OI, A	<u>Y/N/NA</u>	2/3	67	1/1	100
OSHA 300 log ^E	1	RO, A	<u>Y/N/NA</u>	44/49	90	1/5	20
OSHA 300A annual summary ^E	1	RO, A	<u>Y/N/NA</u> ⁺	42/49	86	2/7	29
OSHA posters	1	RO	<u>Y/current,</u> <u>Y/not current, N</u>	17/49	35	13/31	42
Material safety data sheets available	1	RO, I, S, F	Online, In print/complete, In print/current, <u>None of above</u>	10/49	20	21/38	55

^A4 = critical, 3 = highly important, 2 = important, 1 = other.

^BRO = records observation, W = walk-through observations, OI = owner interview; I = isocyanates, S = solvents, F = fire and explosion, D = dust and flying objects, N = noise, E = electrical hazards, A = all hazards, O = other.

^CUnderlined responses triggered a recommendation.

^DNA = Not required for shops with < 25 employees.

^ENA = Not required for shops with < 11 employees.

TABLE IV. Shops with Correct Items and Selecting Items for Improvements in Fire and Emergency Response (sorted by severity and percent correct)

Item	Severity ^A	Evaluation method, health hazard ^B	Responses ^C	Shops with correct response N = 49		Shops selecting item for improvement N = 48	
				# correct ÷ # applicable	%	# selecting ÷ # missing	%
Emergency exits not blocked or obstructed ^D	4	W, F	<u>Y/N</u>	40/49	82	8/9	89
Emergency exits not locked from the inside ^D	4	W, F	<u>Y/N</u>	36/49	73	13/13	100
Fire extinguishers fully charged ^D	3	W, F	<u>Y/N</u>	45/49	92	4/4	100
Fire extinguishers have seal in place ^D	3	W, F	<u>Y/N</u>	44/49	90	5/5	100
Emergency exits lead to safe location ^D	3	W, F	<u>Y/N</u>	43/49	88	3/6	50
Smoking not allowed inside building	3	OI, F	<u>Y/N</u>	40/49	82	3/8	38
Fire extinguishers mounted on wall ^D	3	W, F	<u>Y/N</u>	39/49	80	7/9	78
Fire extinguishers have current tag ^D	3	W, F	<u>Y/N</u>	35/49	71	13/14	93
Fire extinguishers easy to access ^D	3	W, F	<u>Y/N</u>	27/49	55	17/21	81
Grounding during flammable liquid transfer	3	W, F	<u>Y/N</u>	20/49	41	20/28	71
Solvent containers closed when not in use	3	W, F	<u>Y/N</u>	27/45	22	17/26	65
Employees trained to use fire extinguishers	3	OI, F	<u>Y/N</u>	10/49	20	30/38	77
First-aid kit	2	W, D, O	<u>Y/N</u>	49/49	100	—	—
Emergency plan addresses fire, medical emergencies and chemical spills (if written plan)	2	RO, A	<u>Y/N/NA</u>	45/49	92	0/4	0
Eye wash accessible (if present)	2	W, O	<u>Y/N/NA</u>	4/5	80	0/1	0
Emergency exits labeled with illuminated sign ^D	2	W, F	<u>Y/N</u>	17/49	35	14/31	45
Eye wash ^F	2	W, O	<u>Y/N/NA</u>	5/19	26	3/13	23
First-aid kit stocked and up to date (if kit present)	2	W, D, O	<u>Y/N/NA</u>	11/49	22	23/37	62
Written emergency plan ^E	2	RO, A	<u>Y/N</u>	7/49	14	12/42	29
Emergency phone numbers posted	2	W, A	<u>Y/N</u>	9/49	18	21/39	54
Eye wash solution current (if present)	2	W, O	<u>Y/N/NA</u>	0/1	0	0/1	0
Emergency medical clinic or provider identified	1	OI, A	<u>Y/N</u>	28/49	57	5/21	24
Emergency plan reviewed annually	1	OI, A	<u>Y/N</u>	5/49	10	9/43	21

^A 4 = critical, 3 = highly important, 2 = important, 1 = other.

^B RO = records observation, W = walk-through observations, OI = owner interview; I = isocyanates, S = solvents, F = fire and explosion, D = dust and flying objects, N = noise, E = electrical hazards, A = all hazards, O = other.

^C Underlined responses triggered a recommendation.

^D Five items were randomly assessed; given a "no" if any of the five received a "no."

^E NA = Not required for shops with < 11 employees.

^F NA = no acids or bases present or used.

- Providing appropriate chemical-resistant gloves to auto-body technicians
- Requiring employees to wear respirators every time they spray and
- Writing and implementing a respirator program.

Business owners were least likely (<25% of businesses) to say they would make improvements to written safety programs, implement a written policy requiring employees to follow safety rules, stop routine spraying outside the booth, or

provide adequate fire protection for outside spray areas (Tables III–VIII).

DISCUSSION

Baseline assessments identified many areas where safety improvements were needed; in particular, deficiencies were found in safety programs, employee Right-to-Know training, management of compressed gas cylinders, emergency

TABLE V. Shops with Correct Items and Selecting Items for Improvements in Painting and Paint Mixing (sorted by severity and percent correct)

Item	Severity ^A	Evaluation method, health hazard ^B	Responses ^C	Shops with correct response N = 49		Shops selecting item for improvement N = 48	
				# correct ÷ # applicable	%	# selecting ÷ # missing	%
Mixing room ventilation has open and unrestricted vents (if have mixing room with ventilation)	3	W, I, S, F	Y/ <u>N</u> /NA	33/38	87	2/5	40
Mixing room has working ventilation (if have mixing room)	3	W, I, S, F	Y/ <u>N</u> /NA	31/43	72	7/11	64
Monitor the airflow in the paint booth	3	W, I, S	Y/ <u>N</u>	30/49	61	7/18	39
Routinely spray outside booth	3	OI, I, F, S	Y/ <u>N</u>	14/49	29	3/34	9
Outside spray area has fire suppression	3	W, F	Y/ <u>N</u> /NA	16/41	39	2/24	8
Outside spray area has explosion-proof fan (if fan is present)	3	W, F	Y/ <u>N</u> /NA	14/38	37	1/23	4
Outside spray area has explosion-proof lights (if lights are present)	3	W, F	Y/ <u>N</u> /NA	7/41	17	3/33	9
Outside spray area has explosion-proof wiring (if wiring is present)	3	W, F	Y/ <u>N</u> /NA	5/40	13	2/34	6
Changing paint booth exhaust filters	2	OI, I, S	Gauge indicates, On a schedule, Outside contractor, Filters look dirty, Fan slows	33/49	67	5/16	31
Enclosed gun cleaner for solvent-based paints	2	W, S	Y/ <u>N</u>	33/49	67	2/15	13
Mixing room door kept closed	2	W, F	Yes, Fusible link, Blocked open, No door, N/A (no room)	22/48	46	13/27	48

^A 4 = critical, 3 = highly important, 2 = important, 1 = other.

^B RO = records observation, W = walk-through observations, OI = owner interview; I = isocyanates, S = solvents, F = fire and explosion, D = dust and flying objects, N = noise, E = electrical hazards, A = all hazards, O = other.

^C Underlined responses triggered a recommendation.

planning, fire prevention, paint booth and mixing room design, and selection and use of personal protective equipment. Most critical items were present, but one-half of highly important items were not.

Our baseline assessments indicate that, although almost all painters were wearing the appropriate level and type respiratory protection, there was considerable room for improvement in all elements of respiratory protection, including medical evaluation, training, fit-testing, cartridge change schedules, and written programs. In addition, improvements were needed in other types of personal protection such as safety glasses, hearing protection, and gloves. For businesses without safety consultants, more than 30% of items were missing, incorrect,

or deficient for six of the seven focus areas, with the exception of electrical and machine safety.

The use of a private safety consultant and being a member of the local business association were associated with higher levels of health and safety. Private safety consultants were associated with the presence of written safety programs, Right-to-Know training, electrical safety, the condition of paint booths and mixing rooms, and respiratory protection practices. Membership in the local business association was associated with better health and safety conditions in paint and mixing rooms and selecting a greater number of items for improvement. These results reinforce findings from focus groups with owners, whose most important source of health and safety

TABLE VI. Shops with Correct Items and Selecting Items for Improvements in Compressed Gases and ergonomics (sorted by severity and percent correct)

Item	Severity ^A	Evaluation method, health hazard ^B	Responses ^C	Shops with correct response N = 49		Shops selecting item for improvement N = 48	
				# correct ÷ # applicable	%	# selecting ÷ # missing	%
Compressed Gases							
Cylinders stored with safety cap (if present)	3	W, O	<u>Y</u> /N/NA	34/38	89	2/4	50
Cylinders chained	3	W, O	<u>Y</u> /N	18/49	69	12/15	80
Oxygen cylinders stored away from flammable and combustible materials when not on cart (if present)	3	W, F	<u>Y</u> /N/NA	18/26	69	6/8	75
Ergonomics							
Employees work under car supported only by hydraulic jacks	4	I, O	<u>Y</u> /N	43/49	88	5/6	83
Written policy requires assistance for greater than 50 lb.	2	RO, O	<u>Y</u> /N	0/49	0	9/48	19
Assists provided for reaching or working above shoulder level	1	I, O	Stable risers, Rolling platform, Step stools, <u>None of above</u>	45/49	92	0/4	0
Rolling adjustable stands for handling doors	1	I, O	<u>Y</u> /N	35/49	71	0/13	0

^A 4 = critical, 3 = highly important, 2 = important, 1 = other.

^B RO = records observation, W = walk-through observations, OI = owner interview; I = isocyanates, S = solvents, F = fire and explosion, D = dust and flying objects, N = noise, E = electrical hazards, A = all hazards, O = other.

^C Underlined responses triggered a recommendation

information was other owners. Owners also frequently stated that they were likely to rely on private safety consultants for preparing written programs, conducting employee training, and fit-testing respirators.⁽¹¹⁾

Safety consultation has been shown to have an impact on workers' compensation claim rates and costs. For example, Nave et al. examined the effect of insurance company loss control services provided to small- and medium-size businesses.⁽²⁰⁾ Those with more than two years of consultation had lower overall claim, severity-claim, and medical-only claim rates than businesses with one year or less of consultation. They concluded that consultation could help reduce both frequency and severity of claims if flexibility was allowed in selecting which services were provided to a business and consultants focused on developing a partnership with the business.

Baseline assessments involved multiple activities, including record reviews, interviews, and observations; a detailed scoring manual was most likely responsible for very good agreement in side-by-side comparisons of the two industrial hygienists as well as an external evaluator. Thus, ensuring reliability of the baseline assessment tool by other health and safety professionals may be possible if accompanied by detailed instructions.

Business self-assessment and -certification for environmental and occupational health has received some attention in this industry.^(21,22) A side-by-side comparison of a 25-item audit tool in 11 businesses found that owners were able to correctly identify only 22% of unsafe working conditions when compared to research staff.⁽²³⁾ Thus, while it may be possible to ensure consistent application of a safety assessment tool by safety professionals, it is less likely that owners of auto collision repair businesses can reliably employ such a tool.

Owners showed a strong preference for selecting items for improvement related to training, emergency exits, fire extinguishers, and respiratory protection. These choices were most likely influenced by study factors, including information about whether an item was among those most-cited by Minnesota OSHA or assistance was available from the Collision Auto Repair Safety (CARS) study, as well as business factors, such as availability of funds, time, and other resources. Surprisingly, a current or past relationship with a safety consultant did not appear to influence which items were selected for improvement.

Cultural expectations may have also played a role in owners' decisions about improvements. While very few businesses (6%) had a written disciplinary policy with explicit

TABLE VII. Shops with Correct Items and Selecting Items for Improvements in Personal Protective Equipment (sorted by severity and percent correct)

Item	Severity ^A	Evaluation method, health hazard ^B	Responses ^C	Shops with correct response N = 49		Shops selecting item for improvement N = 48	
				# correct ÷ # applicable	%	# selecting ÷ # missing	%
Hearing, Eye, and Skin Protection							
Provide gloves to painters	3	W, S, I	<u>N</u> , Y - thin latex, Y - thick latex, Y - thin nitrile, Y - thick nitrile, Y - butyl, Y - silver shield, Other	49/49	100	—	—
Provide employees with hearing protection	3	I, N	<u>Y/N</u>	45/49	92	1/4	25
Safety glasses provided to employees	3	I, D	<u>Y/N</u>	42/49	86	3/7	43
Provide gloves to body technicians	3	W, S	<u>N</u> , Y - thin latex, Y - thick latex, Y - thin nitrile, Y - thick nitrile, Y - butyl, Y - silver shield, Other	27/49	55	19/22	86
Hearing protection required when using compressed air tools	3	I, N	<u>Y/N</u>	21/49	43	20/28	71
Safety glasses required for grinding, working under cars and cleaning with compressed air	3	I, D	<u>Y/N</u>	11/49	22	26/37	68
Hearing protection policy	3	RO, N	<u>Y/N</u>	5/49	10	32/43	74
Respiratory Protection							
Monitor carbon monoxide levels for airline respirator (if present and used)	4	W, O	<u>Y/N/NA</u>	6/13	46	5/7	71
Use organic vapor cartridges with pre-filter (if using cartridge respirators)	3	W, I, S	<u>Y/N/NA</u>	48/48	100	—	—
Use dust masks when spraying	3	I, I, S	<u>Y/N</u>	49/49	100	—	—
Employees must wear respirator every time they spray	3	I, I, S	<u>Y/N</u>	41/49	84	6/8	75
Written procedures for selecting respirators	3	RO, I, S	<u>Y/N</u>	13/49	27	33/35	94
Written program	3	RO, I, S	<u>Y/N</u>	11/49	22	36/37	97
Written cartridge change-out schedule (if using cartridge respirators)	3	RO, I, S	<u>Y/N/NA</u>	7/49	14	40/44	91
Medical clearance	3	RO, I, S	<u>Y/N</u>	6/49	12	39/41	95
Current fit-test records (if using tight-fitting respirators)	3	RO, I, S	<u>Y/N/NA</u>	5/49	10	40/42	95
Annual respirator training	3	RO, I, S	<u>Y/N</u>	4/49	8	41/43	95

^A 4 = critical, 3 = highly important, 2 = important, 1 = other.

^B RO = records observation, W = walk-through observations, OI = owner interview; I = isocyanates, S = solvents, F = fire and explosion, D = dust and flying objects, N = noise, E = electrical hazards, A = all hazards, O = other.

^C Underlined responses triggered a recommendation.

TABLE VIII. Shops with Correct Items and Selecting Items for Improvements in Machine Safety and Lockout/Tagout (sorted by severity and percent correct)

Item	Severity ^A	Evaluation method, health hazard ^B	Responses ^C	Shops with correct response N = 49		Shops selecting item for improvement N = 48	
				# correct ÷ # applicable	%	# selecting ÷ # missing	%
Electric wiring in paint booth	4	W, F	<u>Y</u> /N/NA	49/49	100	—	—
Unfinished wiring	4	W, E	<u>Y</u> /N	48/49	98	1/1	100
Explosion-proof lighting in paint booth	4	W, F	<u>Y</u> /N/NA	46/49	94	0/3	0
Regular electric outlets in paint booth	4	W, F	<u>Y</u> /N/NA	42/48	88	2/6	33
Open junction boxes	4	W, E	<u>Y</u> /N	43/49	86	4/6	67
Electrical panels have unguarded openings	4	W, E	<u>Y</u> /N	34/49	76	10/11	91
Fire suppression in paint booth	4	W, F	<u>Y</u> /N/NA	34/49	76	3/11	27
GFCI present where water used	4	W, E	<u>Y</u> /N	18/36	50	16/17	94
Dedicated locks for LOTO program	3	W, O	<u>Y</u> /N/NA	4/5	80	4/6	67
Electrical panels easy to access	3	W, E	<u>Y</u> /N	32/49	65	15/17	88
Electrical panels have labeled breakers	3	W, E	<u>Y</u> /N	30/49	61	17/19	89
Electrical panels closed (if have cover)	3	W, E	<u>Y</u> /N	23/49	47	22/25	88
Written LO/TO program	3	RO, O	<u>Y</u> /N/NA	4/11	36	4/7	57
Electrical cords in good repair	3	W, E	<u>Y</u> /N	11/49	23	26/37	70
Point of operation guard for hydraulic press	3	W, O	<u>Y</u> /N/NA	0/16	0	6/16	38
Extension cords used in place of permanent wiring	2	W, E, F	<u>Y</u> /N	15/49	31	19/33	58

^A 4 = critical, 3 = highly important, 2 = important, 1 = other.

^B RO = records observation, W = walk-through observations, OI = owner interview; I = isocyanates, S = solvents, F = fire and explosion, D = dust and flying objects, N = noise, E = electrical hazards, A = all hazards, O = other.

^C Underlined responses triggered a recommendation.

consequences for failure to comply with safety rules and procedures, this easy-to-fix item was rarely selected for improvement (24%). And while safety consultants did appear to have a positive effect on some aspects of safety in these businesses, their influence was focused on solutions that require little or no active participation from owners (e.g., written programs). Our and others' work suggest these outcomes may be due to a commonly held perspective among small business owners that workplace safety relies mostly on employee actions.^(24,25) Focus group results reinforce these findings; while owners agreed that they had a responsibility for providing a safe work environment, they also believe that most of the responsibility for safety resides with employees. Employees concurred; when asked who was responsible for safety the first answer was always "employees."⁽¹¹⁾

Some limitations should be noted. It is possible that businesses in this study may have higher levels of interest in safety than the population of metropolitan Minneapolis-St. Paul collision shops. Owners were generally experienced in the industry and had owned their business for more than ten years. Two-thirds belonged to the local business association (AASP-MN) and nearly one-third had worked or were working with a private safety consultant. All businesses had at least one paint spray booth (a requirement for participation). Non-randomized recruitment techniques may have led to the selection of busi-

nesses with higher-than-average workplace health and safety. Businesses may have "cleaned up" their work sites before scheduled visits from research team members; unscheduled visits would not have been an acceptable approach for this type of study, however.

On the other hand, these data offer insights into an understudied and hard-to-reach small business sector with a substantial number and variety of workplace hazards. The businesses participating in this study were similar in size to those found throughout the United States. We used internal and external side-by-side assessments to ensure data quality. Numerous deficiencies in safety programs and workplace conditions were found. Our baseline results combined with focus group findings suggest that most auto collision repair businesses could benefit from consultation assistance with workplace health and safety.

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